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(54) **ORGANIC ELECTROLUMINESCENCE
DEVICE AND MONOAMINE COMPOUND
FOR ORGANIC ELECTROLUMINESCENCE
DEVICE**

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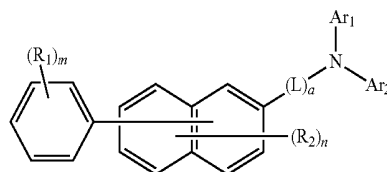
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(57) **ABSTRACT**

An organic electroluminescence device includes a first electrode, a hole transport region on the first electrode, an emission layer on the hole transport region, an electron transport region on the emission layer, and a second electrode on the electron transport region. The hole transport region includes a monoamine compound represented by the following Formula 1:



[Formula 1]

10

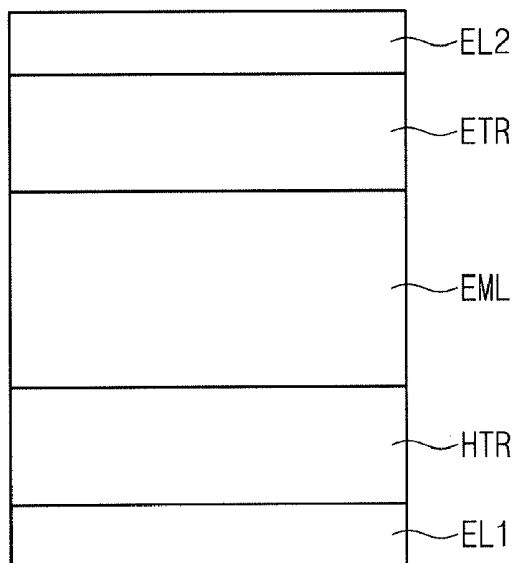


FIG. 1

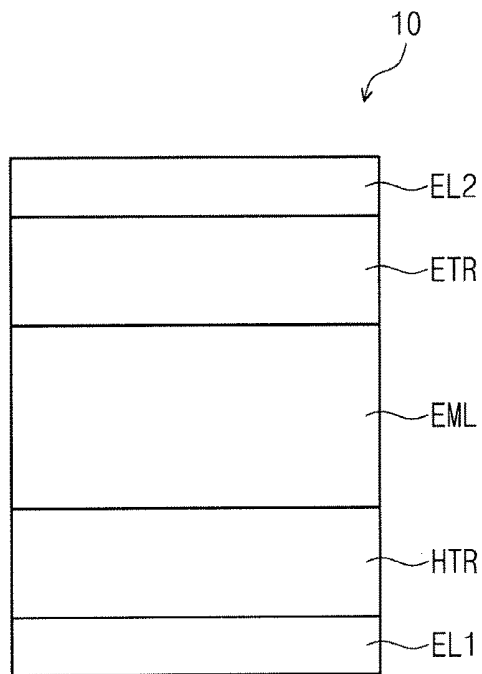


FIG. 2

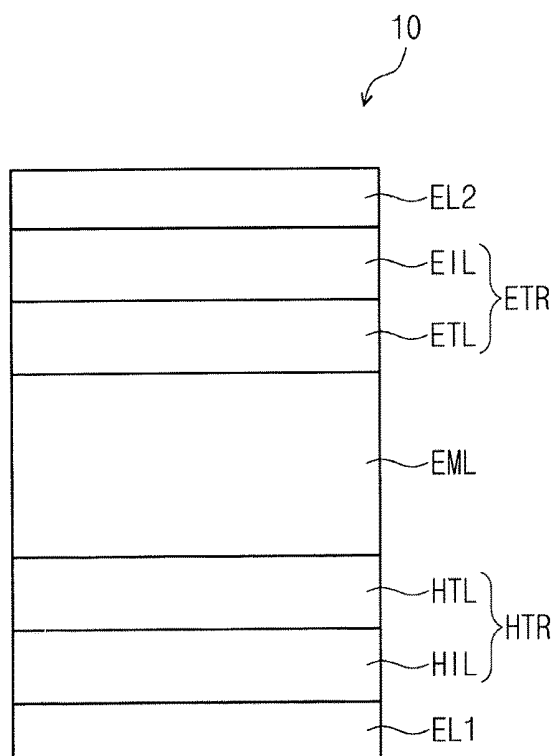
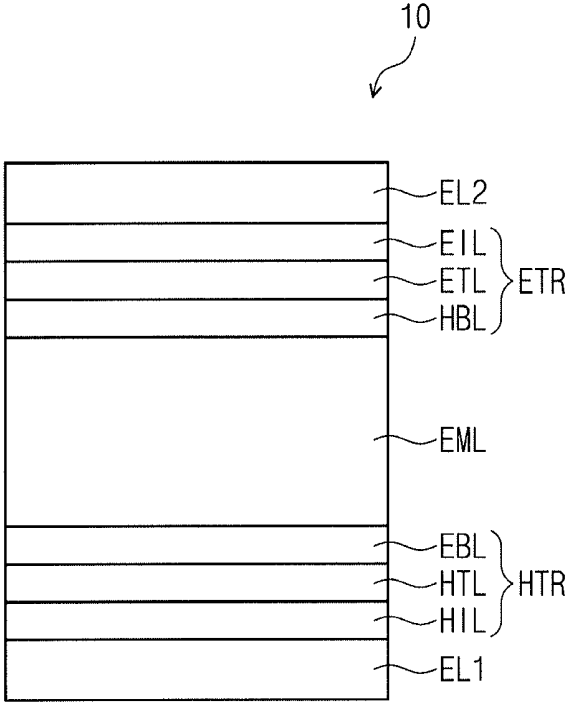


FIG. 3



**ORGANIC ELECTROLUMINESCENCE
DEVICE AND MONOAMINE COMPOUND
FOR ORGANIC ELECTROLUMINESCENCE
DEVICE**

CROSS-REFERENCE TO RELATED
APPLICATION

[0001] Korean Patent Application No. 10-2018-0009993, filed on Jan. 26, 2018, and Korean Patent Application No. 10-2018-0146236, filed on Nov. 23, 2018, in the Korean Intellectual Property Office, and entitled: "Organic Electroluminescence Device and Monoamine Compound for Organic Electroluminescence Device," is incorporated by reference herein in its entirety.

BACKGROUND

1. Field

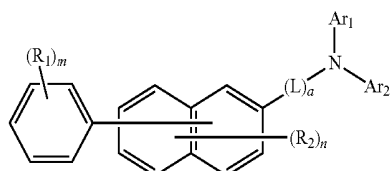
[0002] Embodiments relate to an organic electroluminescence device and a monoamine compound for an organic electroluminescence device.

2. Description of the Related Art

[0003] Development on an organic electroluminescence display as an image display is being actively conducted. An organic electroluminescence display is different from a liquid crystal display and is so called a self-luminescent display which accomplishes display by recombining holes and electrons injected from a first electrode and a second electrode in an emission layer and emitting light from a luminescent material which includes an organic compound in the emission layer.

SUMMARY

[0004] Embodiments are directed to an organic electroluminescence device including a first electrode, a hole transport region on the first electrode, an emission layer on the hole transport region, an electron transport region on the emission layer and a second electrode on the electron transport region, in which the hole transport region includes a monoamine compound represented by the following Formula 1.



[Formula 1]

[0005] In Formula 1, Ar₁ and Ar₂ may each independently be a substituted or unsubstituted alkyl group having 1 to 10 carbon atoms, a substituted or unsubstituted cycloalkyl group having 3 to 20 ring carbon atoms, a substituted or unsubstituted aryl group having 6 to 30 ring carbon atoms, or a substituted or unsubstituted heteroaryl group having 2 to 30 ring carbon atoms, L may be a substituted or unsubstituted arylene group having 6 to 30 ring carbon atoms, or a substituted or unsubstituted heteroarylene group having 2

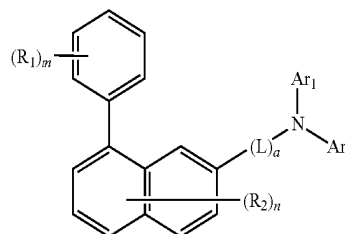
to 30 ring carbon atoms, R₁ may be a hydrogen atom, a deuterium atom, a halogen atom, a substituted or unsubstituted alkyl group having 1 to 20 carbon atoms, a substituted or unsubstituted cycloalkyl group having 3 to 20 ring carbon atoms, or a substituted or unsubstituted aryl group having 6 to 30 ring carbon atoms, R₂ may be a hydrogen atom, a deuterium atom, a halogen atom, a substituted or unsubstituted alkyl group having 1 to 20 carbon atoms, or a substituted or unsubstituted cycloalkyl group having 3 to 20 ring carbon atoms, a may be an integer of 0 to 3, m may be an integer of 0 to 1, n may be an integer of 0 to 6, and when any one of Ar₁ and Ar₂ is 3-dibenzofuranyl, the other may not be 9-phenanthryl.

[0006] The hole transport region may have a plurality of layers, and a layer of the plurality of layers contacting the emission layer may include the monoamine compound according to an example embodiment.

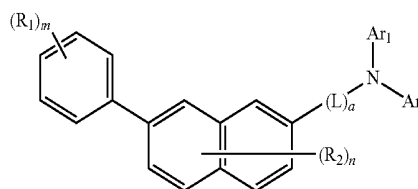
[0007] The hole transport region may include a hole injection layer on the first electrode, a hole transport layer on the hole injection layer, and an electron blocking layer on the hole transport layer, and the electron blocking layer may include the monoamine compound according to an example embodiment.

[0008] The electron transport region may include a hole blocking layer on the emission layer, an electron transport layer on the hole blocking layer, and an electron injection layer on the electron transport layer.

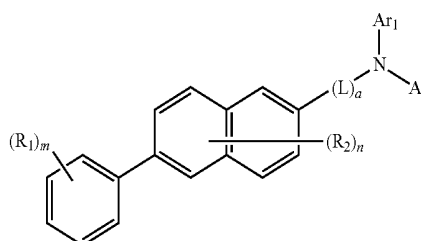
[0009] Formula 1 may be represented by any one of the following Formulae 2 to 8.



[Formula 2]

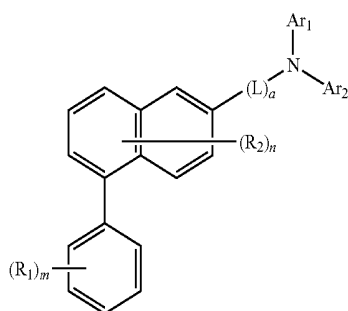


[Formula 3]

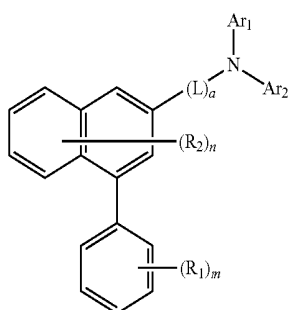


[Formula 4]

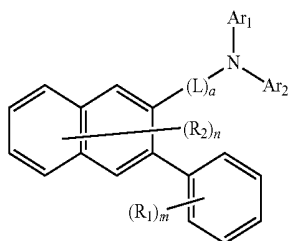
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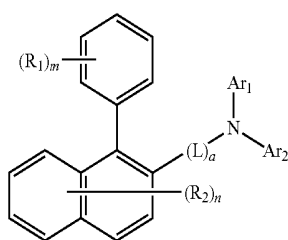
[Formula 5]



[Formula 6]



[Formula 7]



[Formula 8]

[0010] In Formulae 2 to 8, Ar₁, Ar₂, L, R₁, R₂, a, m, and n are the same as defined in Formula 1.

[0011] L may be a substituted or unsubstituted arylene group having 6 to 12 ring carbon atoms.

[0012] L may be a substituted or unsubstituted phenylene group.

[0013] Ar₁ and Ar₂ may be each independently a substituted or unsubstituted aryl group having 6 to 12 ring carbon atoms.

[0014] Ar₁ and Ar₂ may be each independently a substituted or unsubstituted phenyl group, a substituted or unsub-

stituted biphenyl group, a substituted or unsubstituted naphthyl group, or a substituted or unsubstituted fluorenyl group.

[0015] Ar₁ and Ar₂ may be each independently a substituted or unsubstituted heteroaryl group having 5 to 12 ring carbon atoms.

[0016] Ar₁ and Ar₂ may be each independently a substituted or unsubstituted dibenzofuran group, a substituted or unsubstituted dibenzothiophene group, or a substituted or unsubstituted carbazole group.

[0017] Embodiments are also directed to a monoamine compound represented by the above Formula 1.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] Features will become apparent to those of skill in the art by describing in detail example embodiments with reference to the attached drawings in which:

[0019] FIG. 1 illustrates a schematic cross-sectional view of an organic electroluminescence device according to an example embodiment;

[0020] FIG. 2 illustrates a schematic cross-sectional view of an organic electroluminescence device according to an example embodiment; and

[0021] FIG. 3 illustrates a schematic cross-sectional view of an organic electroluminescence device according to an example embodiment.

DETAILED DESCRIPTION

[0022] Example embodiments will now be described more fully hereinafter with reference to the accompanying drawings; however, they may be embodied in different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey example implementations to those skilled in the art. In the drawing figures, the dimensions of layers and regions may be exaggerated for clarity of illustration. Like reference numerals refer to like elements throughout.

[0023] It will be understood that, although the terms first, second, etc. may be used herein to describe various elements, these elements should not be limited by these terms. These terms are only used to distinguish one element from another element. For example, a first element discussed below could be termed a second element, and similarly, a second element could be termed a first element. As used herein, the singular forms are intended to include the plural forms as well, unless the context clearly indicates otherwise.

[0024] It will be further understood that the terms “comprise” or “have,” when used in this specification, specify the presence of stated features, numerals, steps, operations, elements, parts, or a combination thereof, but do not preclude the presence or addition of one or more other features, numerals, steps, operations, elements, parts, or a combination thereof. It will also be understood that when a layer, a film, a region, a plate, etc. is referred to as being “on” another part, it can be “directly on” the other part, or intervening layers may also be present. On the other hand, when a layer, a film, a region, a plate, etc. is referred to as being “under” another part, it can be “directly under” the other part, or intervening layers may also be present.

[0025] First, an organic electroluminescence device according to an example embodiment will be explained referring to FIGS. 1 to 3.

[0026] FIG. 1 is a schematic cross-sectional view illustrating an organic electroluminescence device according to an example embodiment. FIG. 2 is a schematic cross-sectional view illustrating an organic electroluminescence device according to an example embodiment. FIG. 3 is a schematic cross-sectional view illustrating an organic electroluminescence device according to an example embodiment.

[0027] Referring to FIGS. 1 to 3, an organic electroluminescence device 10 according to an example embodiment includes a first electrode EL1, a hole transport region HTR, an emission layer EML, an electron transport region ETR, and a second electrode EL2.

[0028] The hole transport region HTR includes the monoamine compound according to an example embodiment. Hereinafter, the monoamine compound according to an example embodiment will be specifically explained, and then each layer of the organic electroluminescence device 10 will be explained.

[0029] In the present disclosure, “substituted or unsubstituted” may mean unsubstituted or substituted with at least one substituent selected from the group of deuterium, halogen, cyano, nitro, silyl, boron, phosphine, alkyl, alkenyl, aryl and heterocyclic group. In addition, each of the substituent described above may be substituted or unsubstituted. For example, biphenyl may be interpreted as aryl, or phenyl substituted with phenyl.

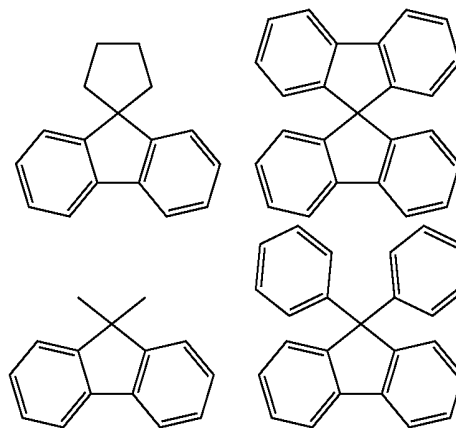
[0030] In the present disclosure, examples of a halogen atom are a fluorine atom, a chlorine atom, a bromine atom, and an iodine atom.

[0031] In the present disclosure, the alkyl group may have a linear, branched or cyclic form. The carbon number of the alkyl group may be 1 to 30, 1 to 20, 1 to 10, or 1 to 4. Examples of the alkyl group may include methyl, ethyl, n-propyl, isopropyl, n-butyl, s-butyl, t-butyl, i-butyl, 2-ethylbutyl, 3,3-dimethylbutyl, n-pentyl, i-pentyl, neopentyl, t-pentyl, cyclopentyl, 1-methylpentyl, 3-methylpentyl, 2-ethylpentyl, 4-methyl-2-pentyl, n-hexyl, 1-methylhexyl, 2-ethylhexyl, 2-butylhexyl, cyclohexyl, 4-methylcyclohexyl, 4-t-butylcyclohexyl, n-heptyl, 1-methylheptyl, 2,2-dimethylheptyl, 2-ethylheptyl, 2-butylheptyl, n-octyl, t-octyl, 2-ethyloctyl, 2-butyloctyl, 2-hexyloctyl, 3,7-dimethyloctyl, cyclooctyl, n-nonyl, n-decyl, adamantyl, 2-ethyldecyl, 2-butyldecyl, 2-hexyldecyl, 2-octyldecyl, n-undecyl, n-dodecyl, 2-ethyldodecyl, 2-butyldecyl, 2-hexyldodecyl, 2-octyldodecyl, n-tridecyl, n-tetradecyl, n-pentadecyl, n-hexadecyl, 2-ethylhexadecyl, 2-butylhexadecyl, 2-hexylhexadecyl, 2-octylhexadecyl, n-heptadecyl, n-octadecyl, n-nonadecyl, n-eicosyl, 2-ethyl eicosyl, 2-butyl eicosyl, 2-hexyl eicosyl, 2-octyl eicosyl, n-heneicosyl, n-docosyl, n-tricosyl, n-tetracosyl, n-pentacosyl, n-hexacosyl, n-heptacosyl, n-octacosyl, n-nonacosyl, n-triacontyl, etc.

[0032] In the present disclosure, the aryl group means any functional group or substituent derived from an aromatic hydrocarbon ring. The aryl group may be monocyclic aryl or polycyclic aryl. The carbon number of the aryl group for forming a ring may be 6 to 30, 6 to 20, or 6 to 12. Examples of the aryl group may include phenyl, naphthyl, fluorenyl, anthracenyl, phenanthryl, biphenyl, terphenyl, quaterphenyl, quinqphenyl, sexiphenyl, biphenylene, triphenylene, pyrenyl, benzofluoranthenyl, chrysenyl, etc.

[0033] In the present disclosure, the fluorenyl group may be substituted, and two substituents may be combined with

each other to form a spiro structure. Examples of the substituted fluorenyl group may include the following groups:



[0034] In the present disclosure, the heteroaryl group may be heteroaryl including at least one of O, N, P, Si, or S as a heteroatom. When the heteroaryl group includes two heteroatoms, the two heteroatoms may be the same or different from each other. The carbon number of the heteroaryl group for forming a ring may be 2 to 30, or 5 to 12. The heteroaryl group may be monocyclic heteroaryl or polycyclic heteroaryl. Polycyclic heteroaryl may have bicyclic or tricyclic structure, for example. Examples of the heteroaryl group may include thiophene, furan, pyrrole, imidazole, thiazole, oxazole, oxadiazole, triazole, pyridine, bipyridine, pyrimidine, triazine, triazole, acridyl, pyridazine, pyrazinyl, quinoline, quinazoline, quinoxaline, phenoxazine, phthalazine, pyrido pyrimidine, pyrido pyrazine, pyrazino pyrazine, isoquinoline, indole, carbazole, N-aryl carbazole, N-heteroaryl carbazole, N-alkyl carbazole, benzoxazole, benzoimidazole, benzothiazole, benzocarbazole, benzothiophene, dibenzothiophene, thienothiophene, benzofuran, phenanthroline, thiazole, isoxazole, oxadiazole, thiadiazole, phenothiazine, dibenzosilole, dibenzofuran, etc.

[0035] In the present disclosure, the silyl group may include alkyl silyl and aryl silyl. Examples of the silyl group may include trimethylsilyl, triethylsilyl, t-butyl dimethylsilyl, vinyl dimethylsilyl, propyl dimethylsilyl, triphenylsilyl, diphenylsilyl, phenylsilyl, etc.

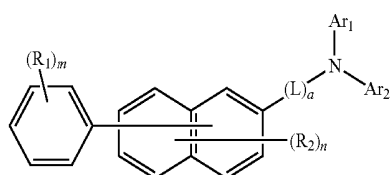
[0036] In the present disclosure, the boron group may include alkyl boron and aryl boron. Examples of the boron group may include trimethyl boron, triethyl boron, t-butyl dimethyl boron, triphenyl boron, diphenyl boron, phenyl boron, etc.

[0037] In the present disclosure, the alkenyl group may be linear or branched. The carbon number is not specifically limited, and may be 2 to 30, 2 to 20, or 2 to 10. Examples of the alkenyl group may include vinyl, 1-butenyl, 1-pentenyl, 1,3-butadienyl aryl, styrenyl, styrylvinyl, etc.

[0038] The above explanation on the aryl group may be applied to the arylene group, except that the arylene group is divalent.

[0039] The above explanation on the heteroaryl group may be applied to the heteroarylene group, except that the heteroarylene group is divalent.

[0040] A monoamine compound according to an example embodiment is represented by the following Formula 1.



[Formula 1]

[0041] According to the present example embodiment, in Formula 1, Ar_1 and Ar_2 may each independently be a substituted or unsubstituted alkyl group having 1 to 10 carbon atoms, a substituted or unsubstituted cycloalkyl group having 3 to 20 ring carbon atoms, a substituted or unsubstituted aryl group having 6 to 30 ring carbon atoms, or a substituted or unsubstituted heteroaryl group having 2 to 30 ring carbon atoms.

[0042] In Formula 1, L may be a substituted or unsubstituted arylene group having 6 to 30 ring carbon atoms, or a substituted or unsubstituted heteroarylene group having 2 to 30 ring carbon atoms.

[0043] In Formula 1, R_1 may be a hydrogen atom, a deuterium atom, a halogen atom, a substituted or unsubstituted alkyl group having 1 to 20 carbon atoms, a substituted or unsubstituted cycloalkyl group having 3 to 20 ring carbon atoms, or a substituted or unsubstituted aryl group having 6 to 30 ring carbon atoms.

[0044] In Formula 1, R_2 may be a hydrogen atom, a deuterium atom, a halogen atom, a substituted or unsubstituted alkyl group having 1 to 20 carbon atoms, or a substituted or unsubstituted cycloalkyl group having 3 to 20 ring carbon atoms.

[0045] In an example embodiment, R_2 may be neither an aryl group nor a heteroaryl group. In a compound of Formula 1 in which R_2 is an aryl group or a heteroaryl group, the naphthalene structure may have a largely distributed HOMO (highest occupied molecular orbital) energy level and the amine group may not maintain the property of extending device life due to the relatively decreased electron density, thereby decreasing life of the organic electroluminescence device including the compound. When R_2 is referred to as being neither an aryl group nor a heteroaryl group, it may include both the case where R_2 is neither an aryl group nor a heteroaryl group and the case where R_2 is substituted with neither an aryl group nor a heteroaryl group.

[0046] In Formula 1, a may be an integer of 0 to 3. In case a is an integer of 2 or more, a plurality of L may be the same or different from each other.

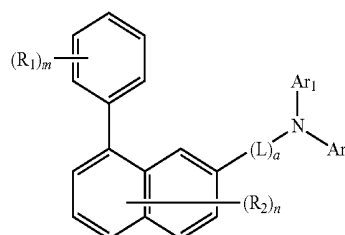
[0047] In Formula 1, m may be an integer of 0 to 1.

[0048] In Formula 1, n may be an integer of 0 to 6. In case n is an integer of 2 or more, a plurality of R_2 may be the same or different from each other.

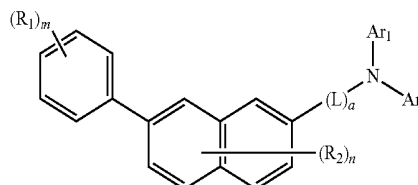
[0049] In Formula 1, in case any one of Ar_1 and Ar_2 is 3-dibenzofuranyl, the other may not be 9-phenanthryl. For example, when Ar_1 is 3-dibenzofuranyl, Ar_2 is not 9-phenanthryl, and when Ar_2 is 3-dibenzofuranyl, Ar_1 is not 9-phenanthryl. Furthermore, the compound of Formula 1, where the nitrogen atom is substituted with both of 3-dibenzofuranyl and 9-phenanthryl, is excluded. A compound of Formula 1 in which the nitrogen atom is substituted with both of 3-dibenzofuranyl and 9-phenanthryl may have a strong molecular stacking and increased deposition tempera-

ture, which may result in thermal decomposition and thereby degrade the quality of organic electroluminescence device including the compound.

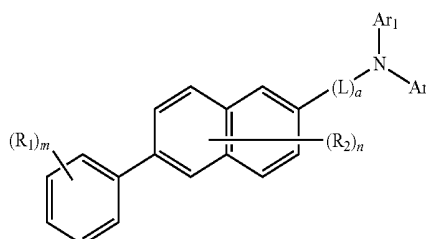
[0050] In an embodiment, Formula 1 may be represented by any one of the following Formulae 2 to 8.



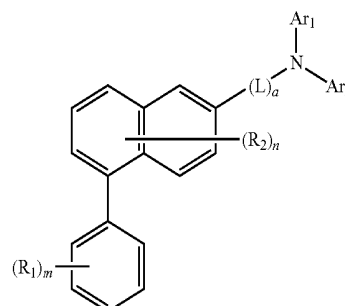
[Formula 2]



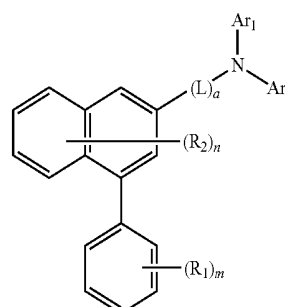
[Formula 3]



[Formula 4]

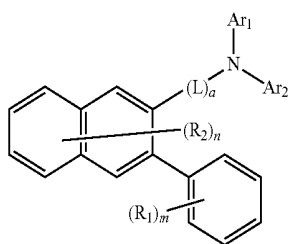


[Formula 5]

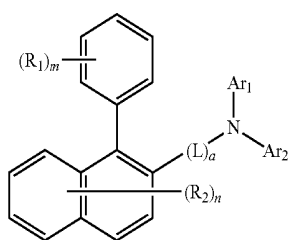


[Formula 6]

-continued



[Formula 7]



[Formula 8]

[0051] In Formulae 2 to 8, Ar_1 , Ar_2 , L , R_1 , R_2 , a , m , and n are the same as defined in Formula 1.

[0052] In Formula 1, m may be 1, and L may be a substituted or unsubstituted arylene group having 6 to 12 ring carbon atoms. For example, L may be a substituted or unsubstituted phenylene group.

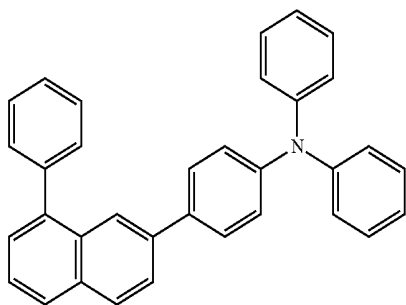
[0053] In Formula 1, Ar_1 and Ar_2 may be each independently a substituted or unsubstituted aryl group having 6 to 12 ring carbon atoms. For example, Ar_1 and Ar_2 may be each independently a substituted or unsubstituted phenyl group, a substituted or unsubstituted biphenyl group, a substituted or unsubstituted naphthyl group, or a substituted or unsubstituted fluorenyl group.

[0054] In Formula 1, Ar_1 and Ar_2 may be each independently a substituted or unsubstituted heteroaryl group having 5 to 12 ring carbon atoms. For example, Ar_1 and Ar_2 may be each independently a substituted or unsubstituted dibenzofuran group, a substituted or unsubstituted dibenzothiophene group, or a substituted or unsubstituted carbazole group.

[0055] In Formula 1, R_2 may be a hydrogen atom or a deuterium atom.

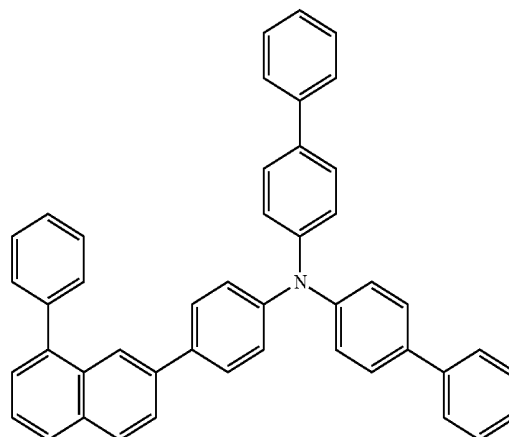
[0056] The monoamine compound represented by Formula 1 according to an example embodiment may be any one selected from the group of compounds represented in the following Compound Groups 1 to 7.

[0057] [Compound Group 1]

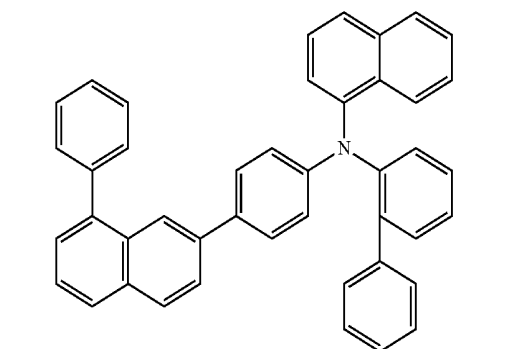


A1

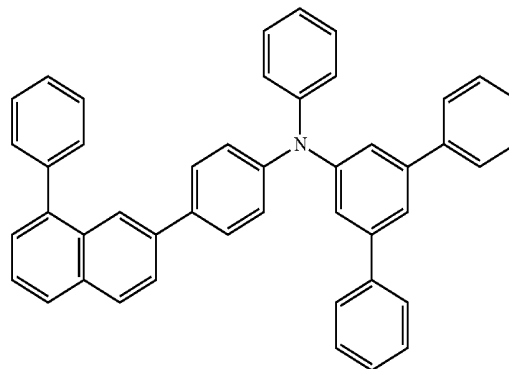
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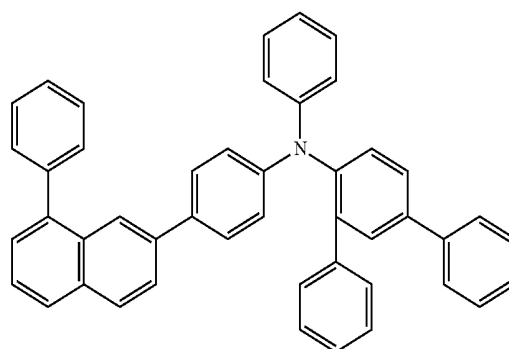
A2



A3



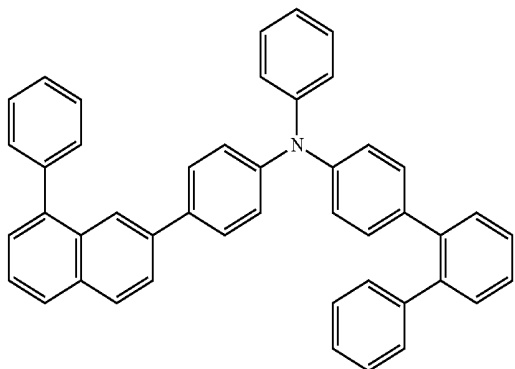
A4



A5

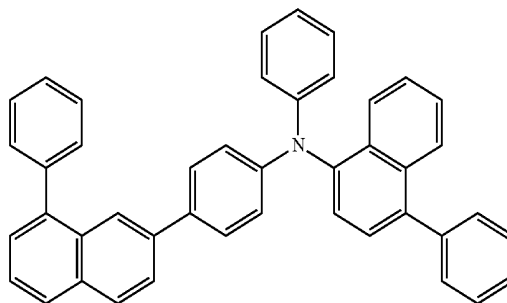
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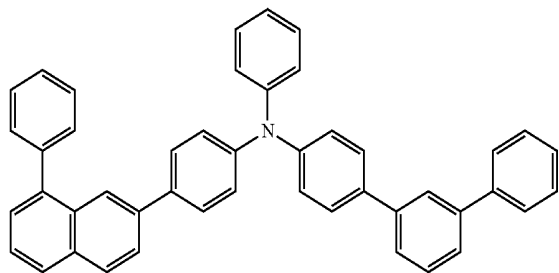
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A10

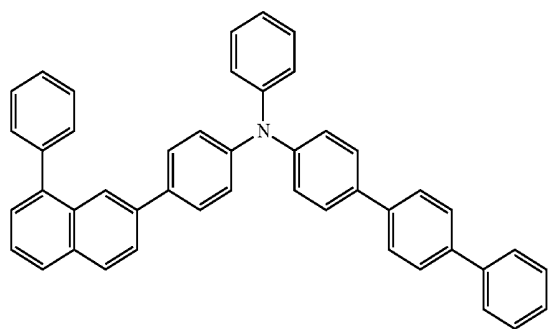


A11

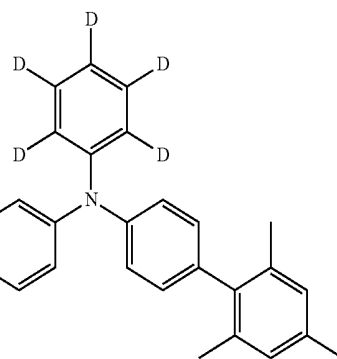
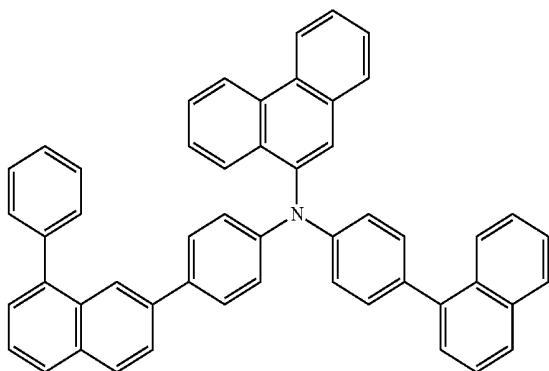
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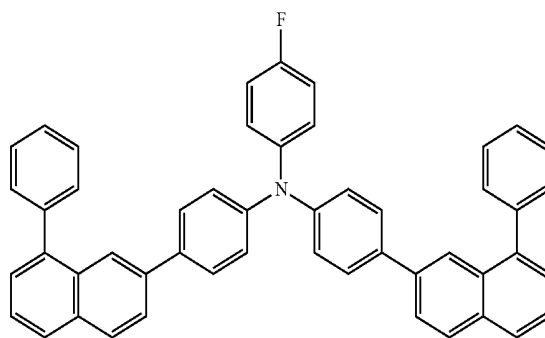
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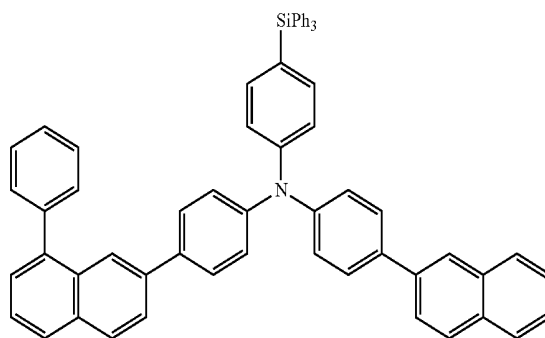
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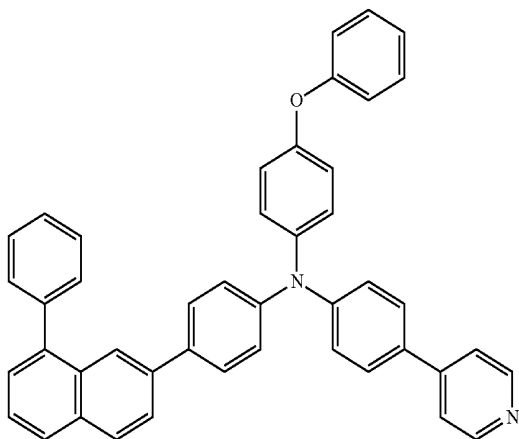


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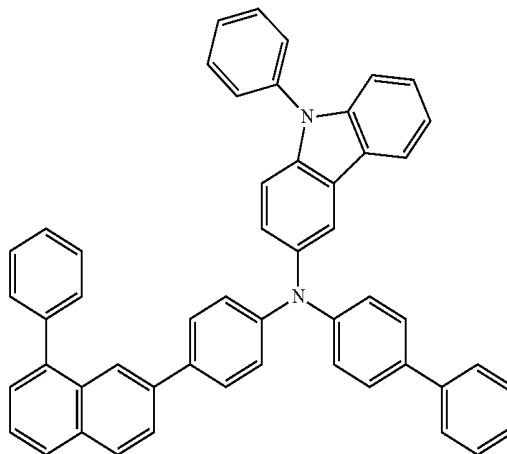
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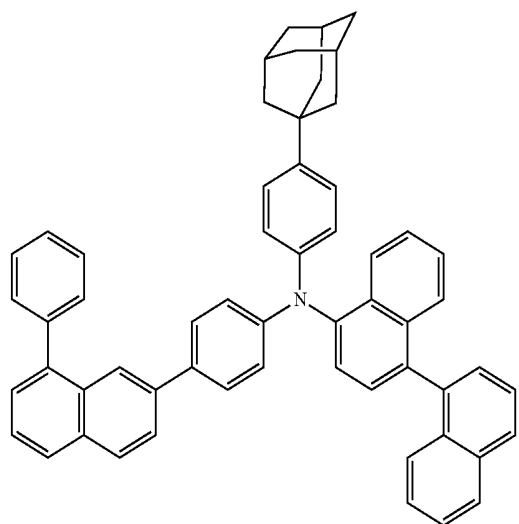
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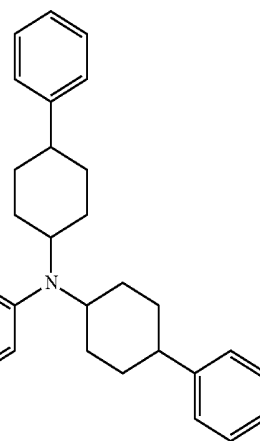
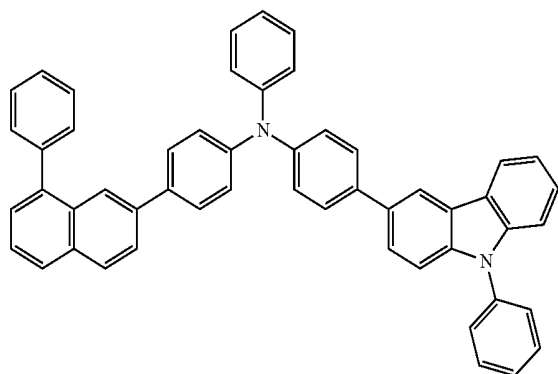


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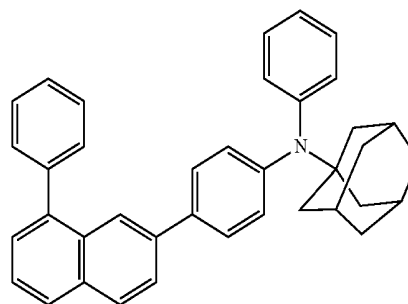
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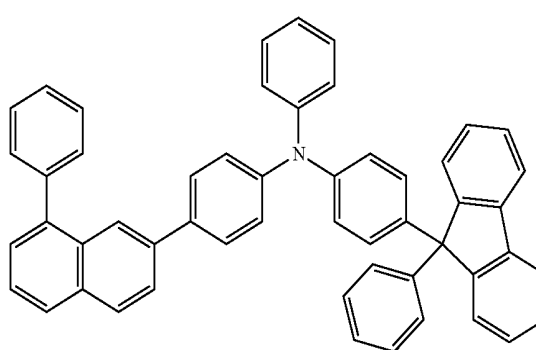
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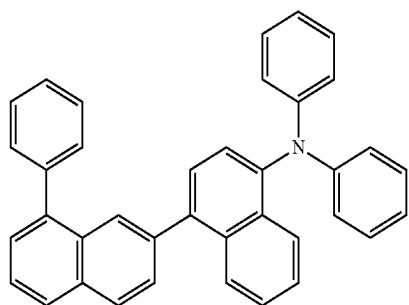


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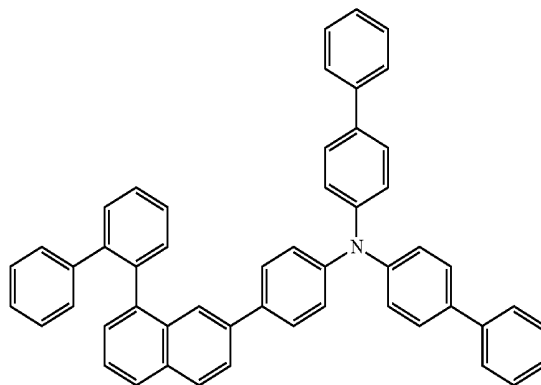
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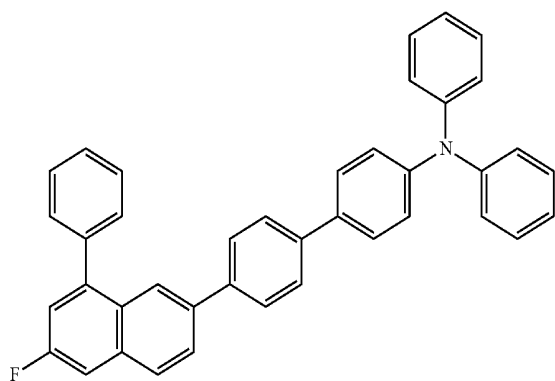


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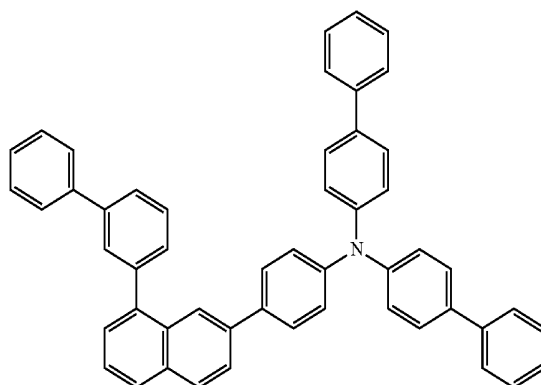
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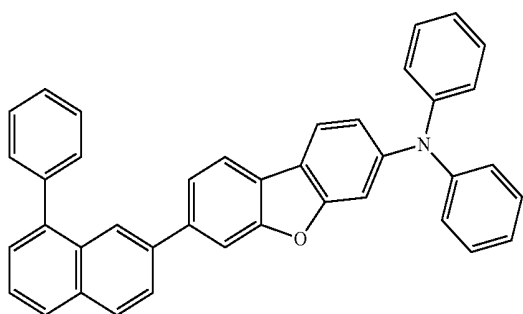
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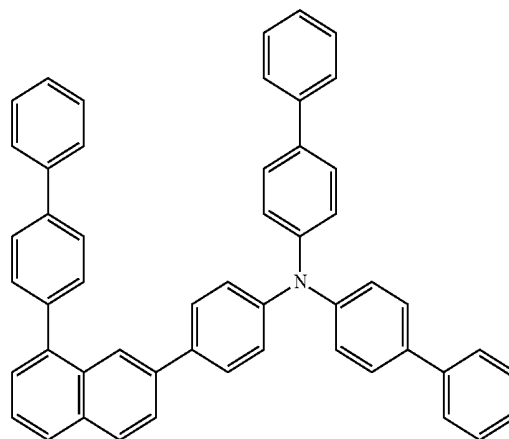
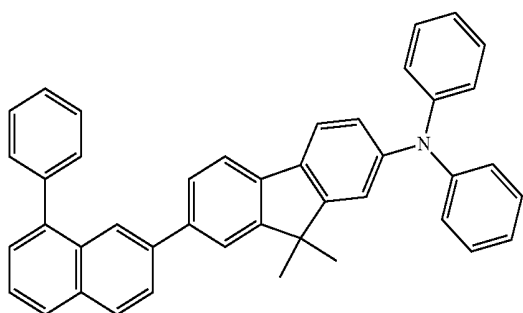


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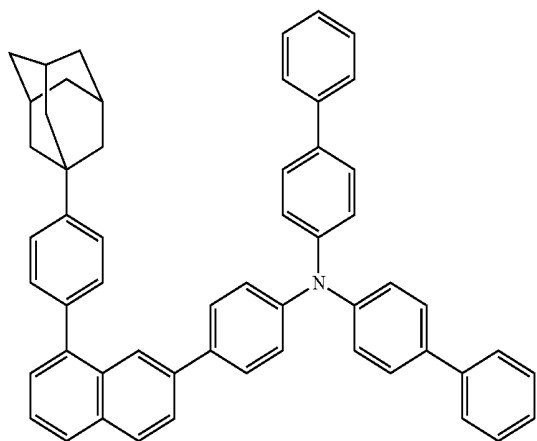
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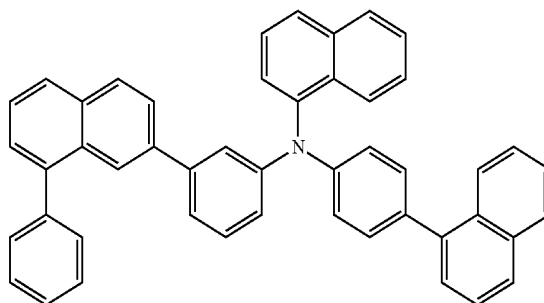
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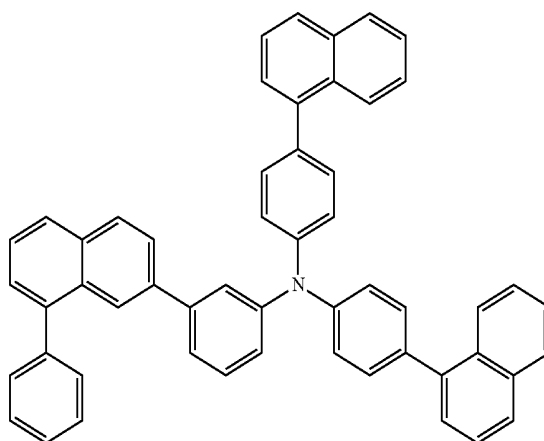
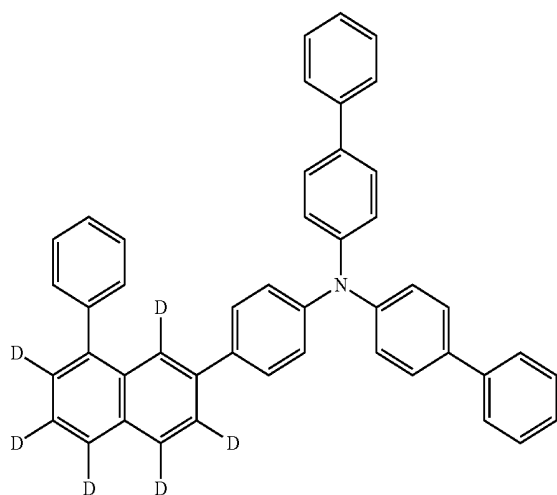
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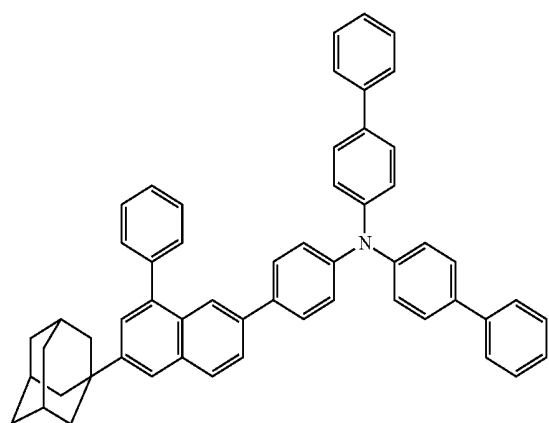


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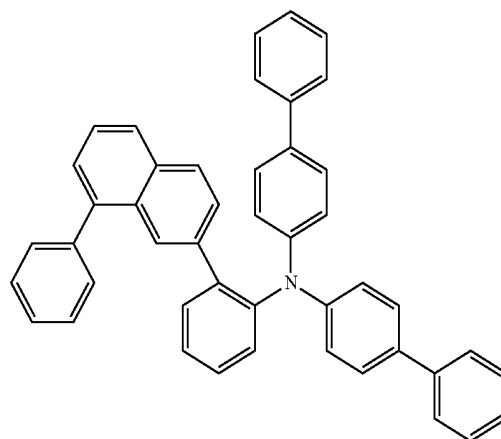
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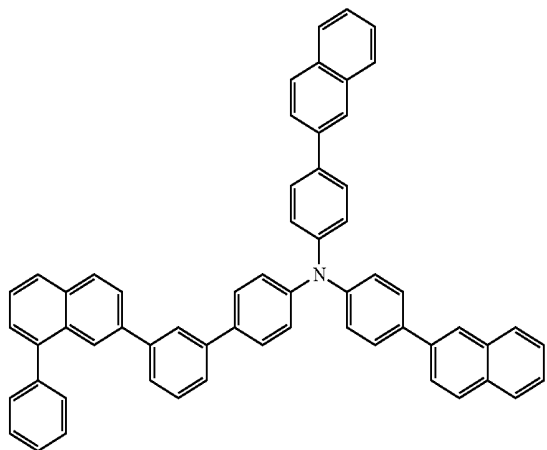


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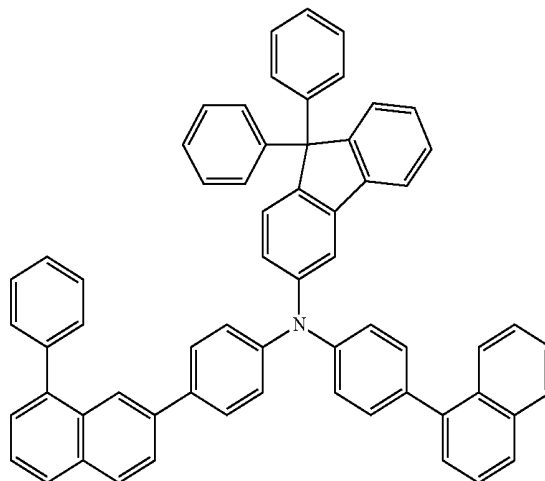
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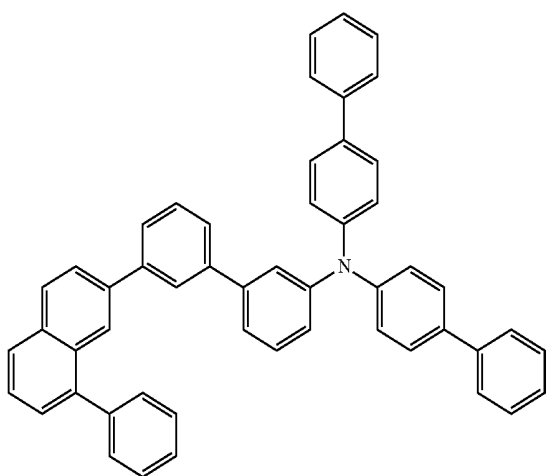


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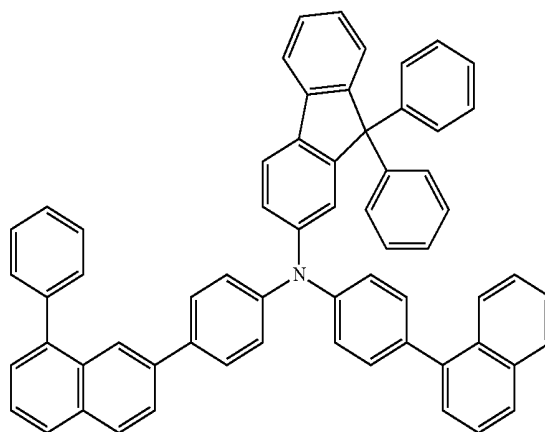
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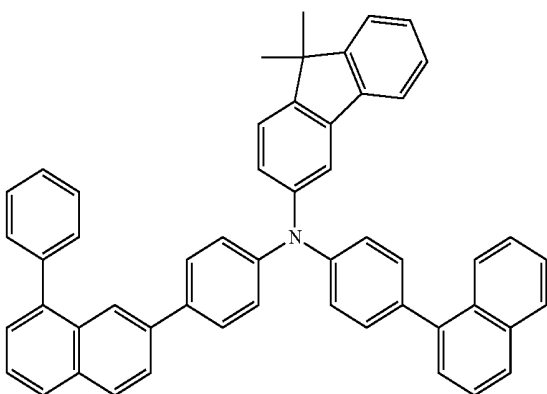
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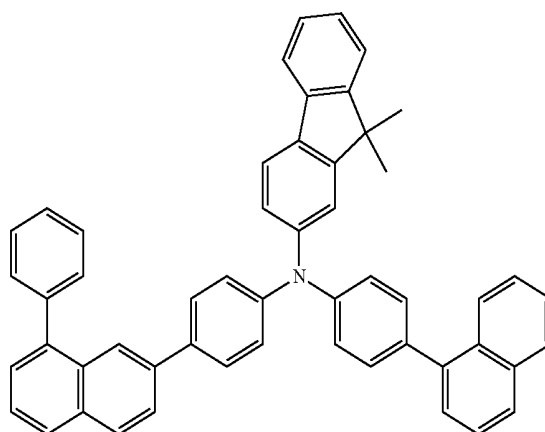
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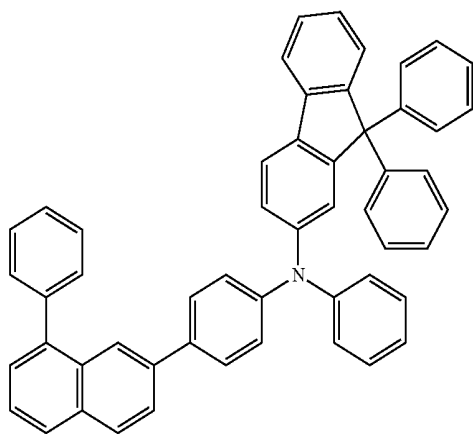
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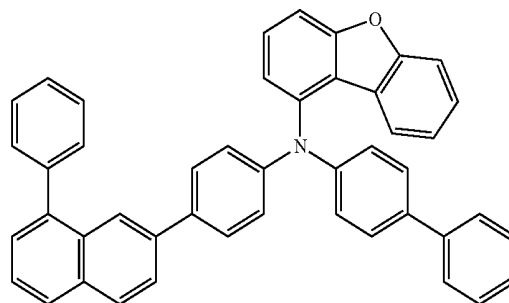


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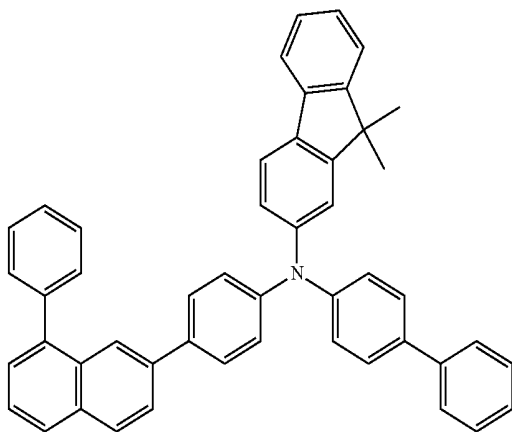
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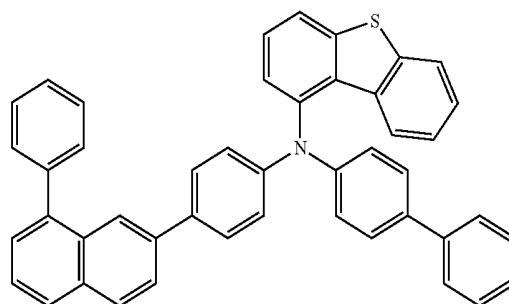


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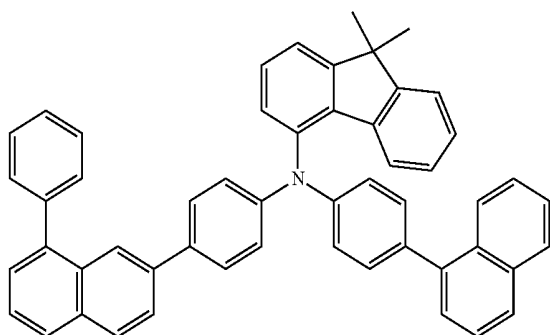
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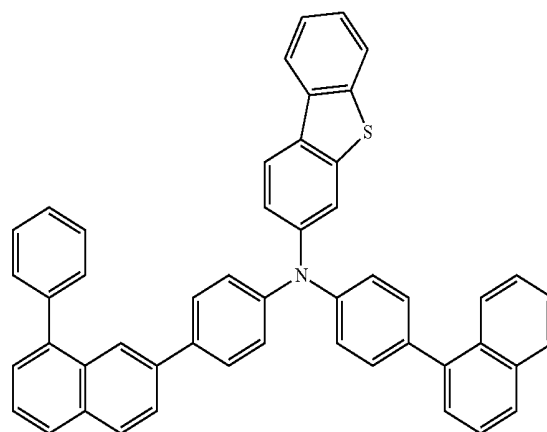
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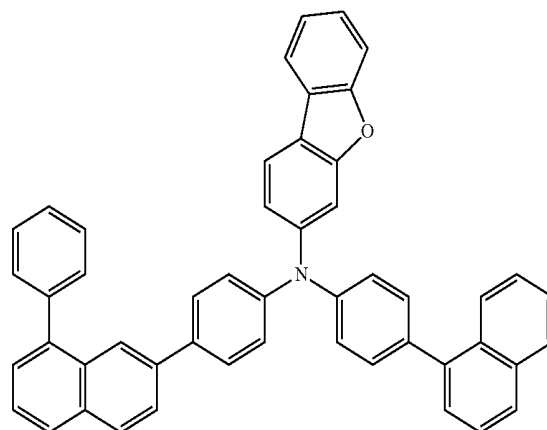
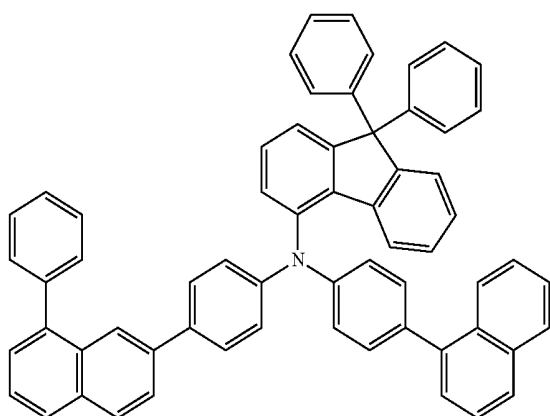
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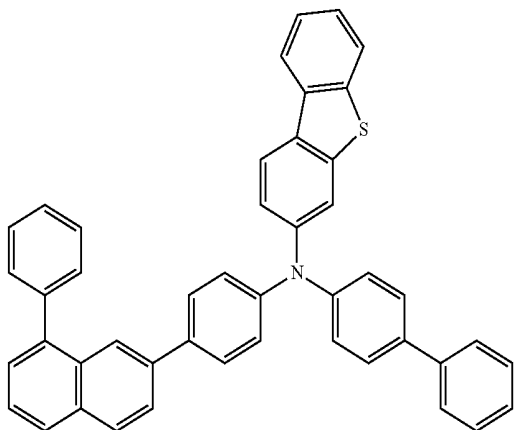
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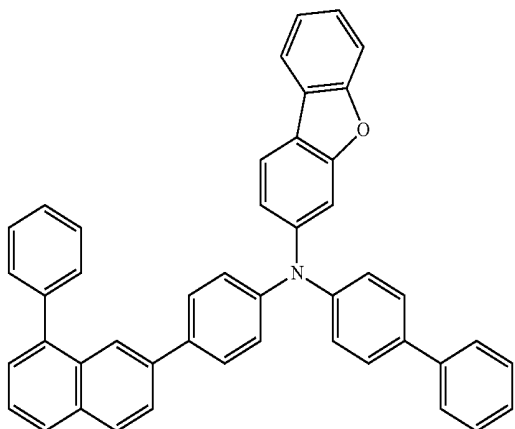
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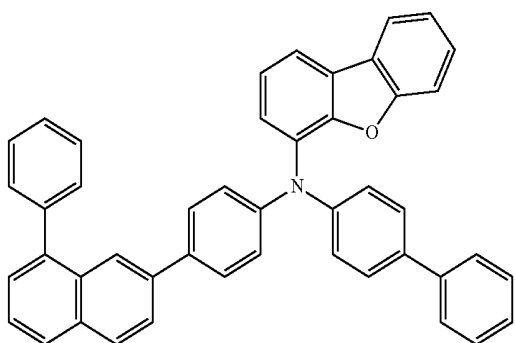
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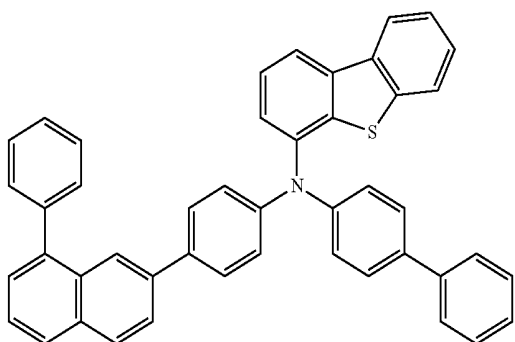
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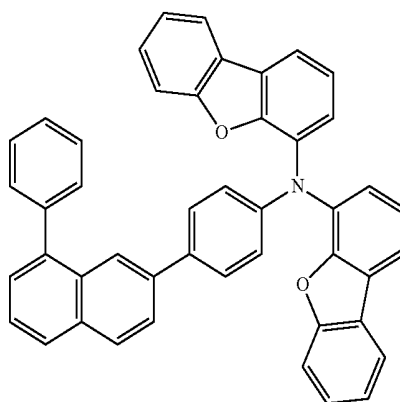


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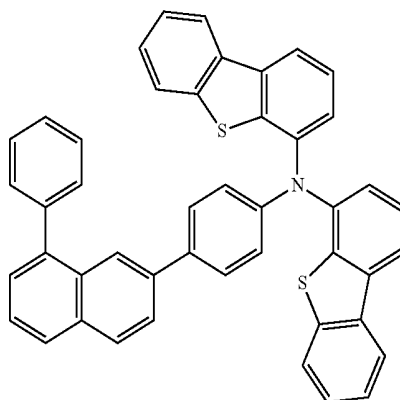


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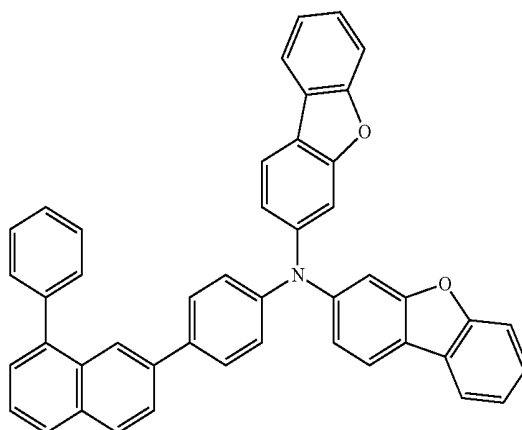
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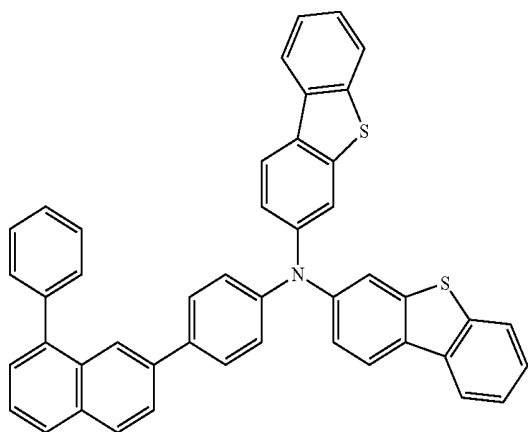


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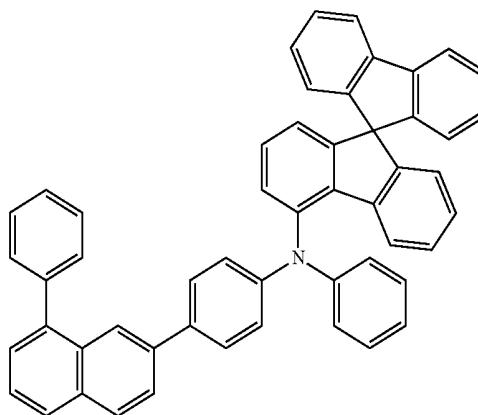
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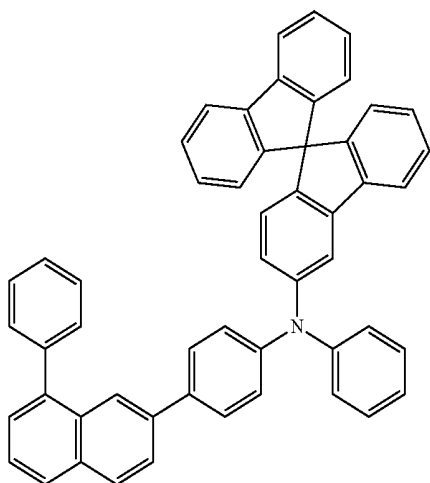


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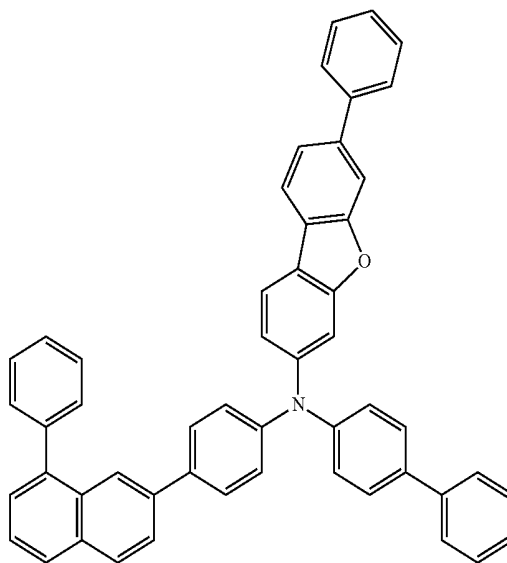
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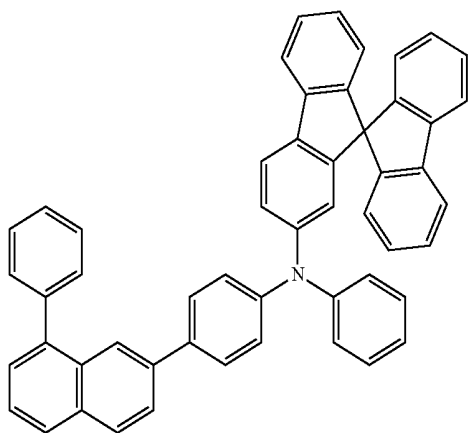
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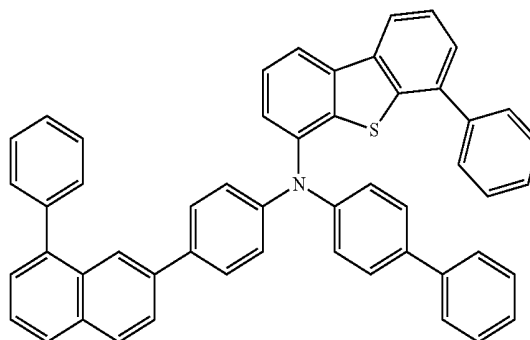
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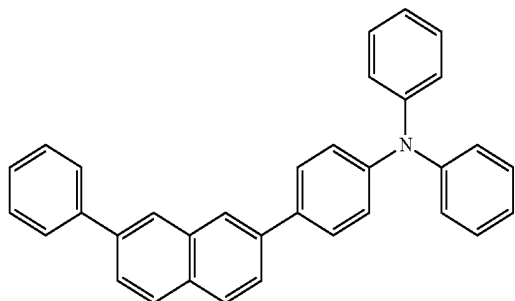


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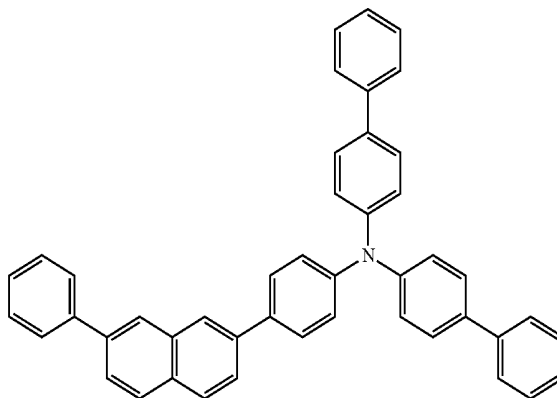


[0058] [Compound Group 2]

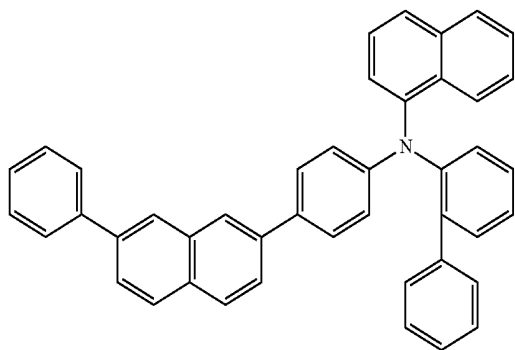
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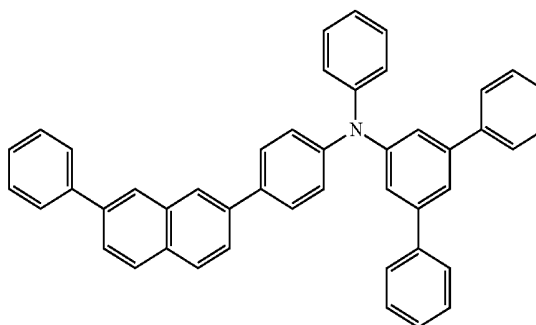
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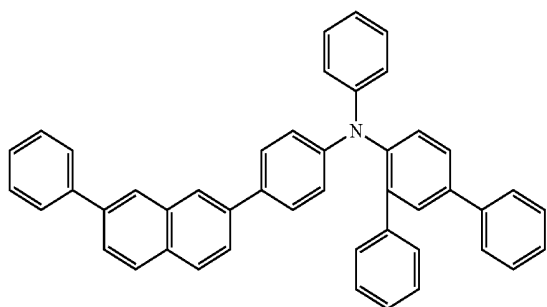
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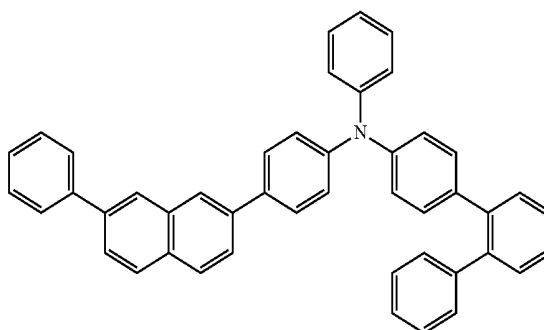
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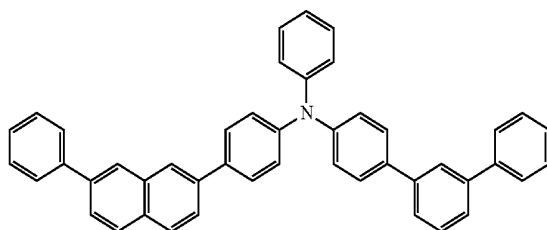
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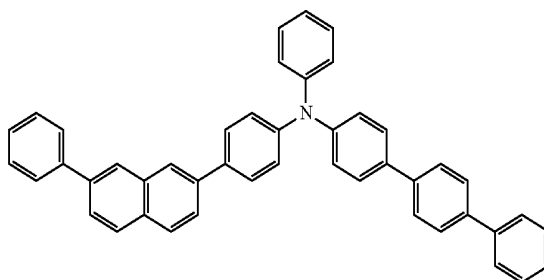
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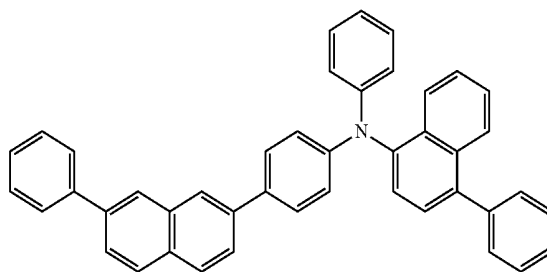
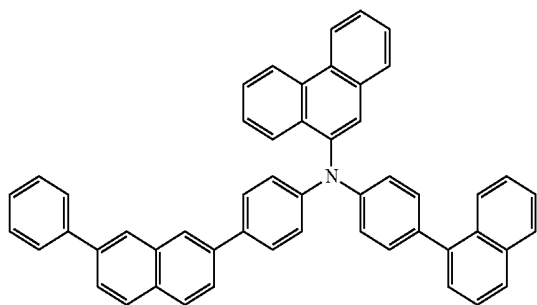


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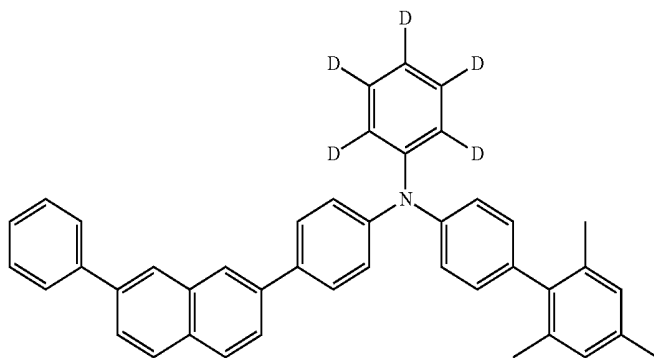


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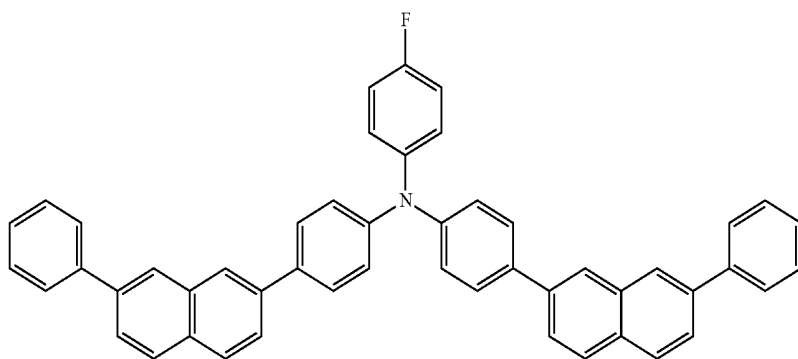
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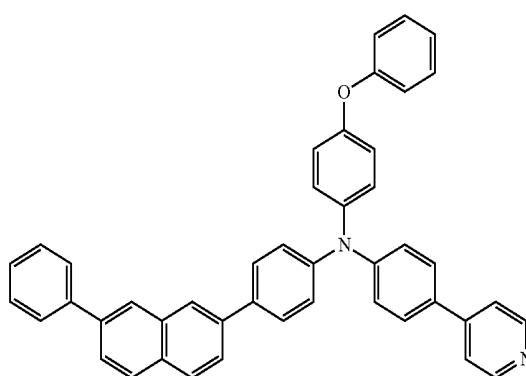
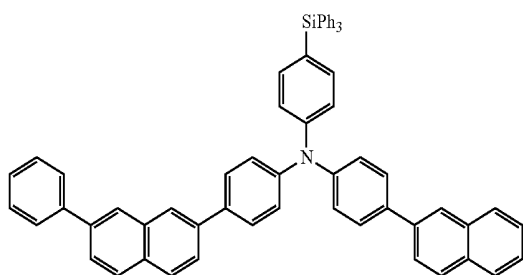


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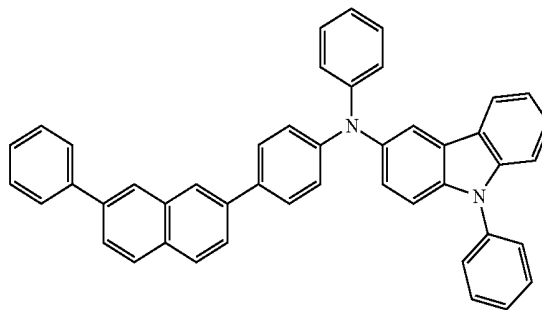
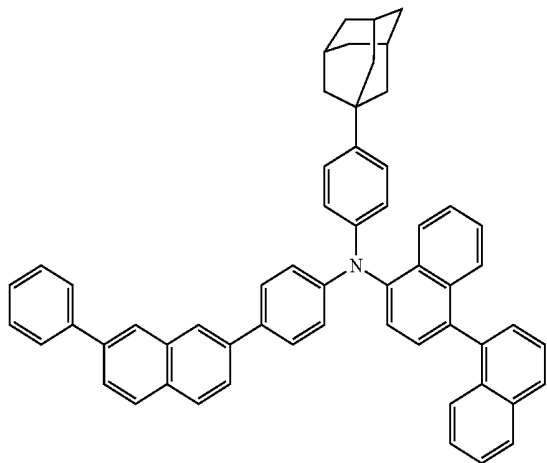
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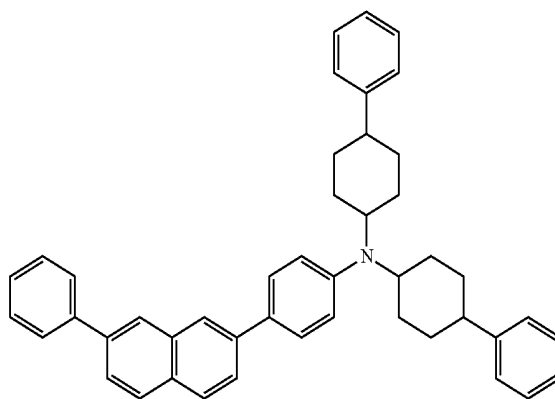
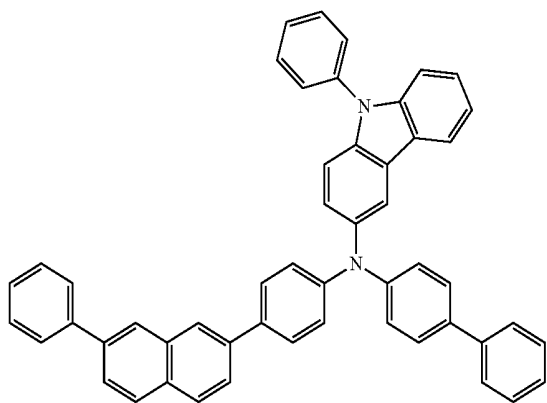
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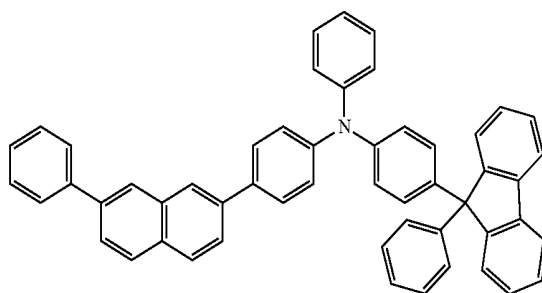
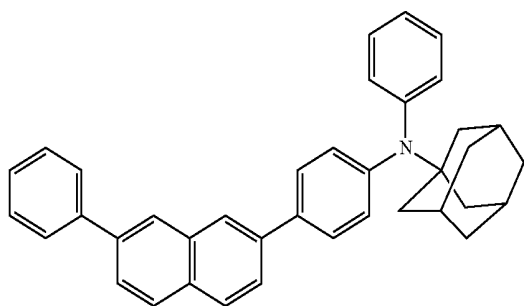
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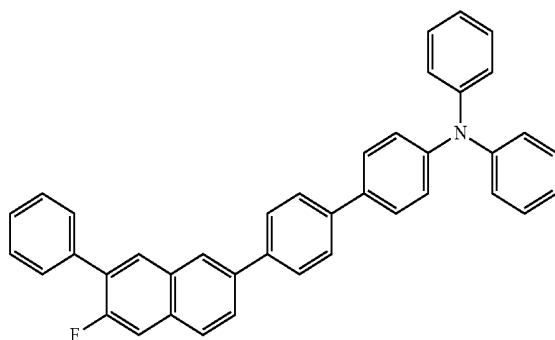
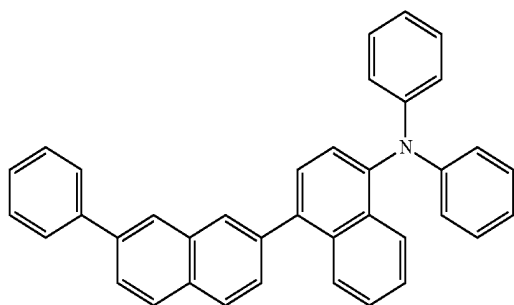
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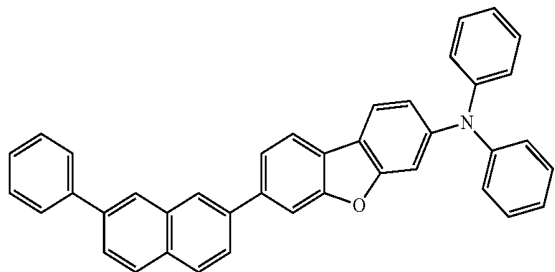
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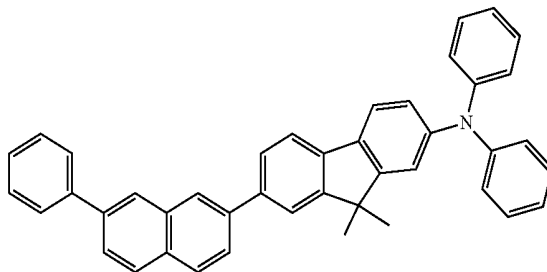


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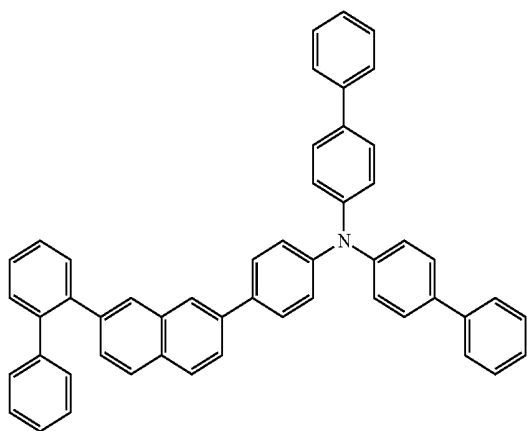
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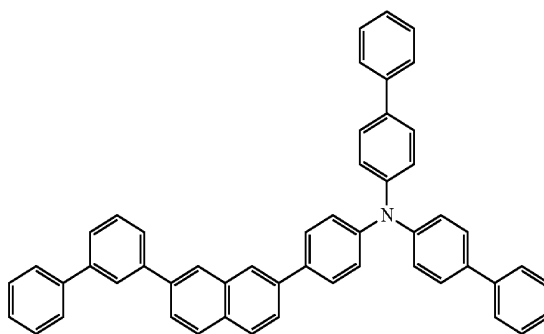
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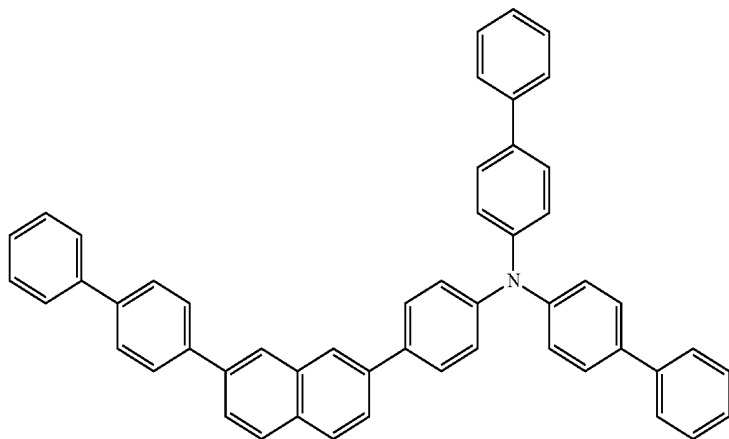
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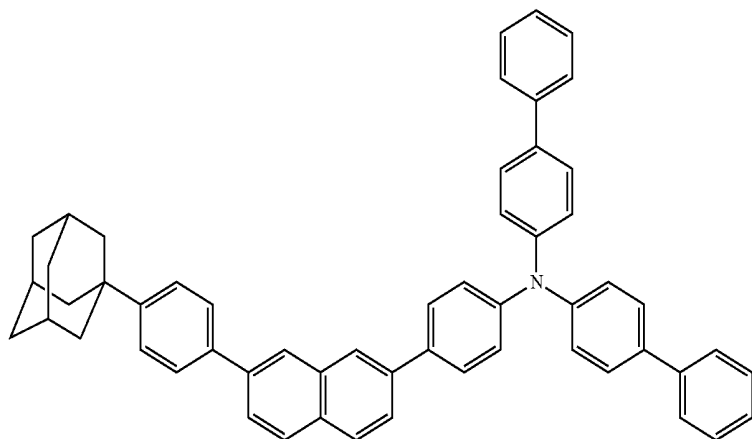
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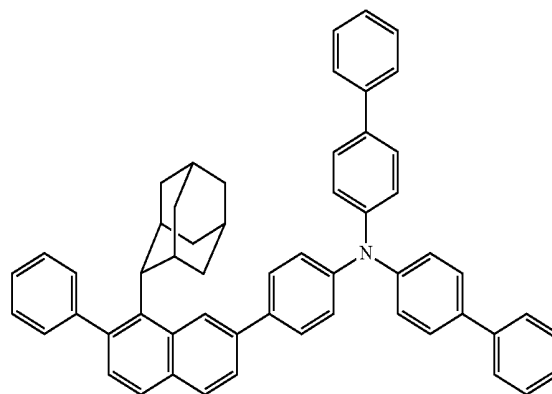
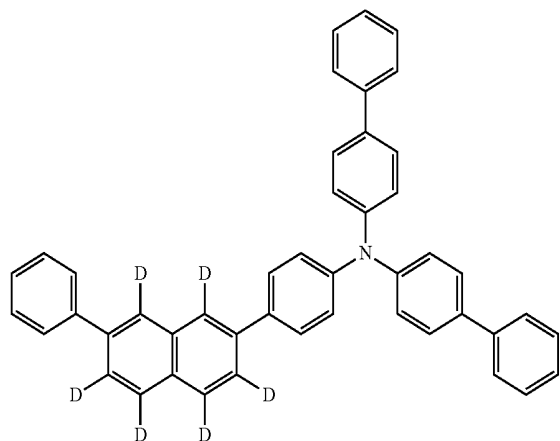


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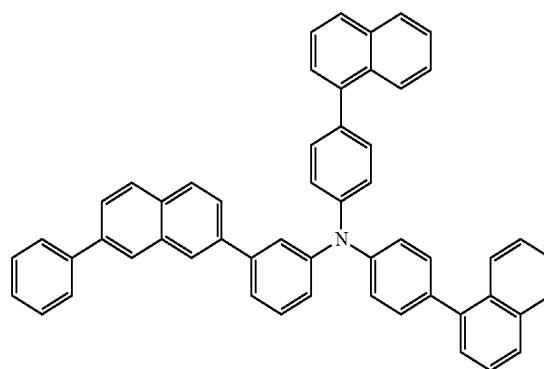
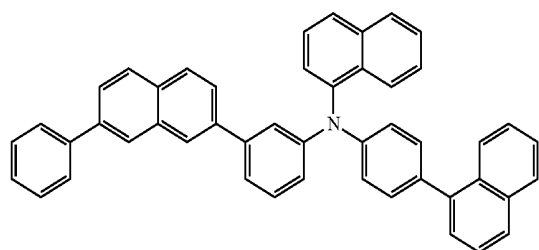
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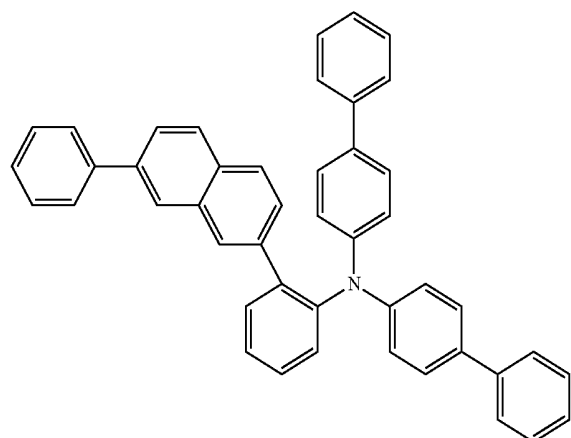


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B32

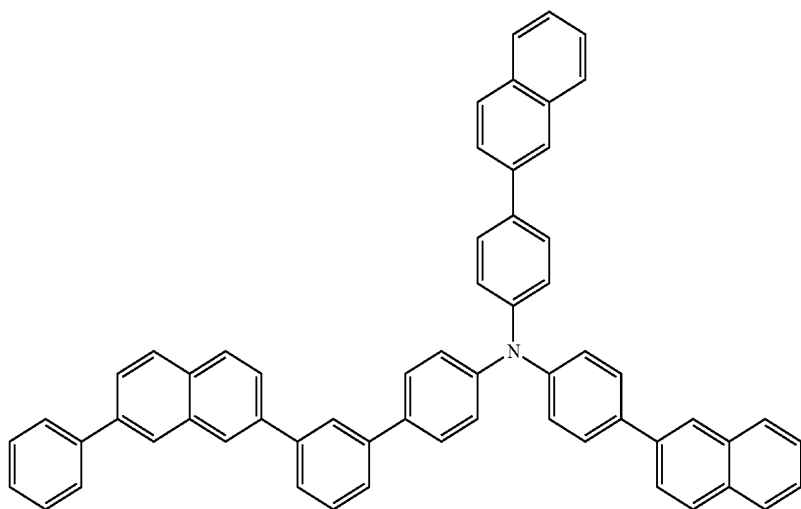


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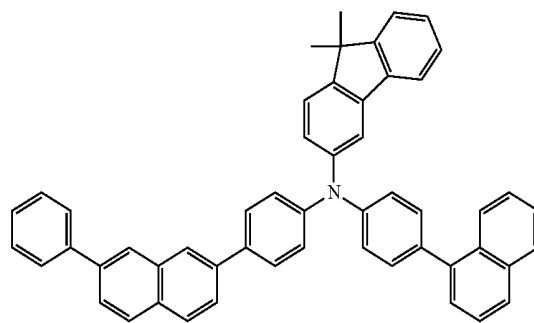
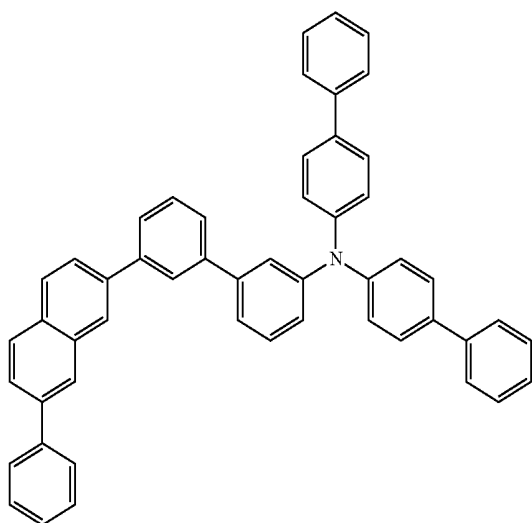
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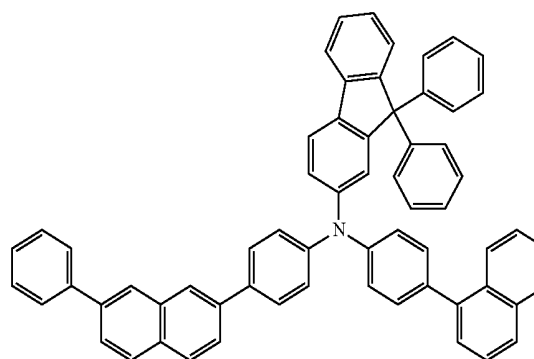
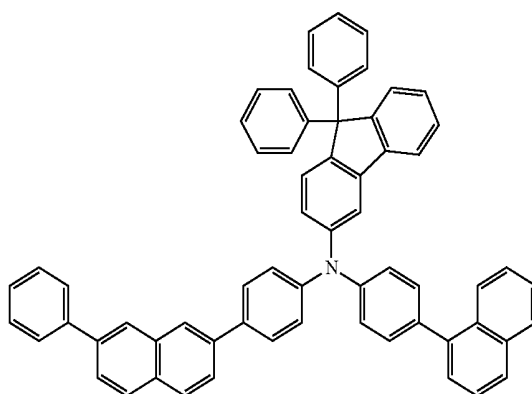
B35

B36

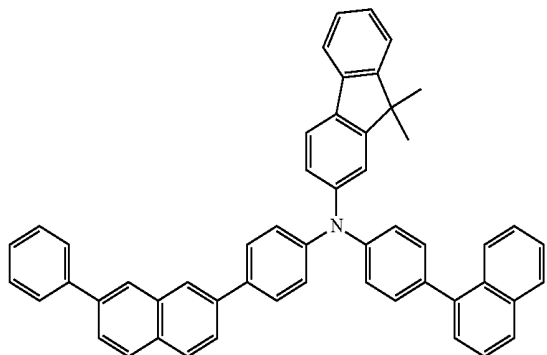


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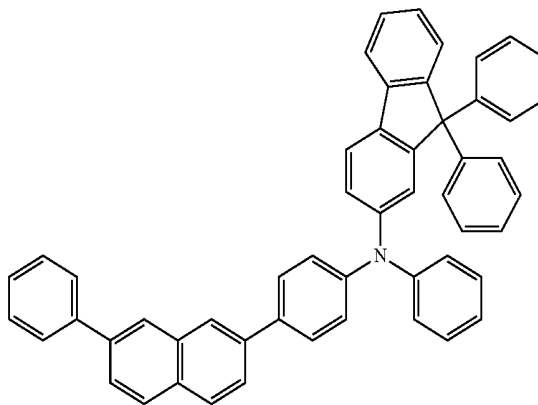
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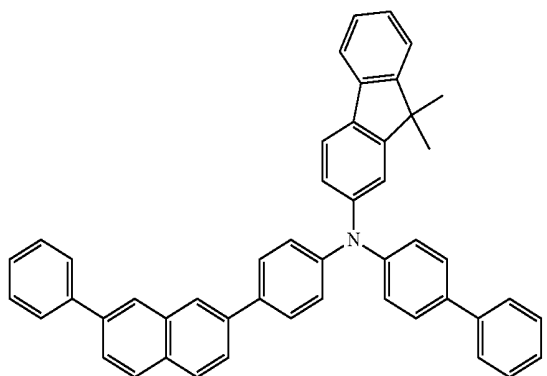
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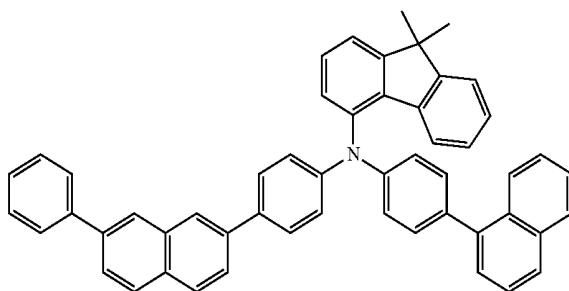
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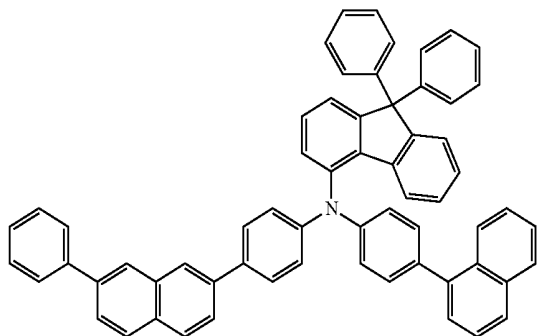
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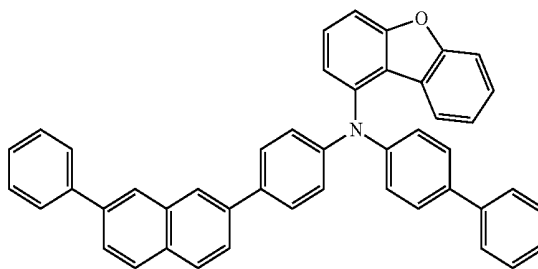
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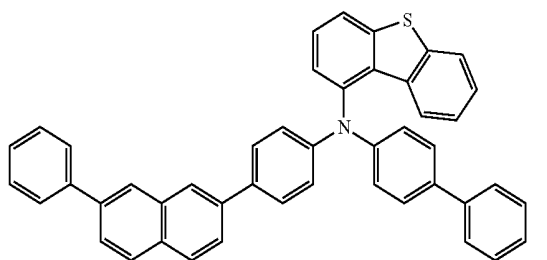
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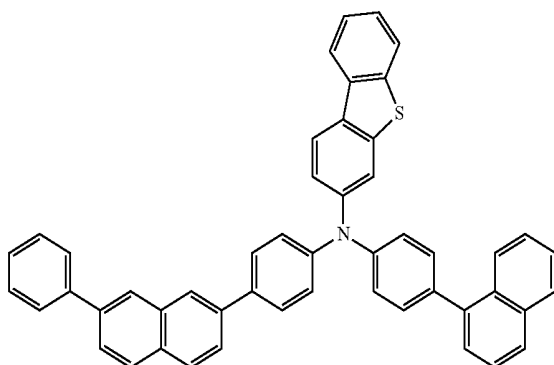
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B45



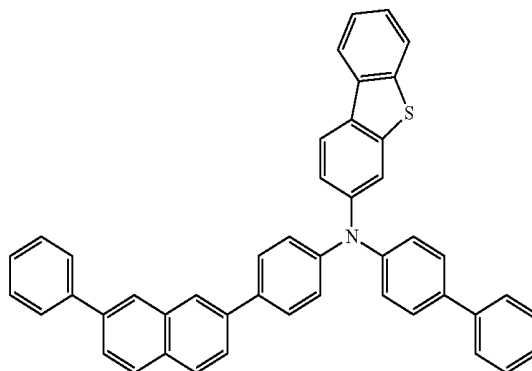
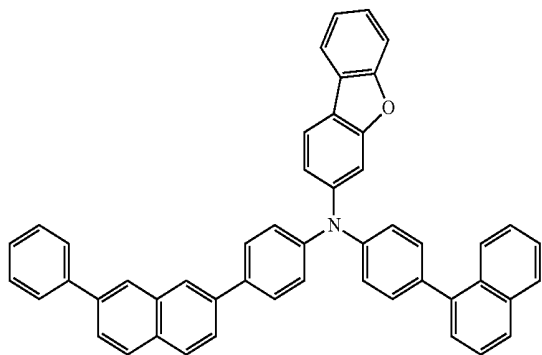
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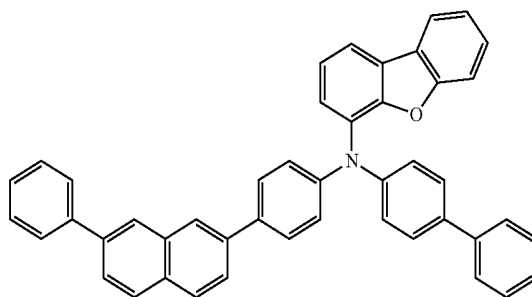
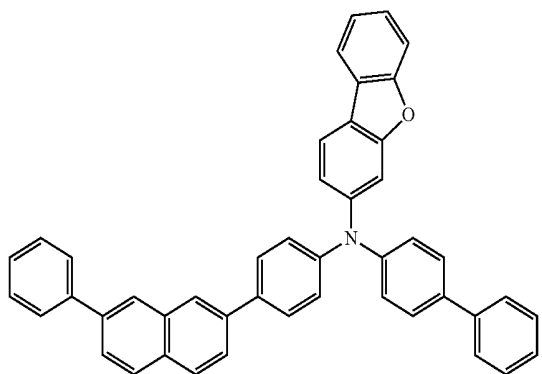
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B48



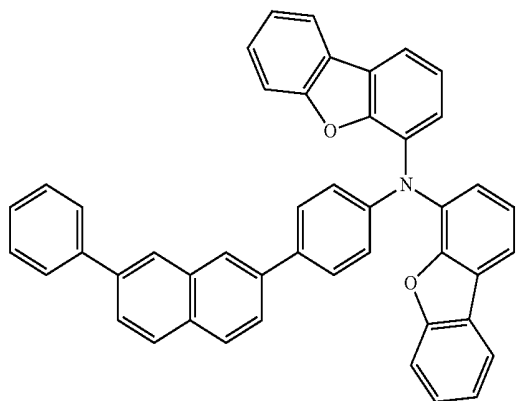
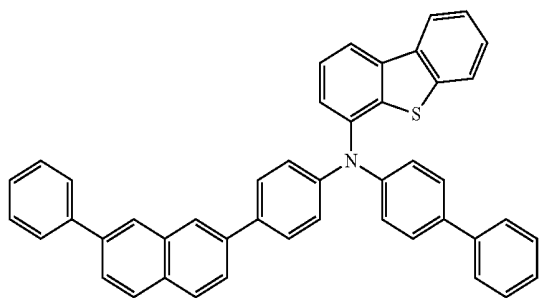
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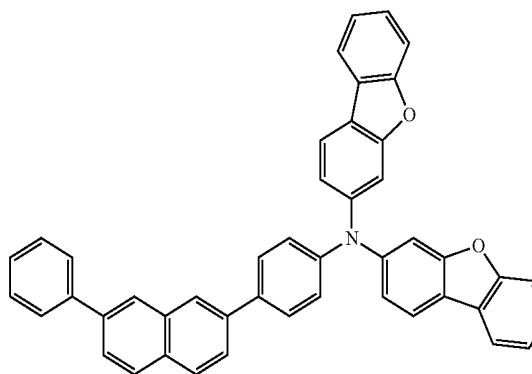
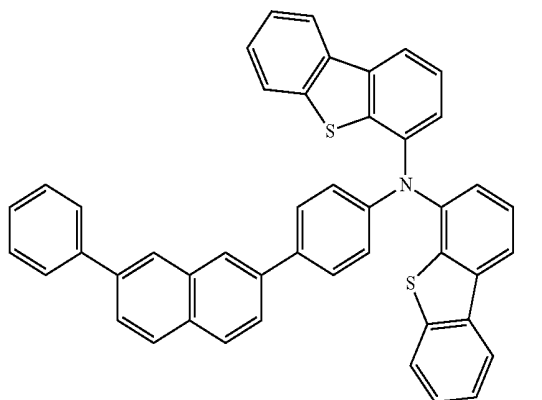
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B52

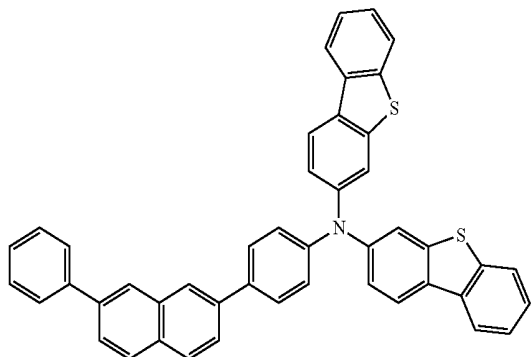


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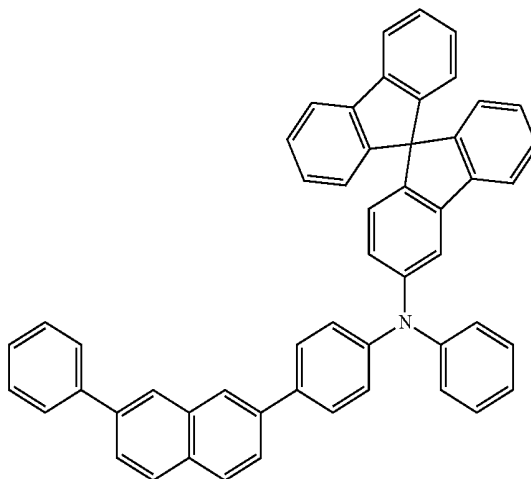
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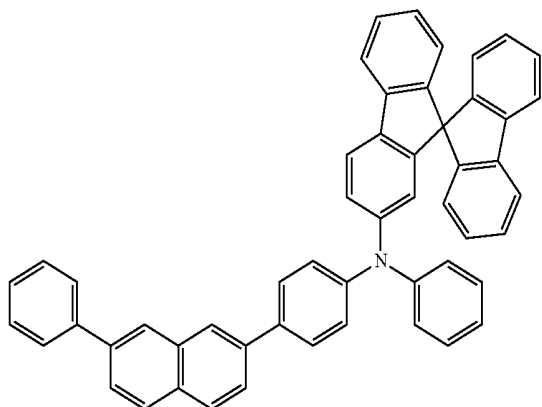
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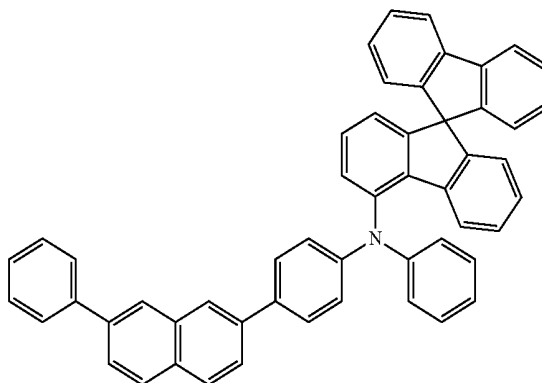
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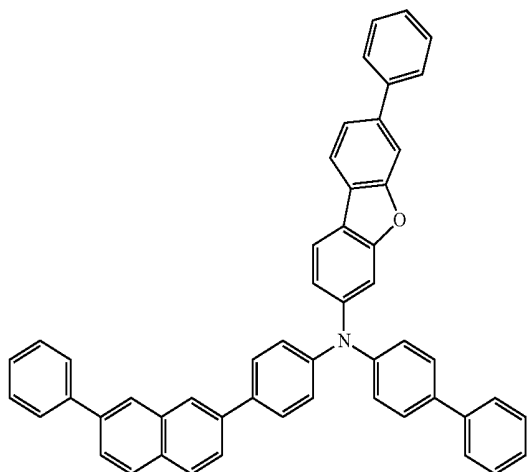
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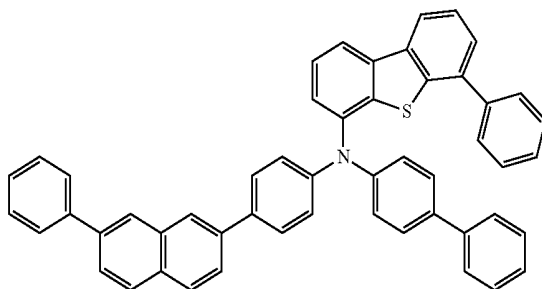
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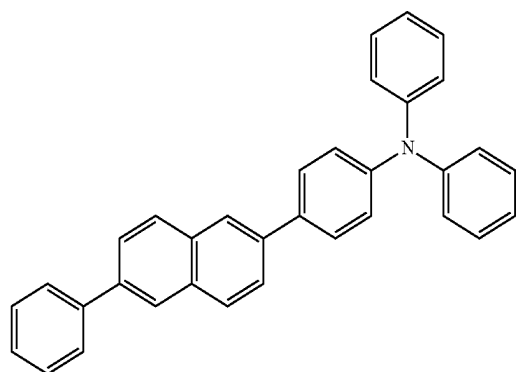
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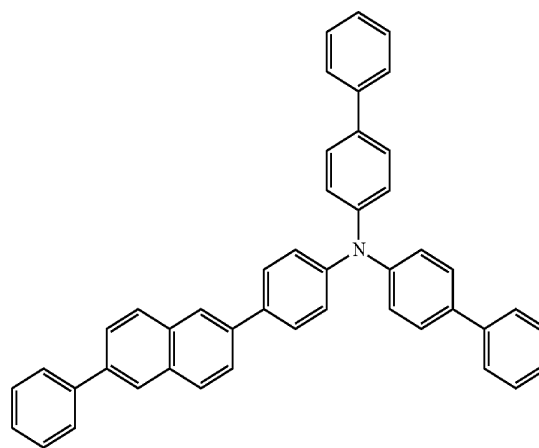
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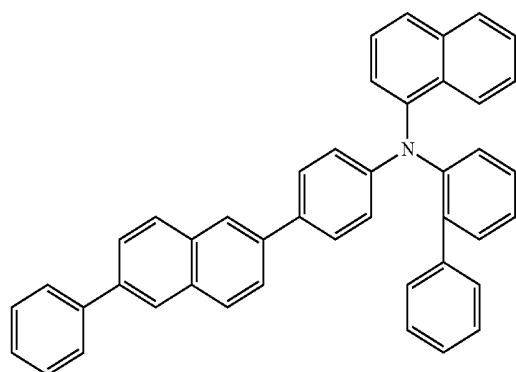
[0059] [Compound Group 3]



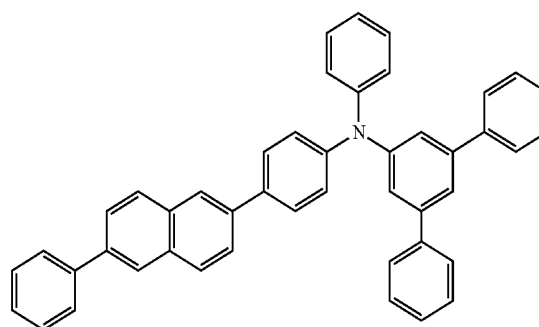
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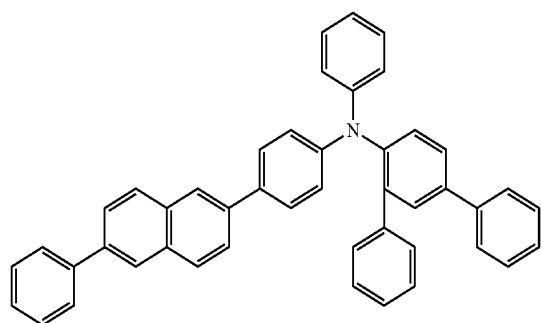
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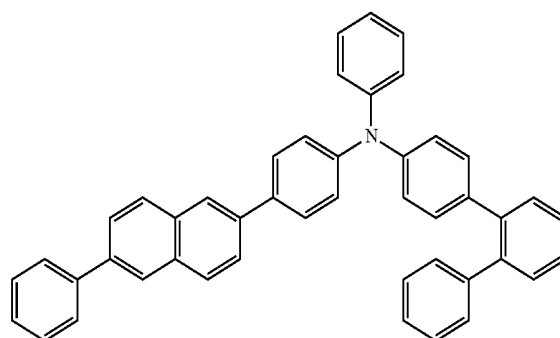
C3



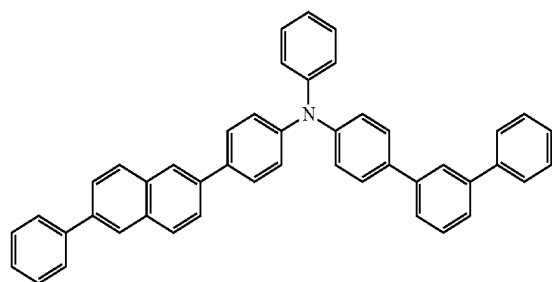
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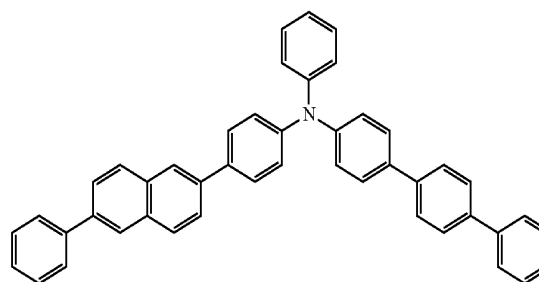
C5



C6



C7

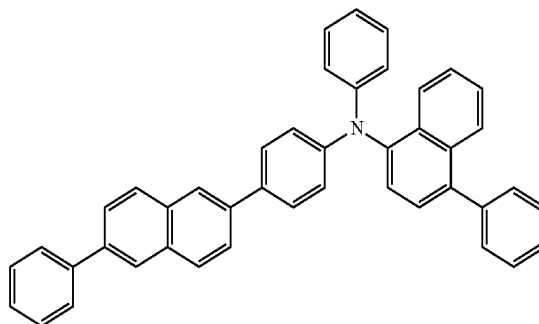
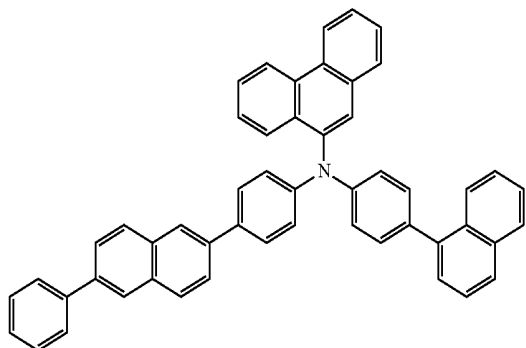


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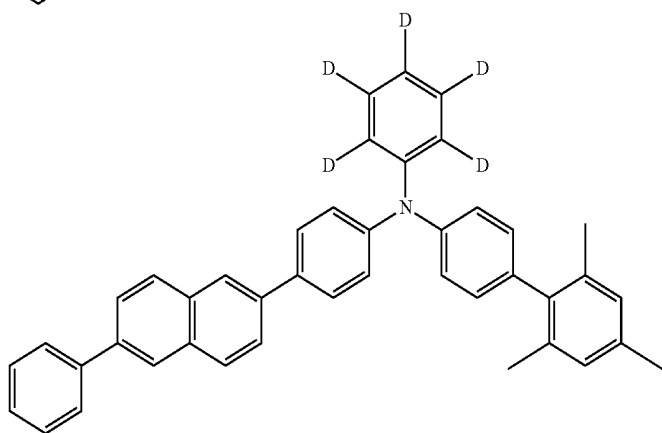
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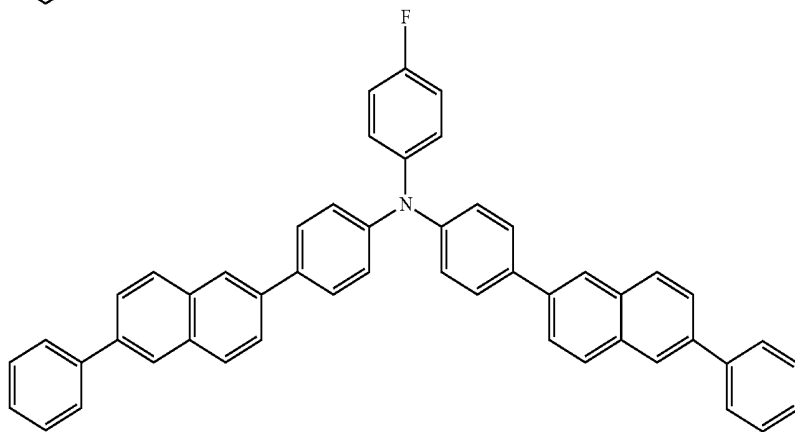
C10



C11

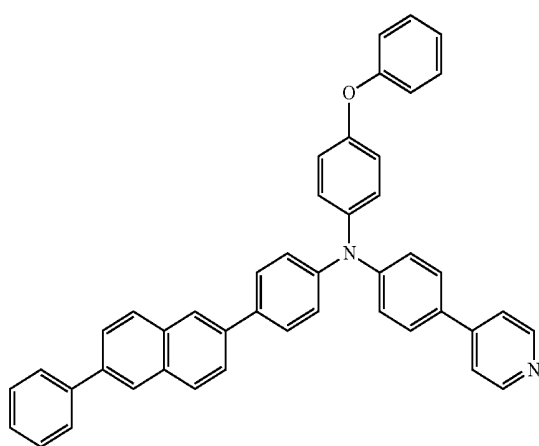
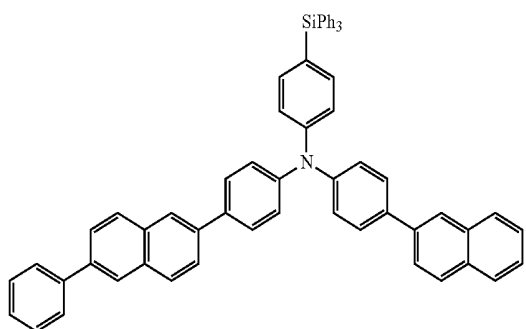


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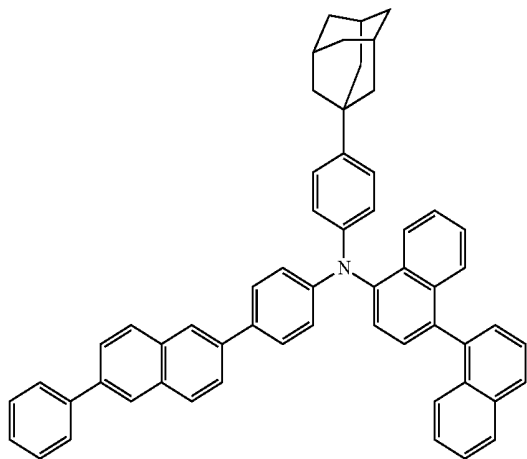
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C14

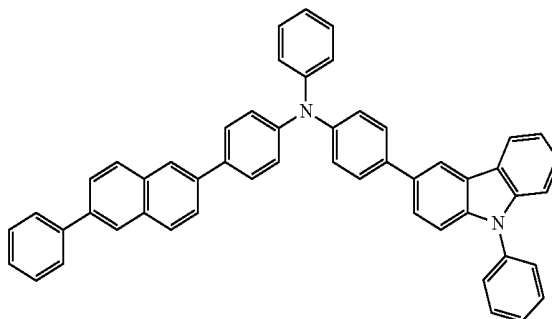


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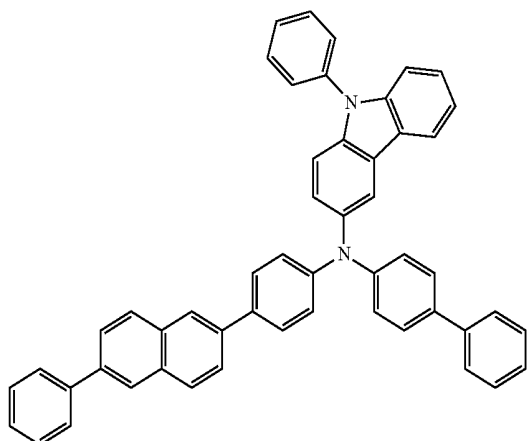
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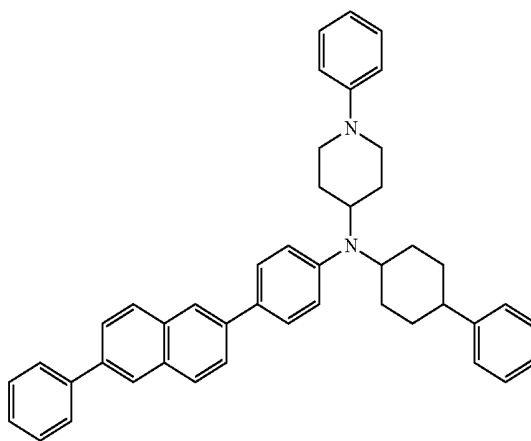
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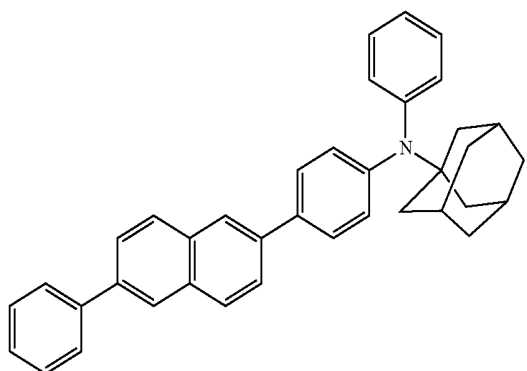
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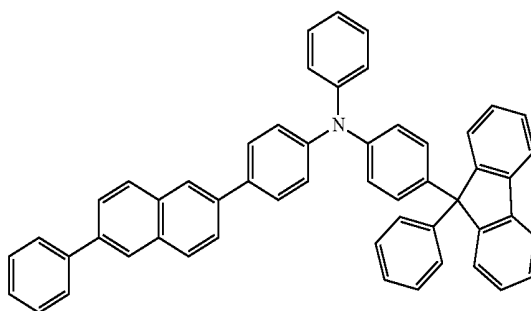
C18



C19

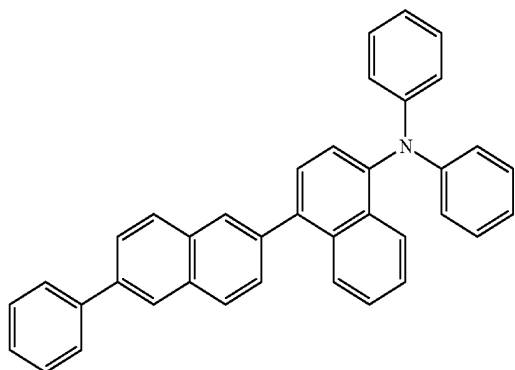


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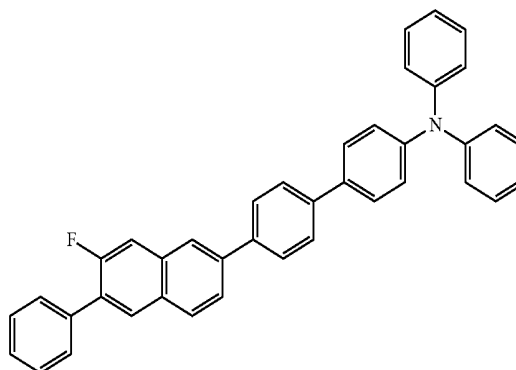


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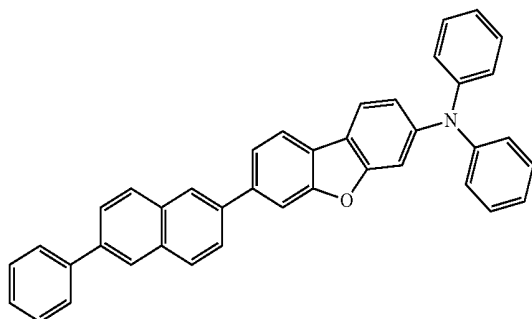
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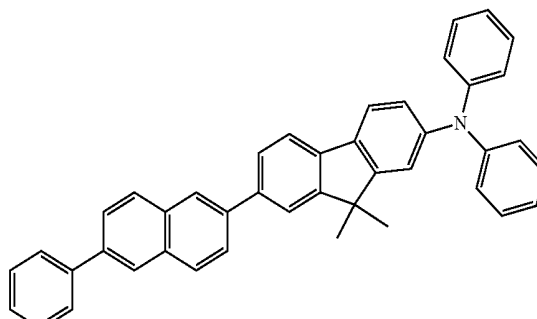
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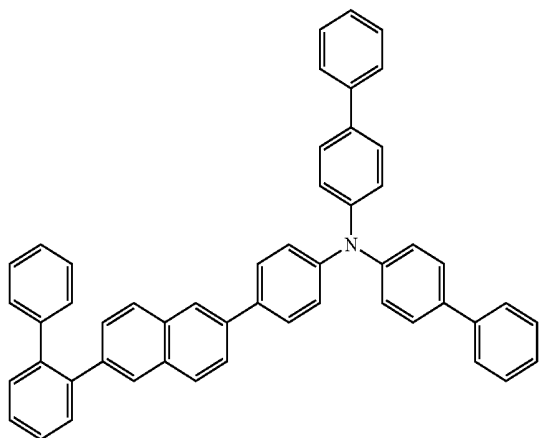
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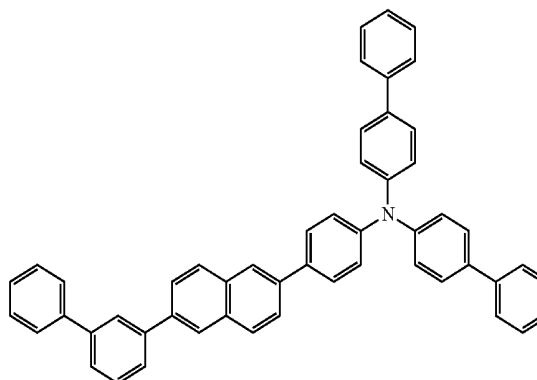
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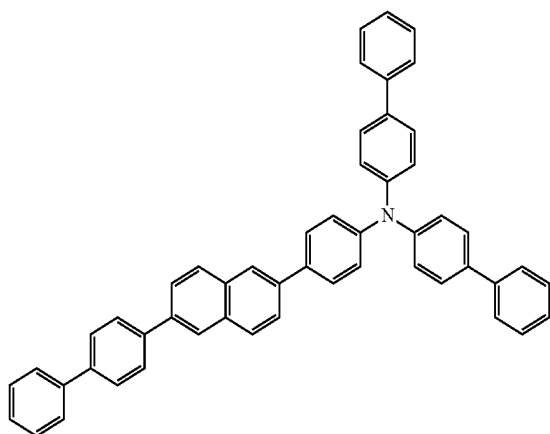
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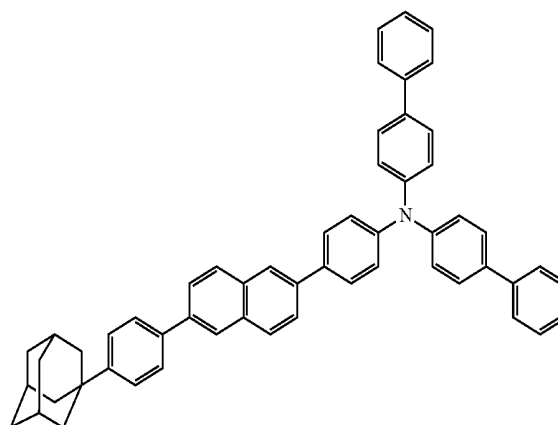
C26



C27

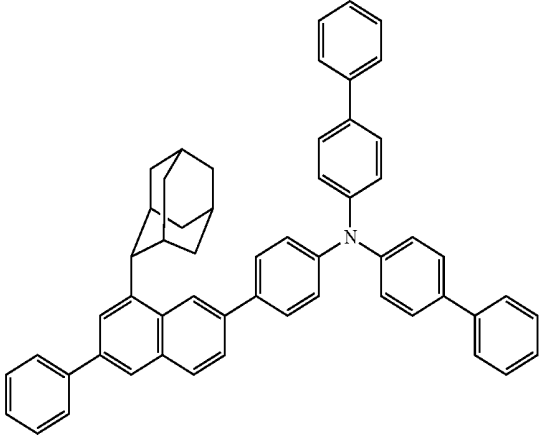
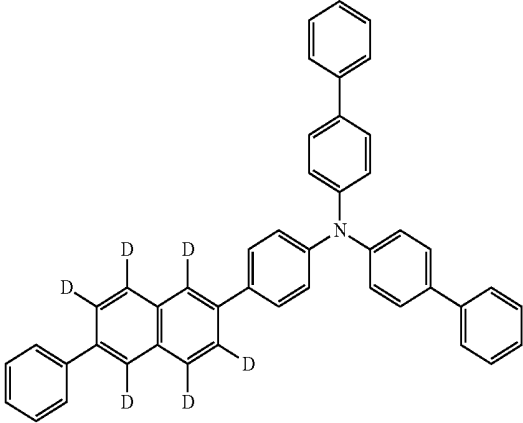


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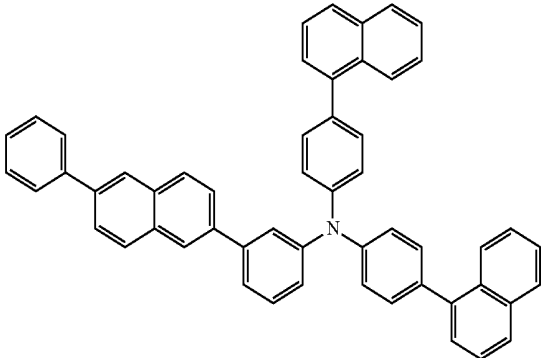
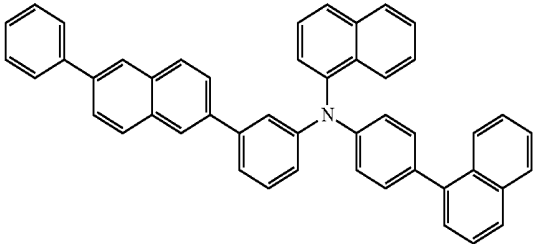
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C30

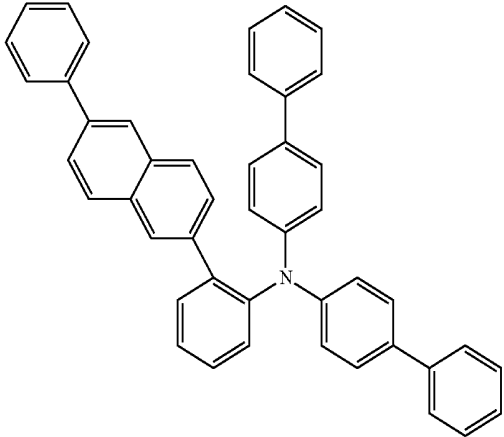


C31

C32

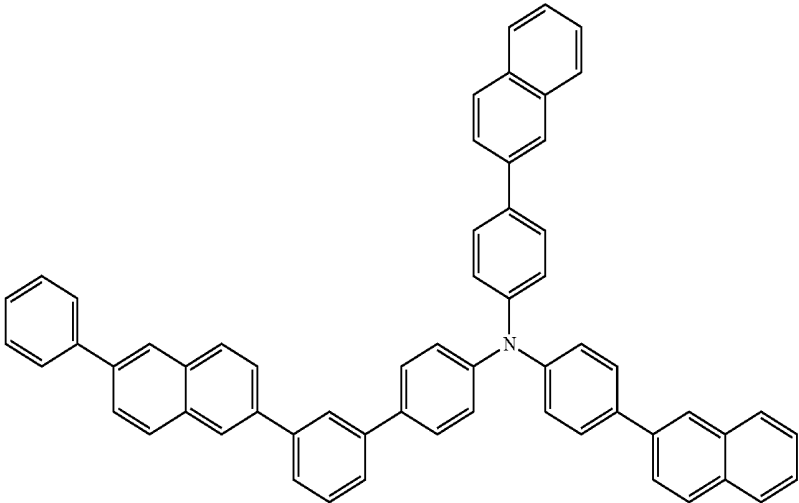


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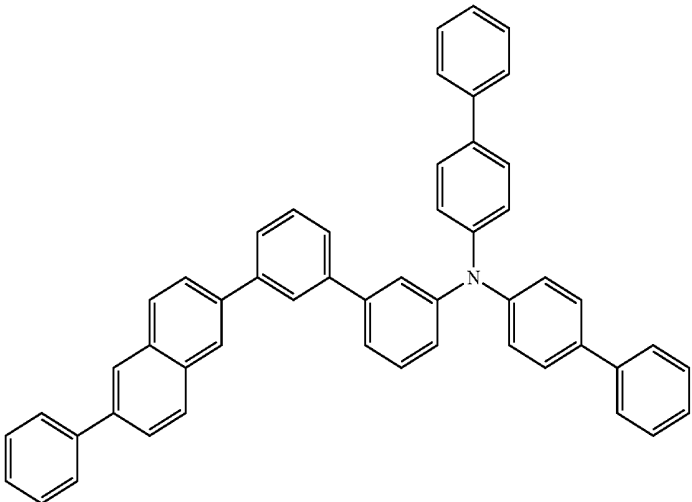


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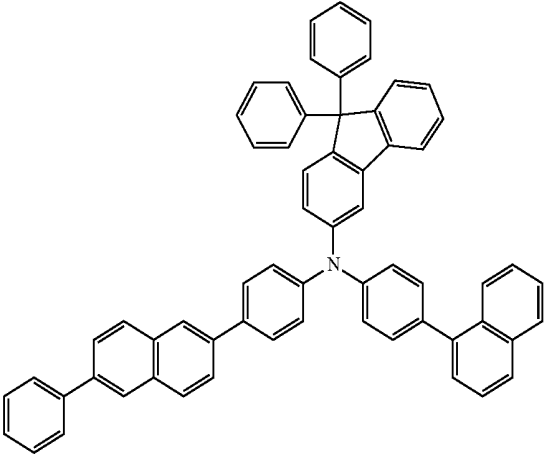
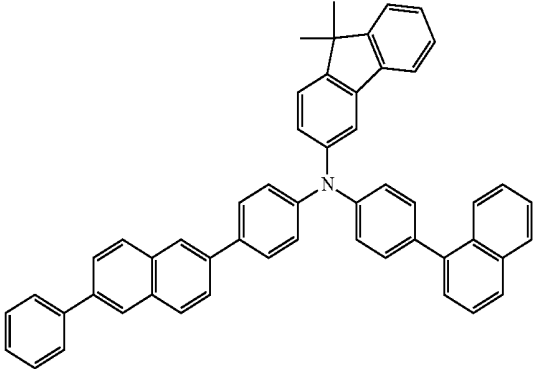


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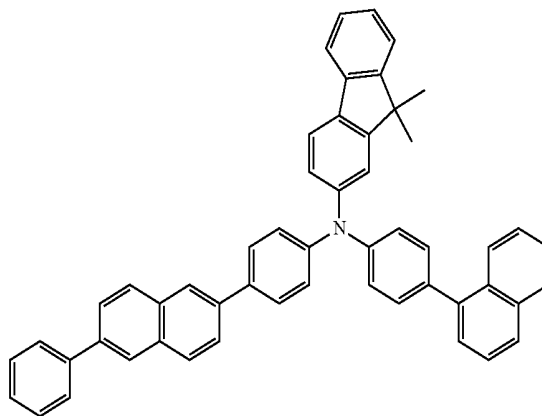
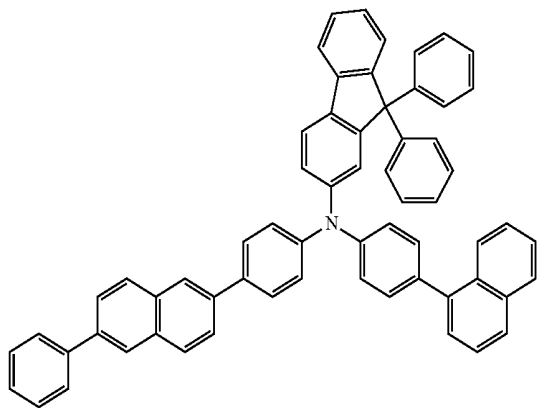
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C37



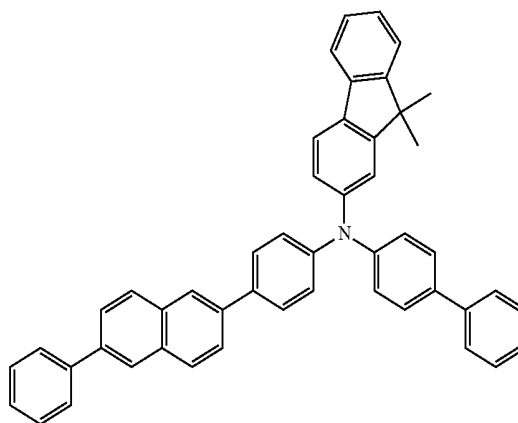
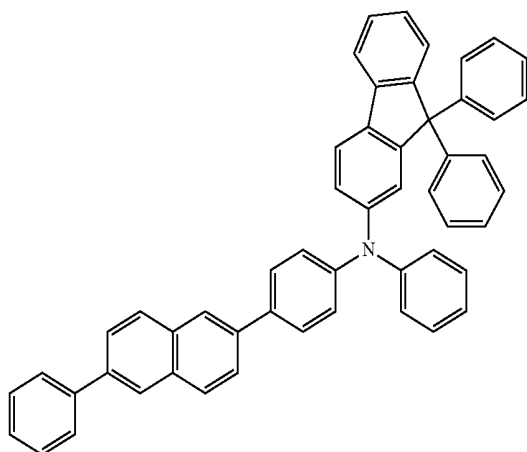
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C38

C39



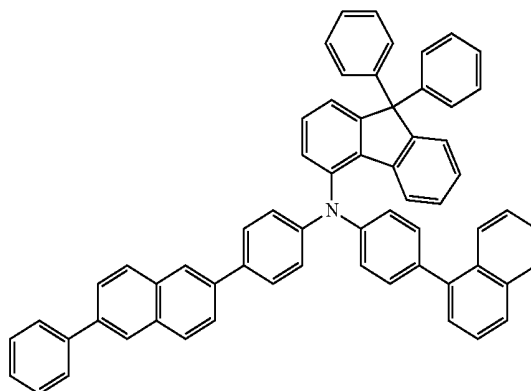
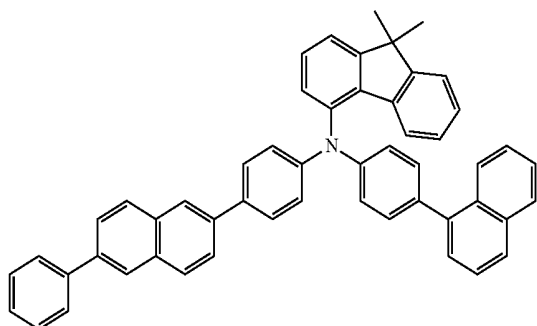
C40

C41



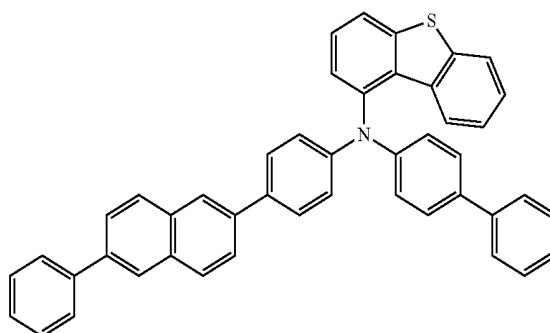
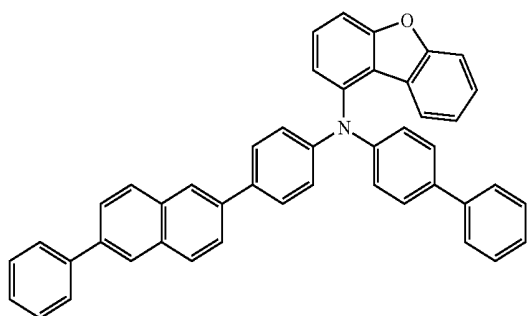
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C43



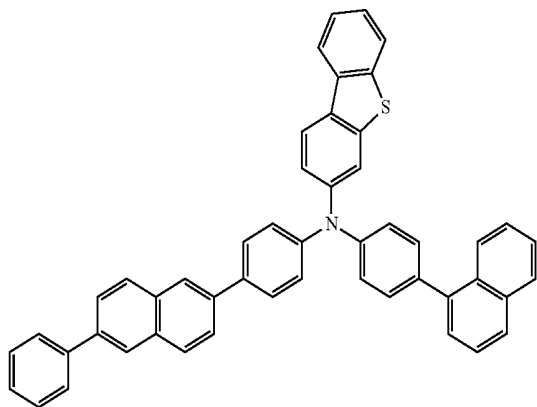
C44

C45

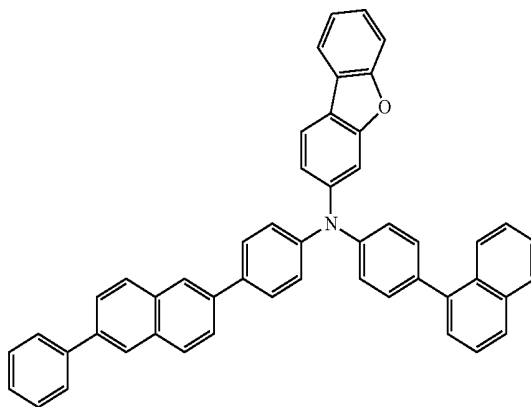


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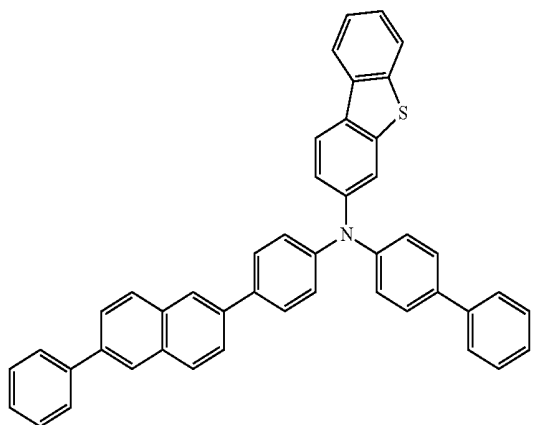
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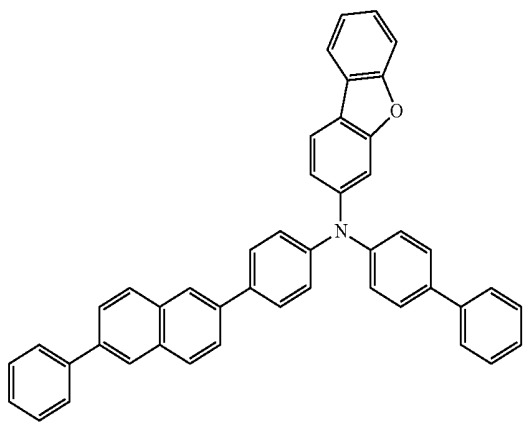
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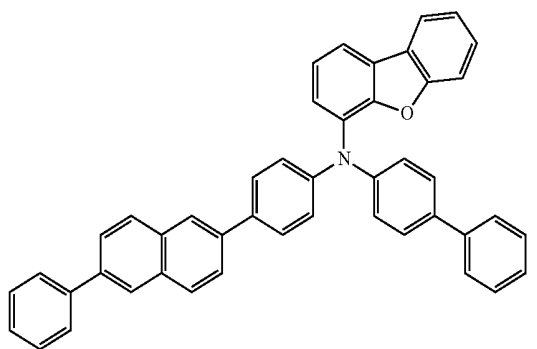
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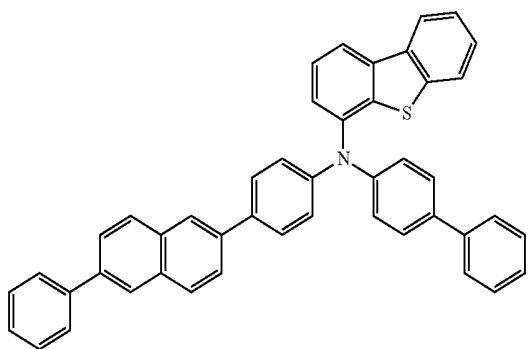
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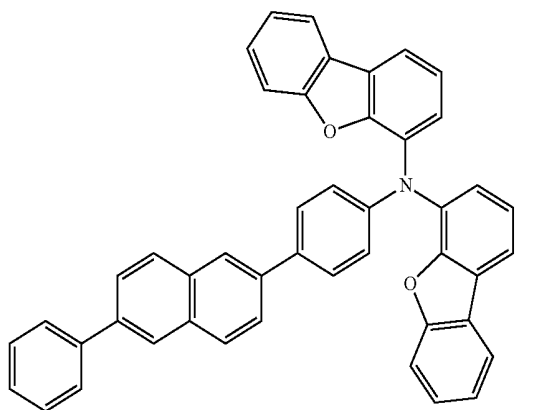
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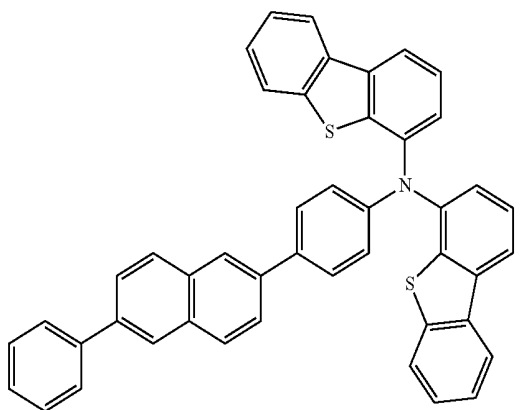
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C52

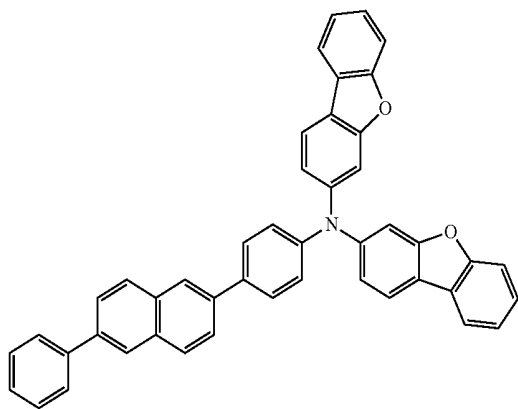


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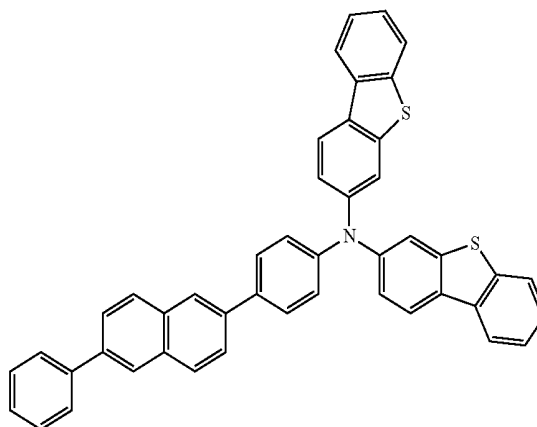


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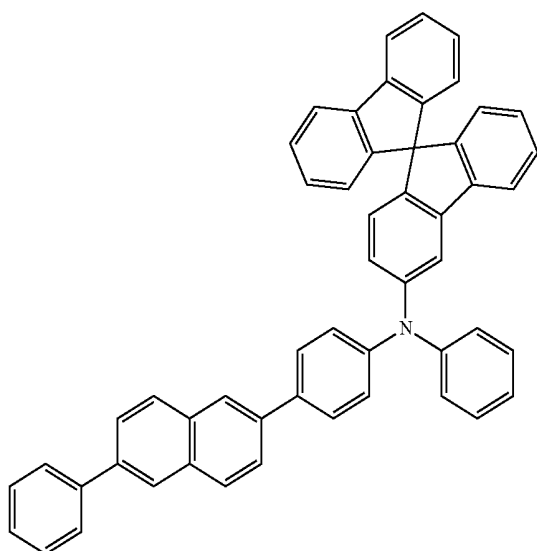
C54



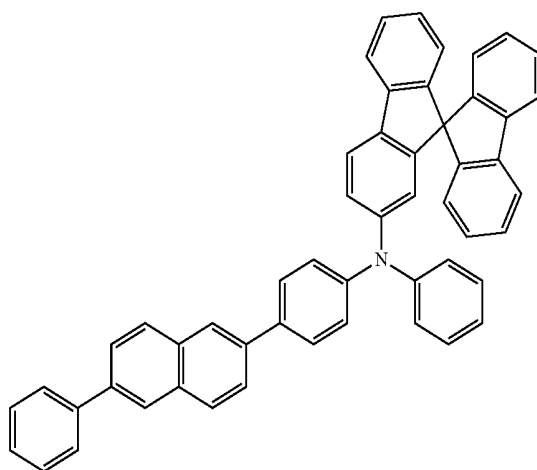
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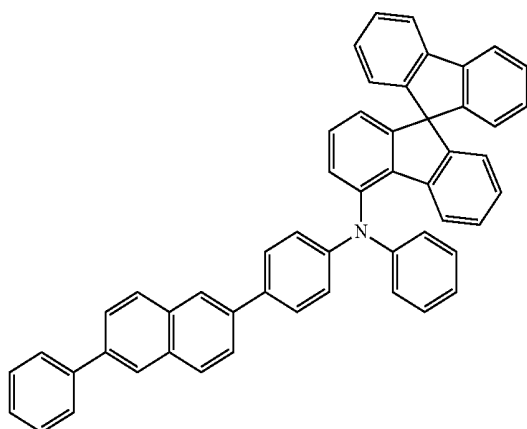
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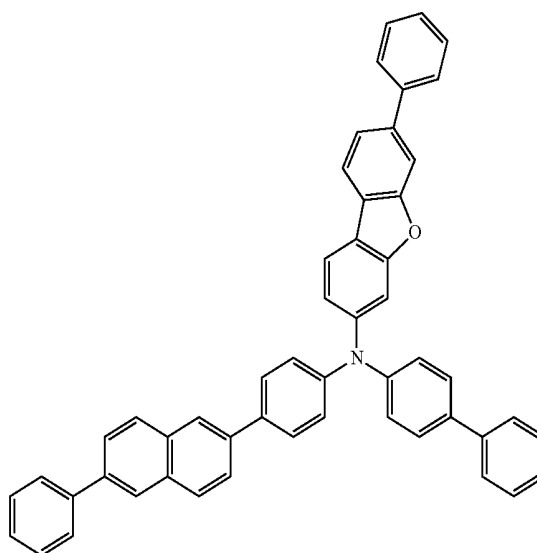
C57



C58

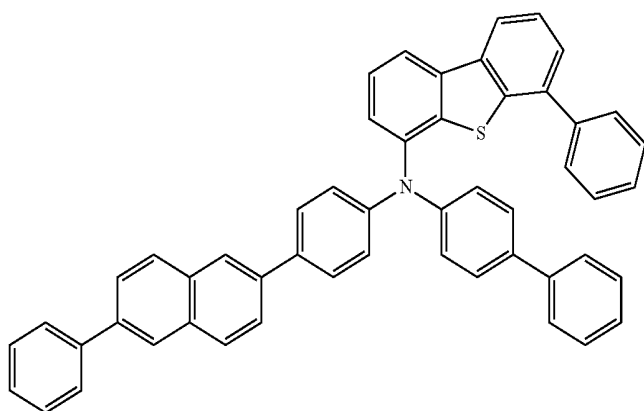


C59



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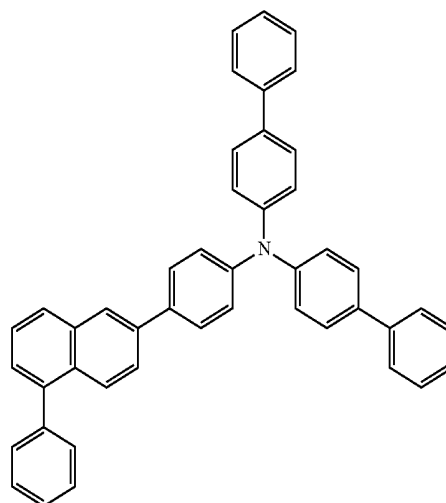
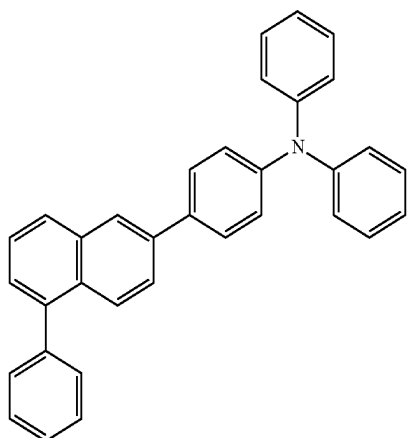
C60



[0060] [Compound Group 4]

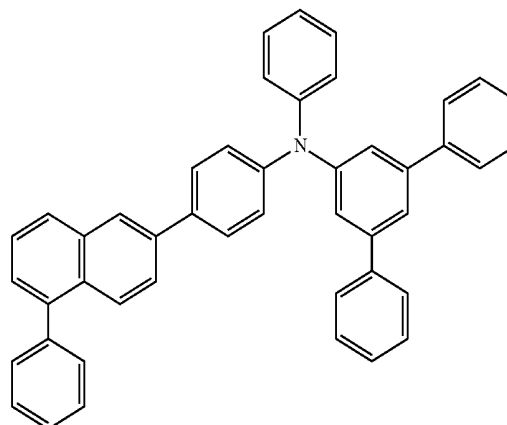
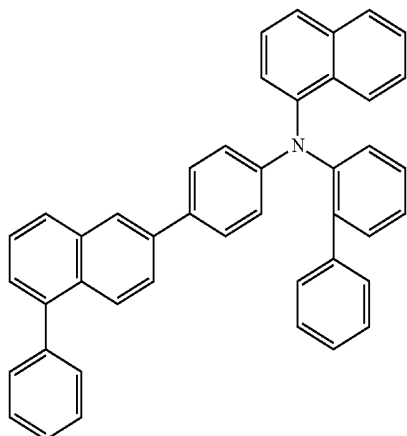
D1

D2



D3

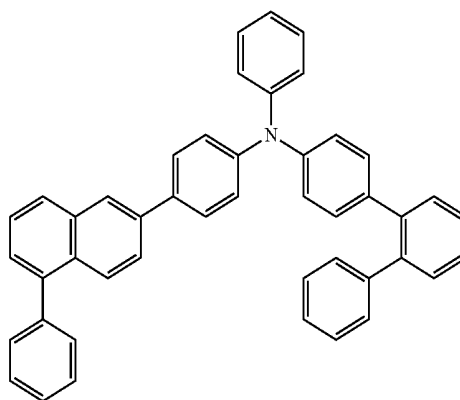
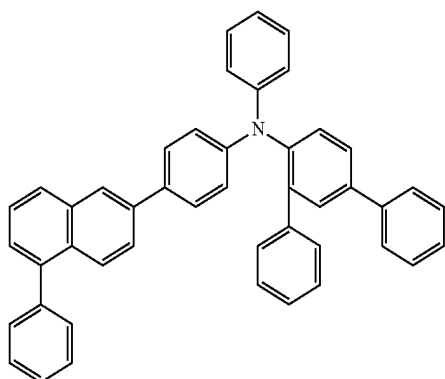
D4



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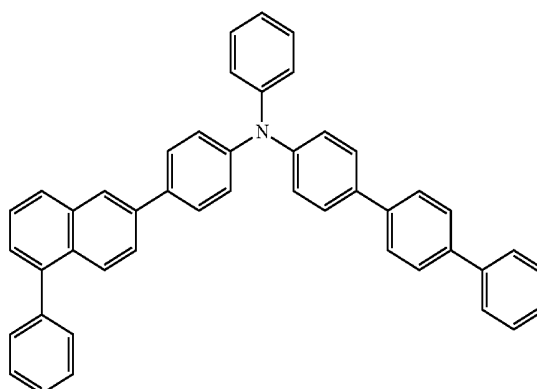
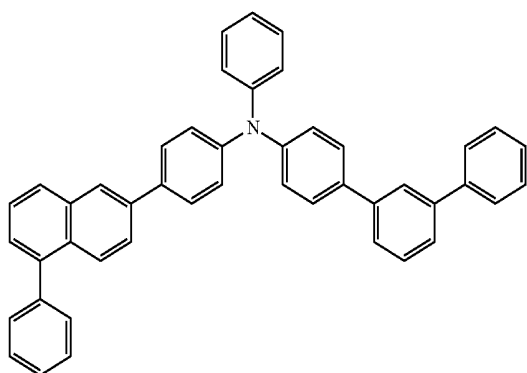
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D6



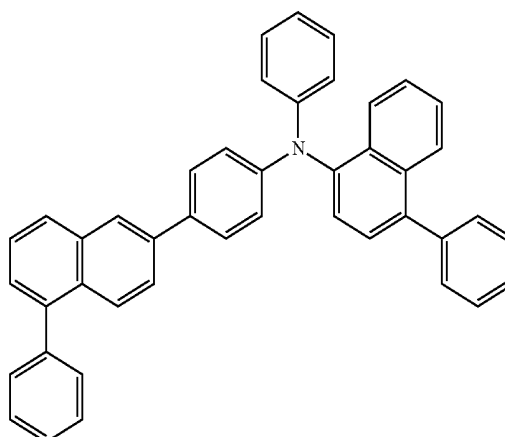
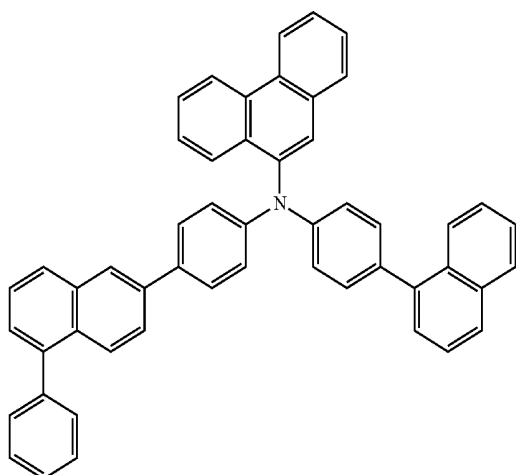
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D8



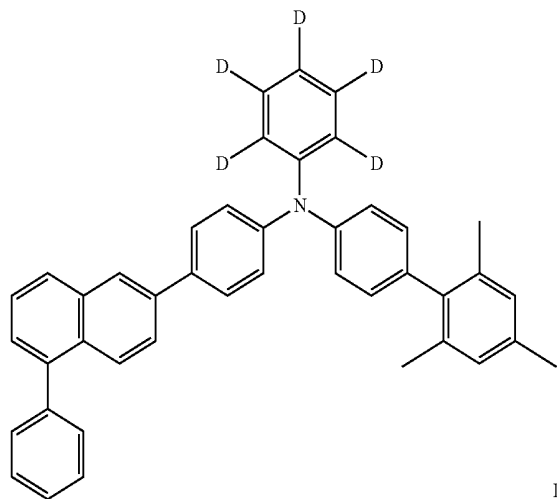
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D10

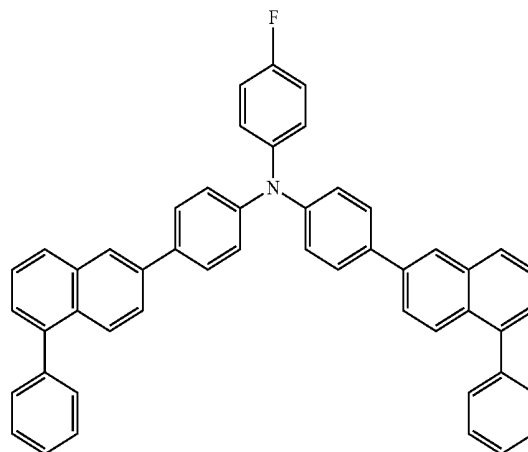


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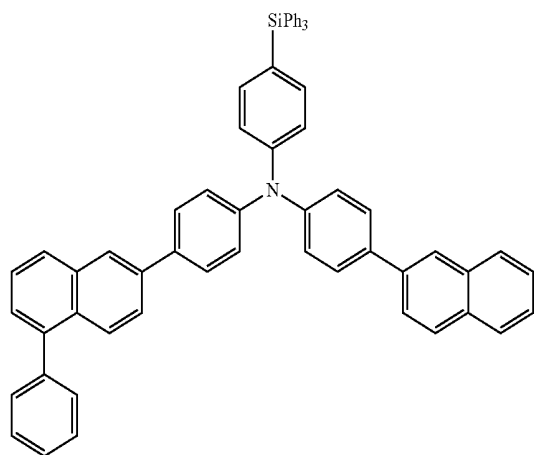
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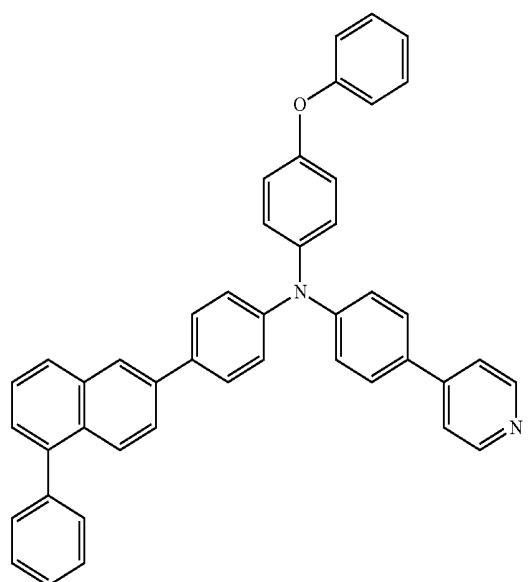
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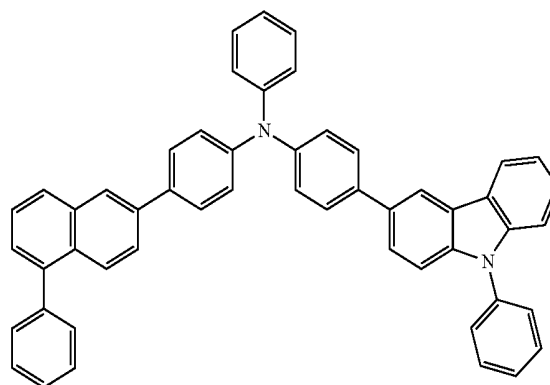
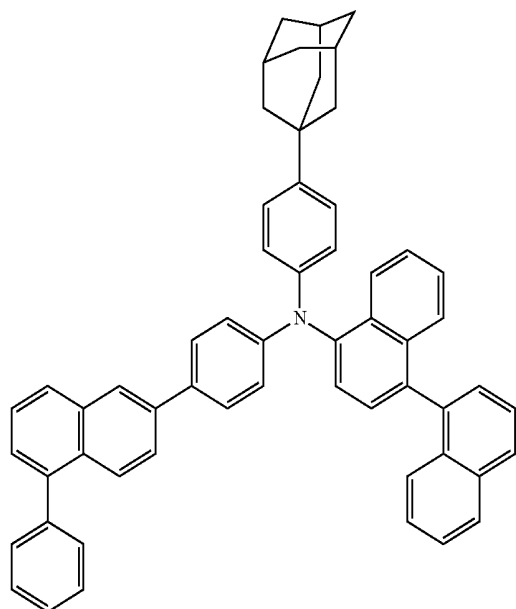
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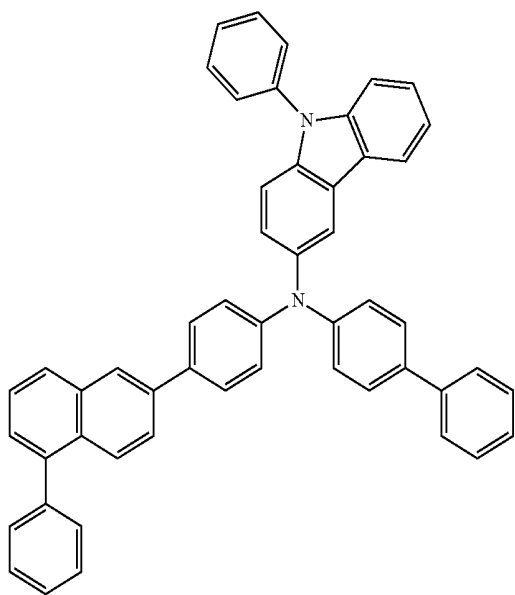


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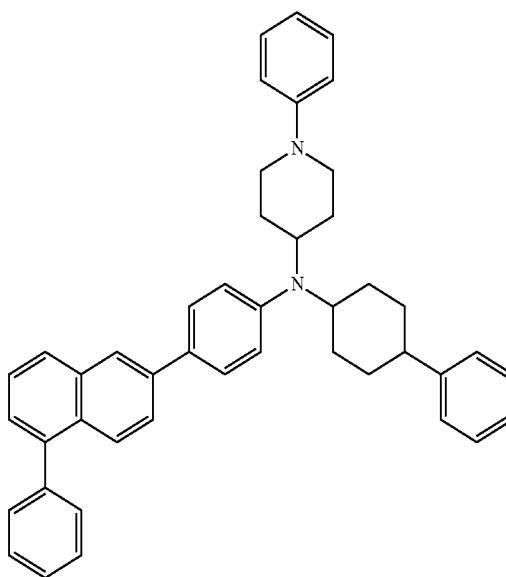


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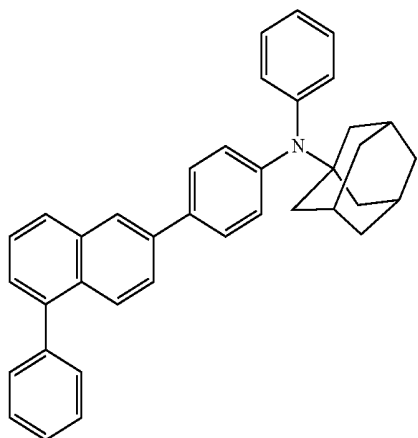


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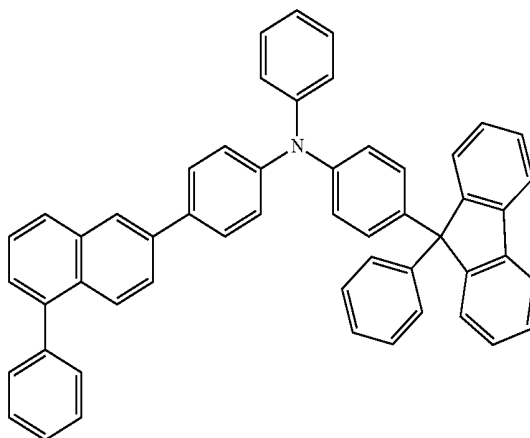
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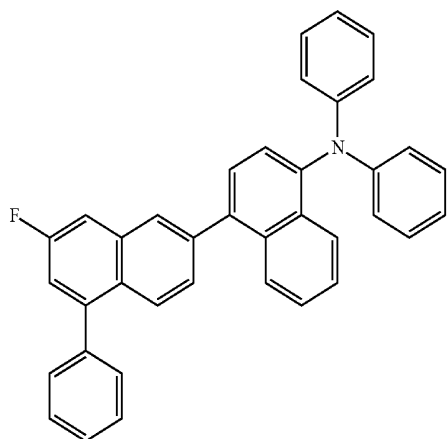
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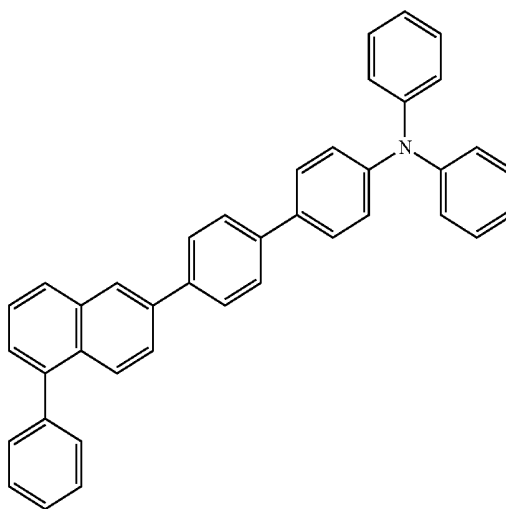
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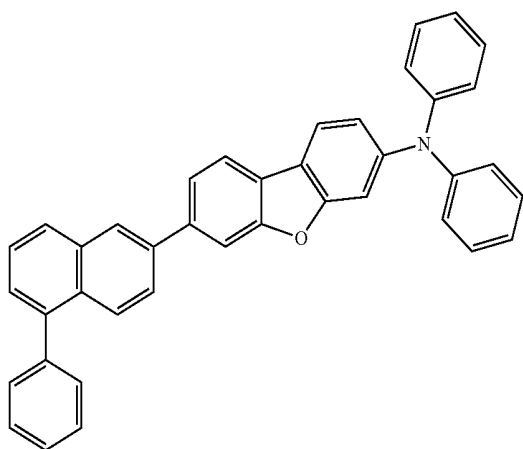
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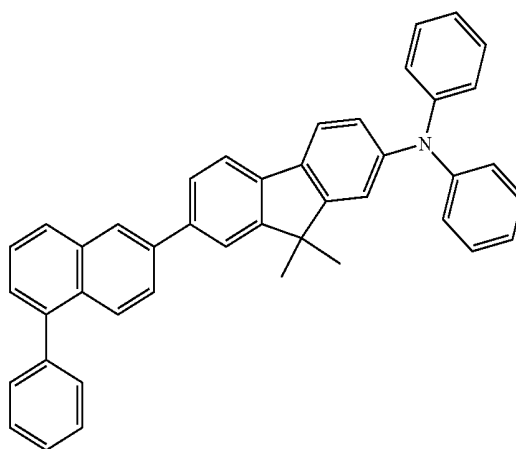
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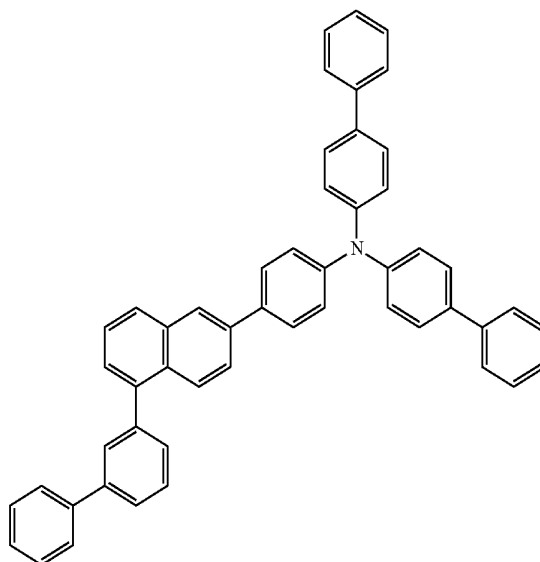
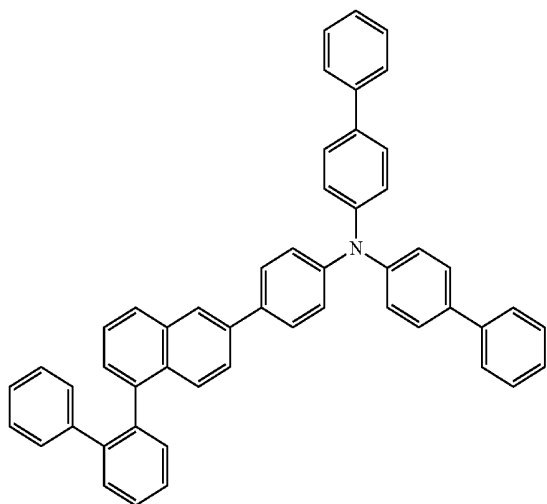


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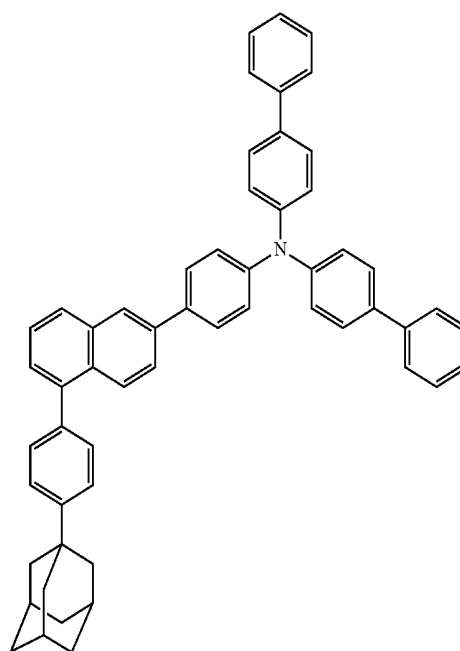
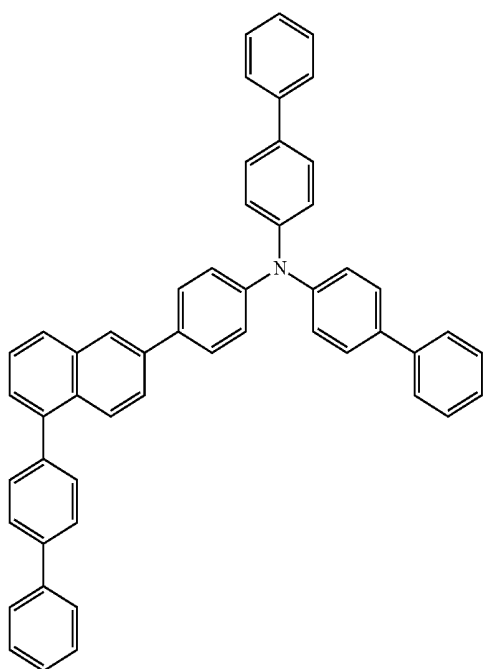
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D26



D27

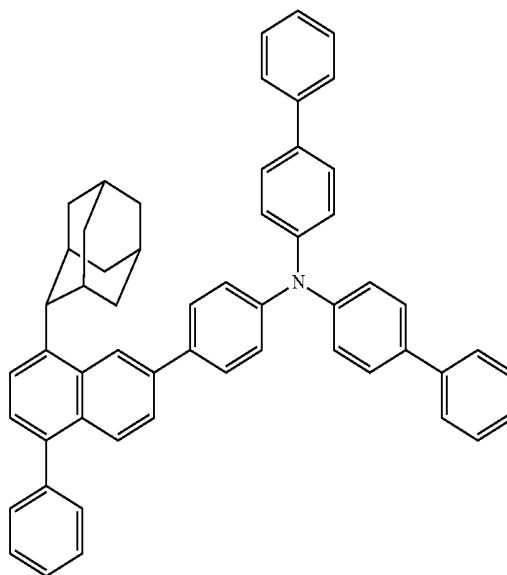
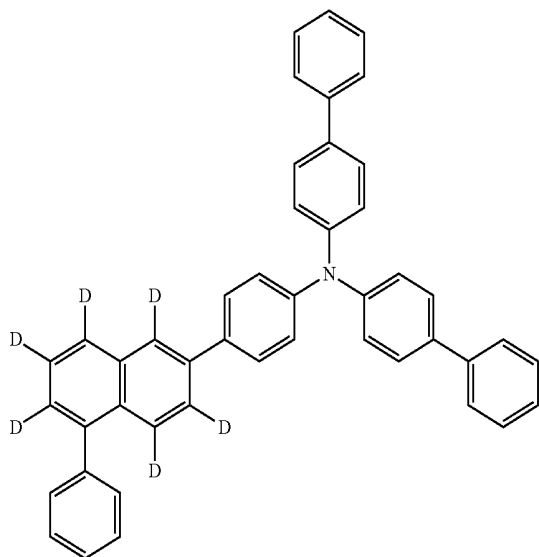
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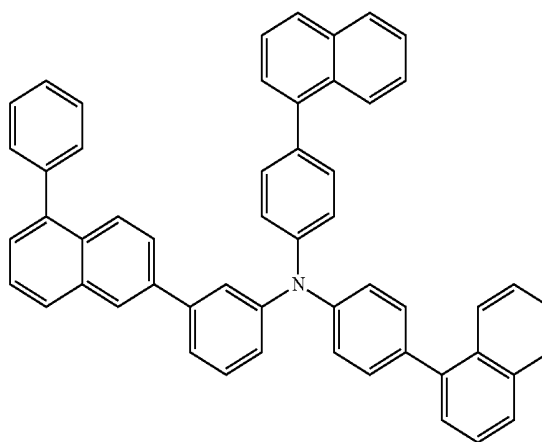
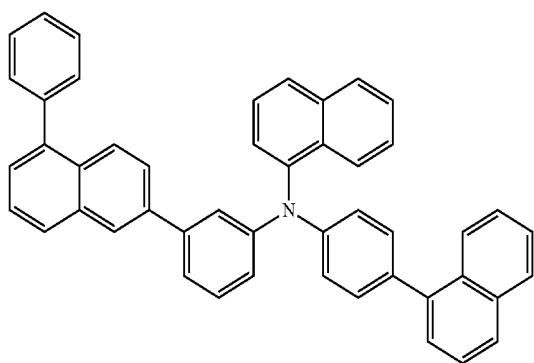
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D30



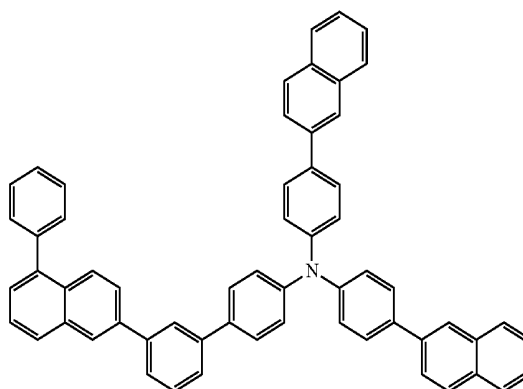
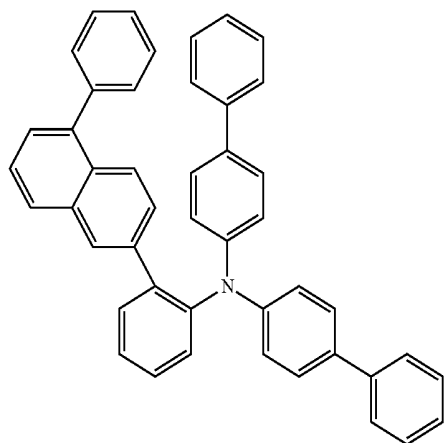
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D32



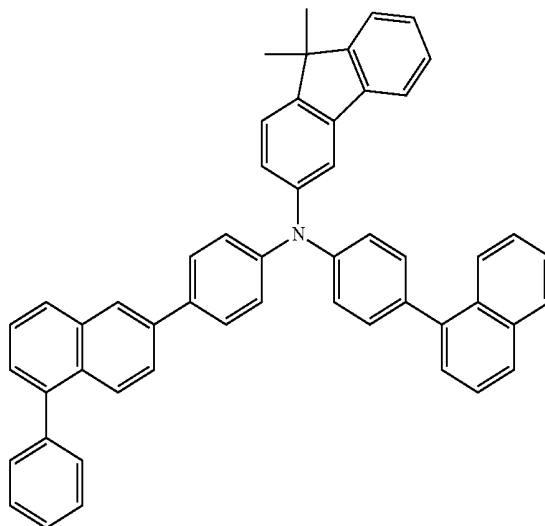
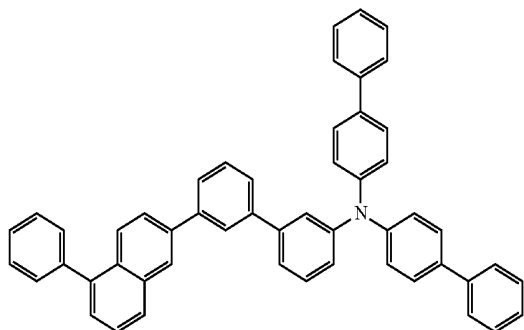
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D34



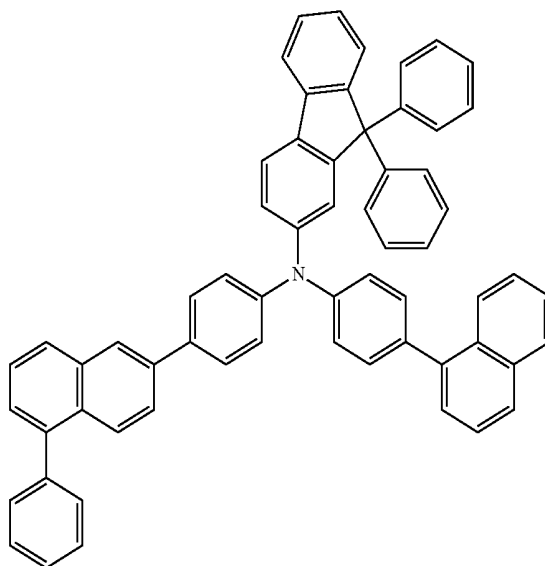
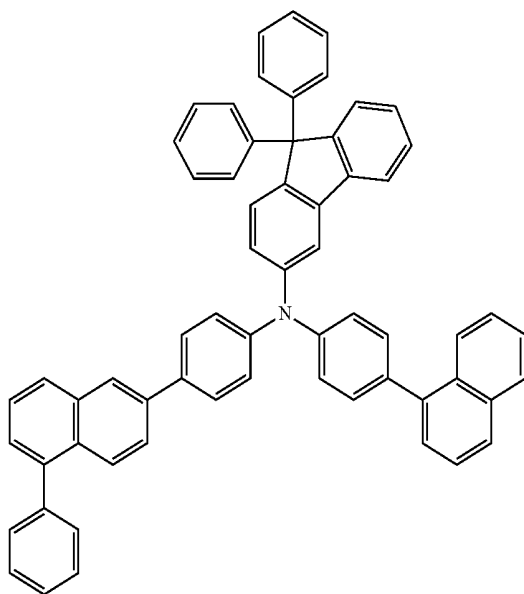
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D35

D36



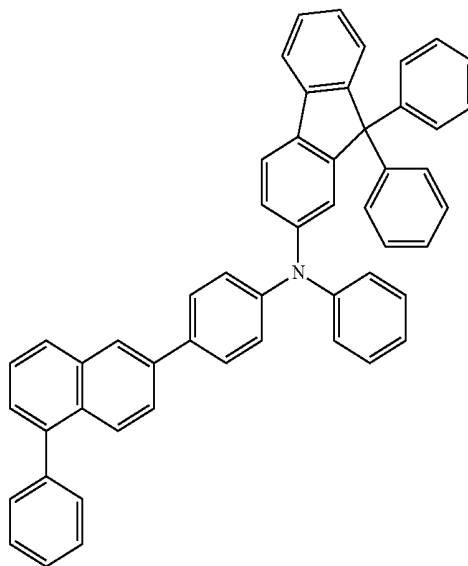
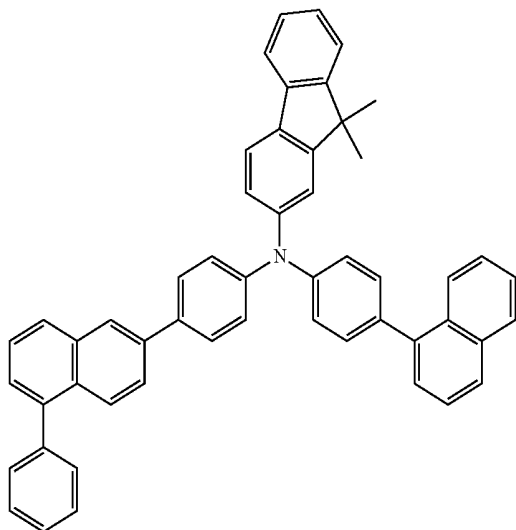
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D38



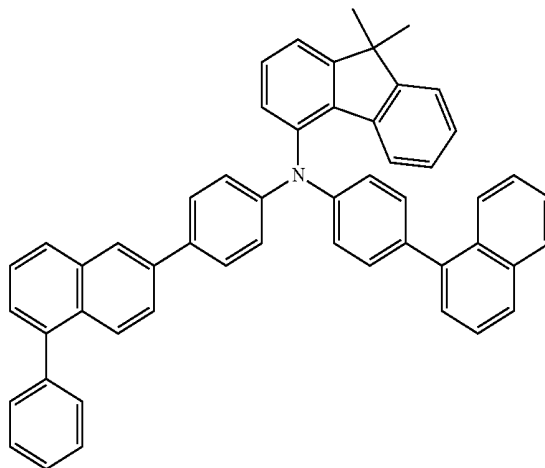
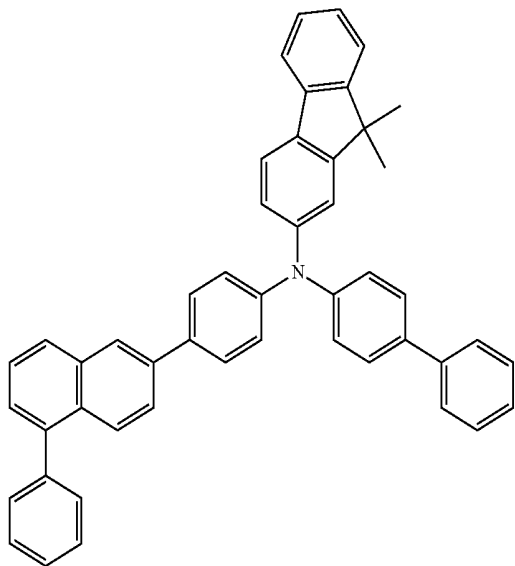
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D40



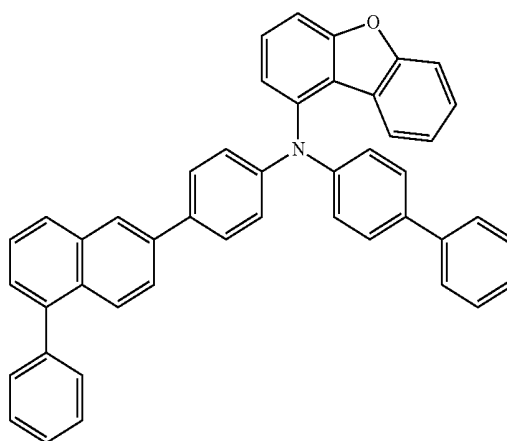
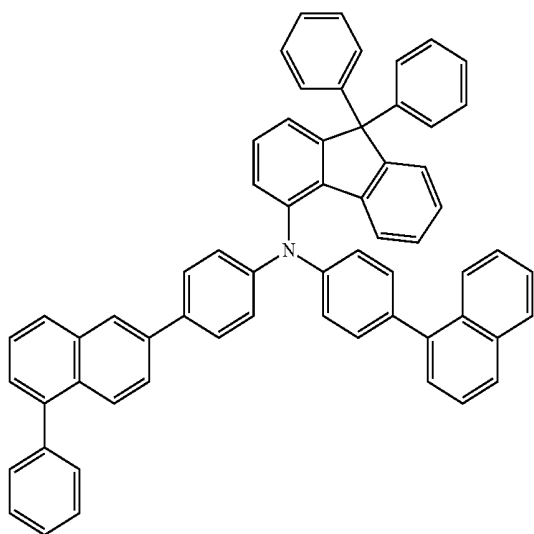
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D42



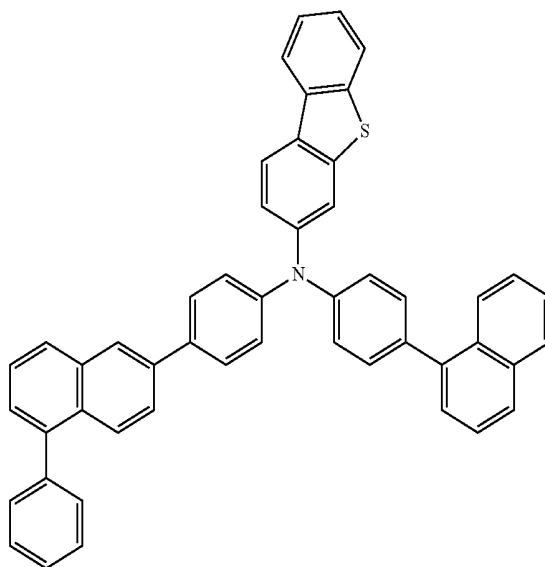
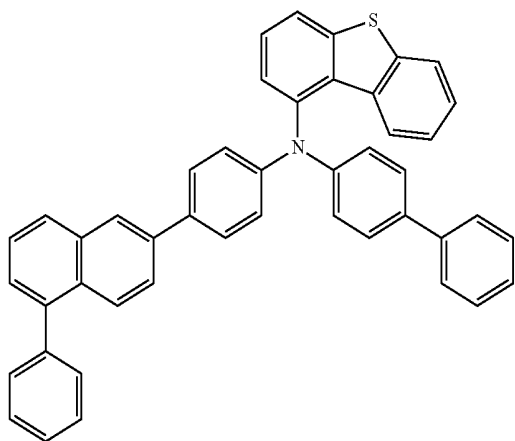
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D44



D45

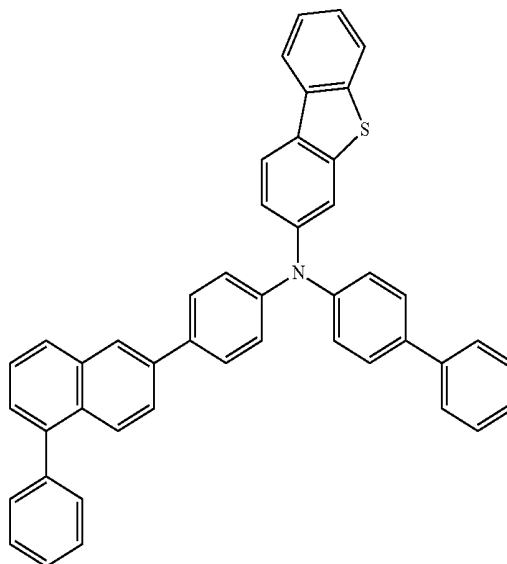
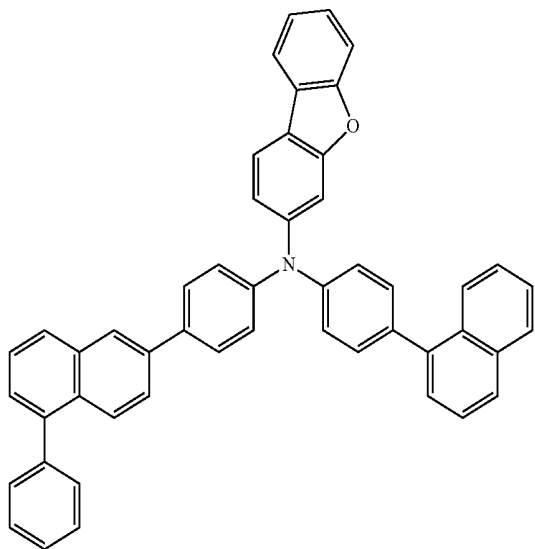
D46



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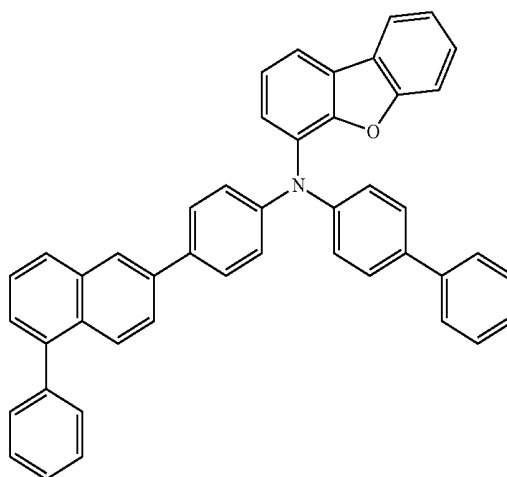
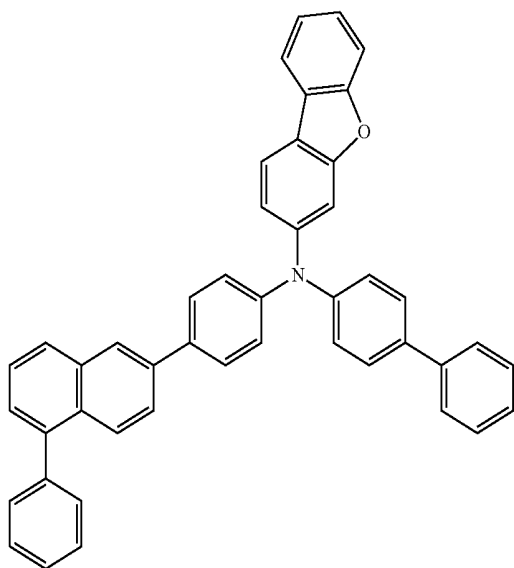
D47

D48



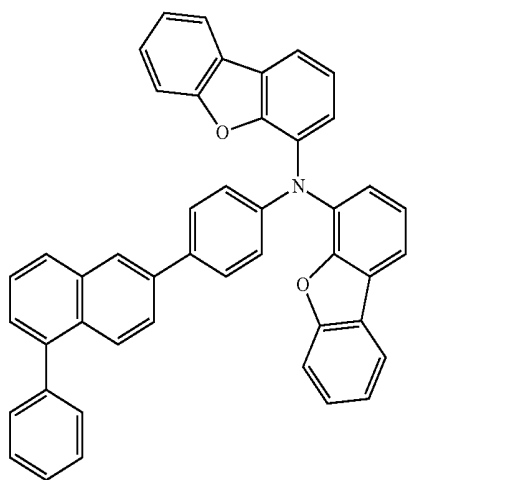
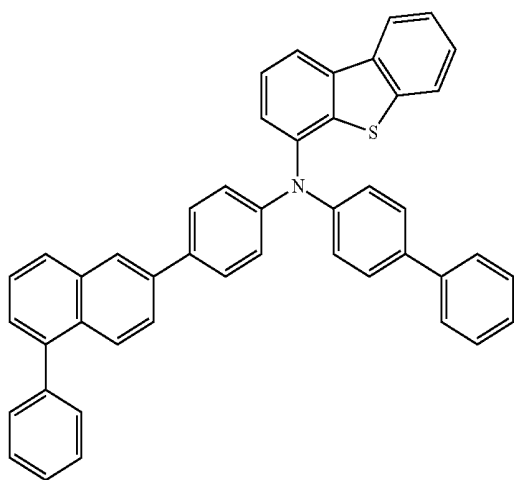
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D50

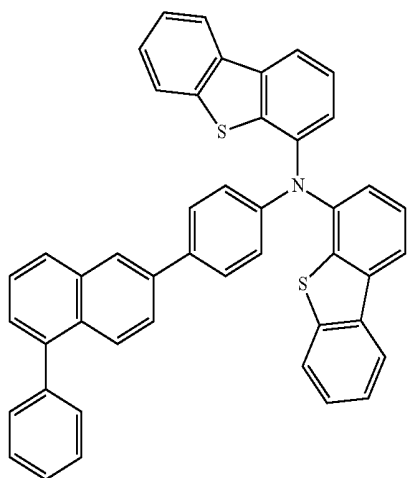


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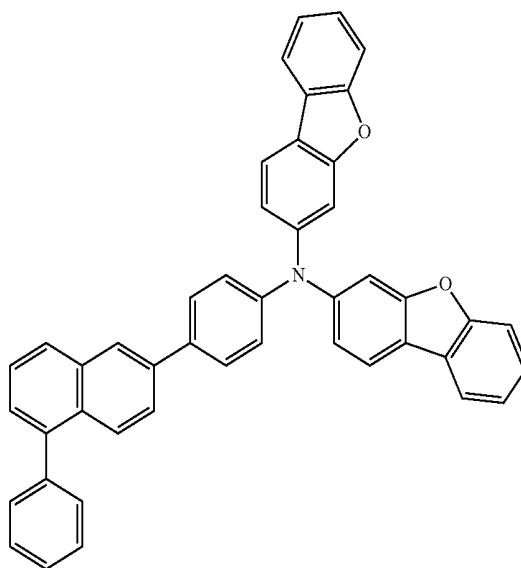
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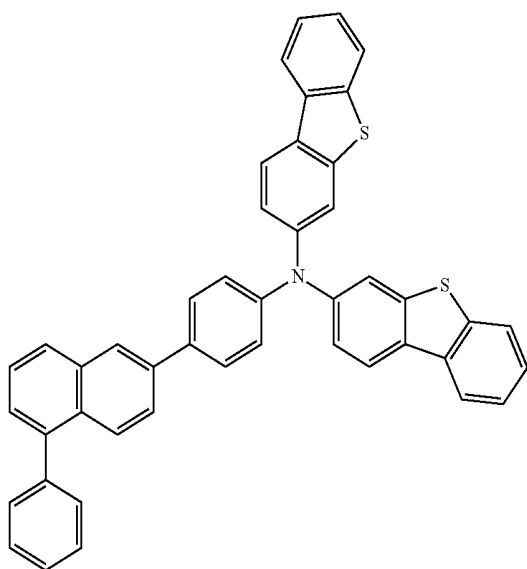
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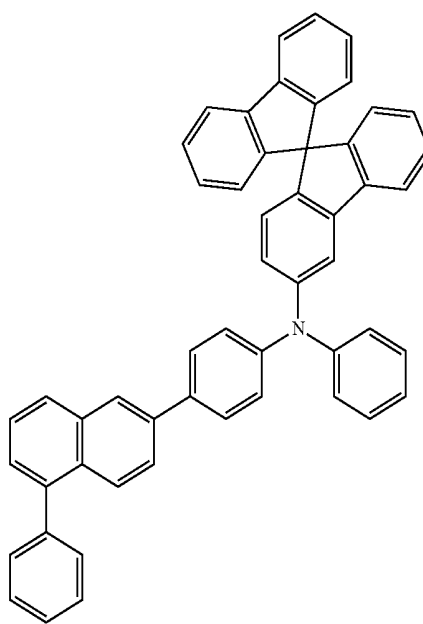
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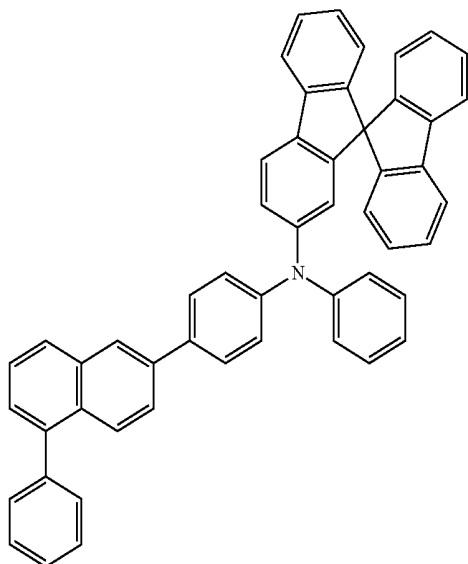
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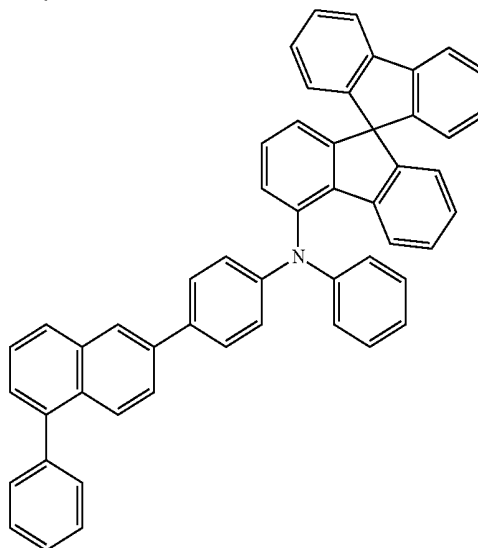
D56



D57

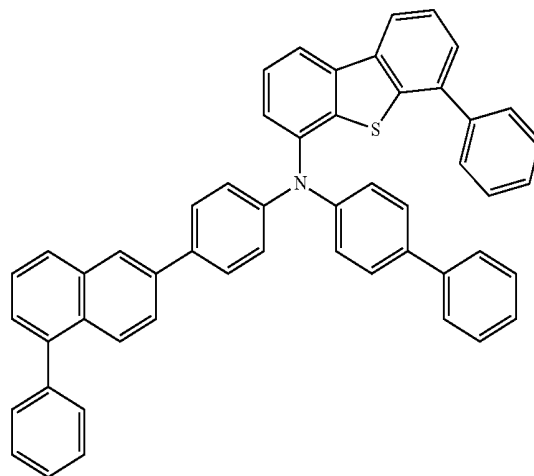
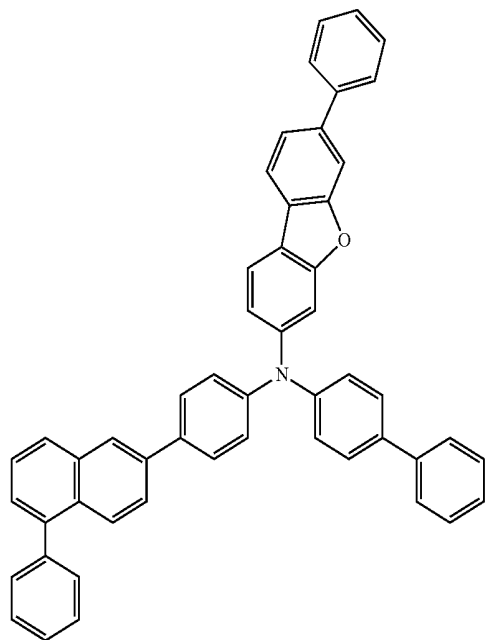


D58



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D59

D60

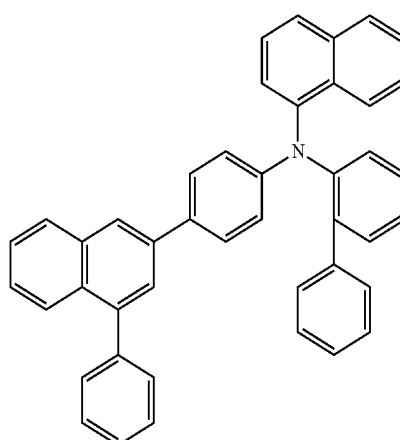
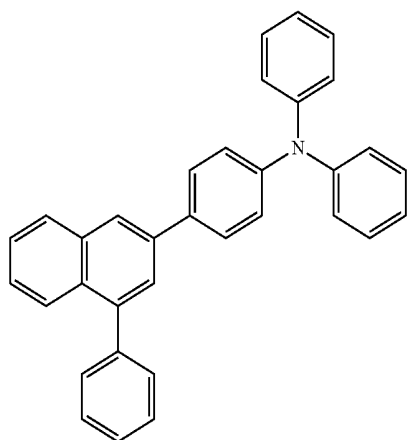


[0061] [Compound Group 5]

E1

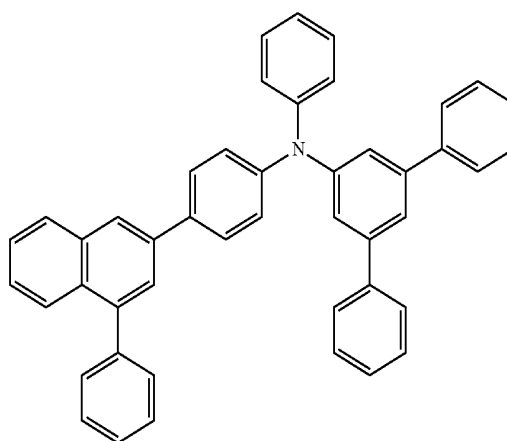
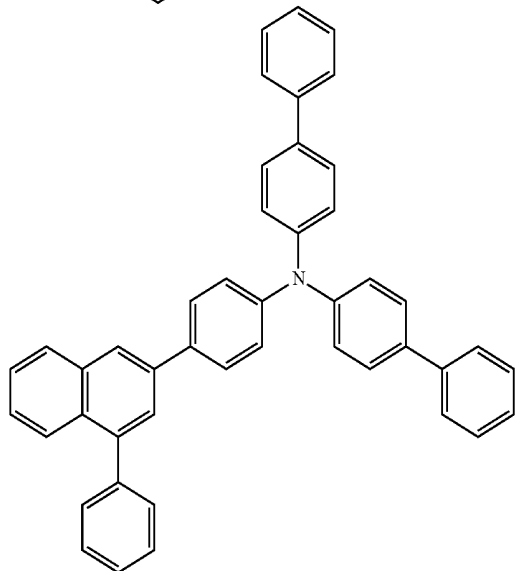
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E3



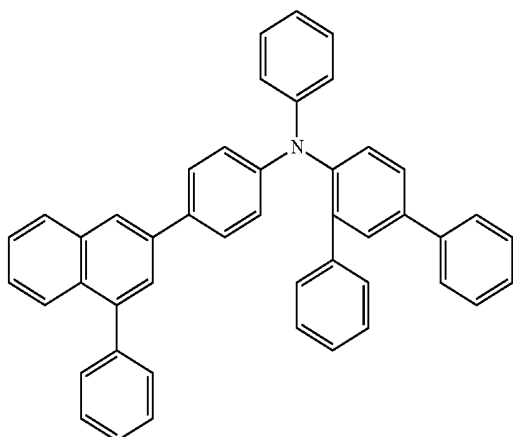
E2

E4



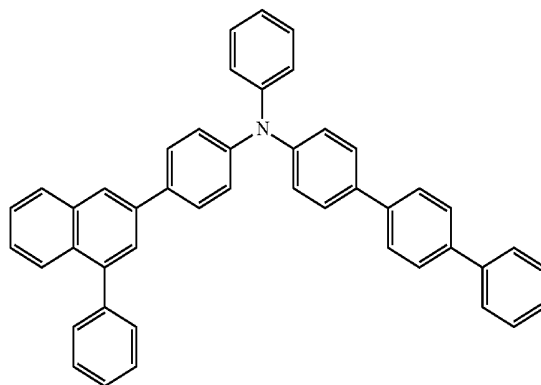
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E5



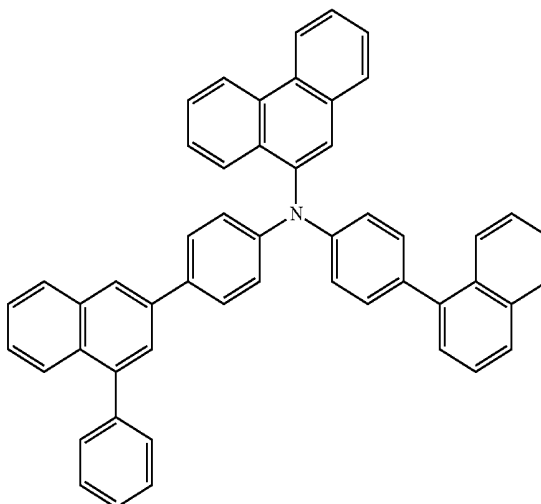
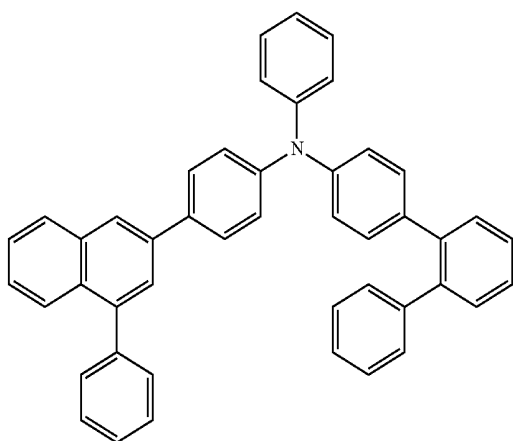
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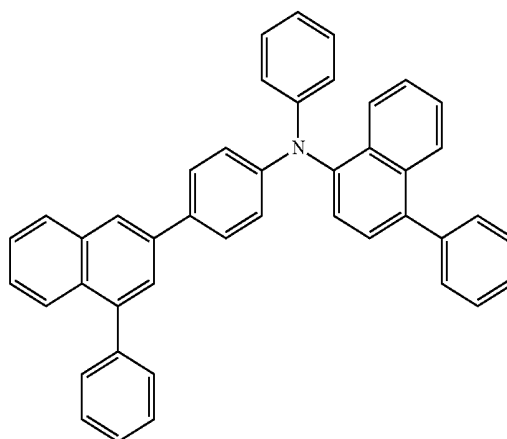
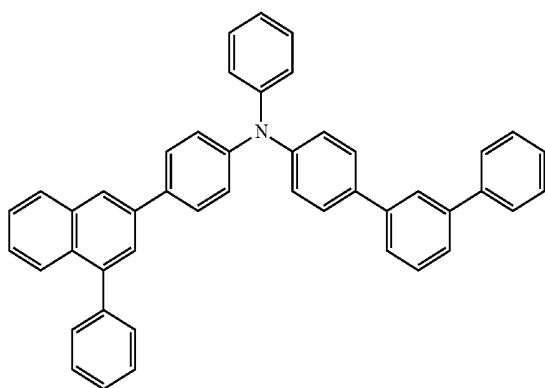
E9

E6



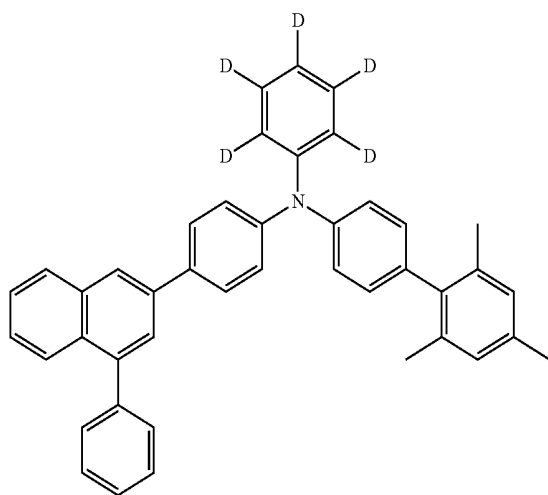
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E7



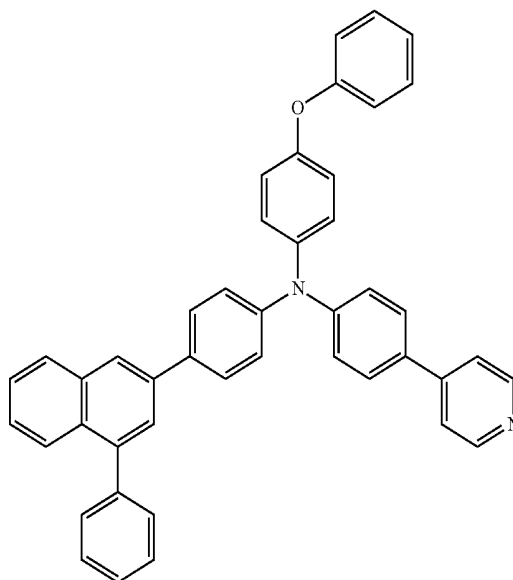
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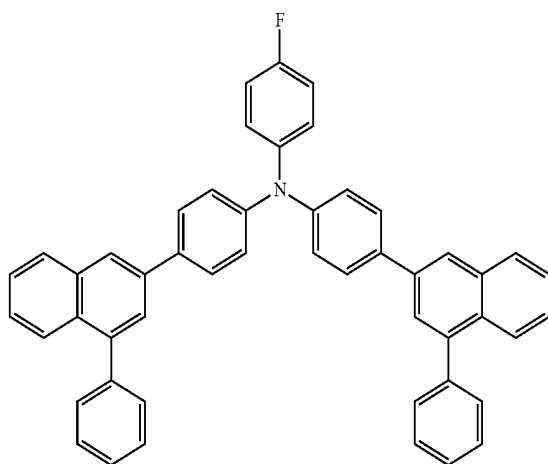


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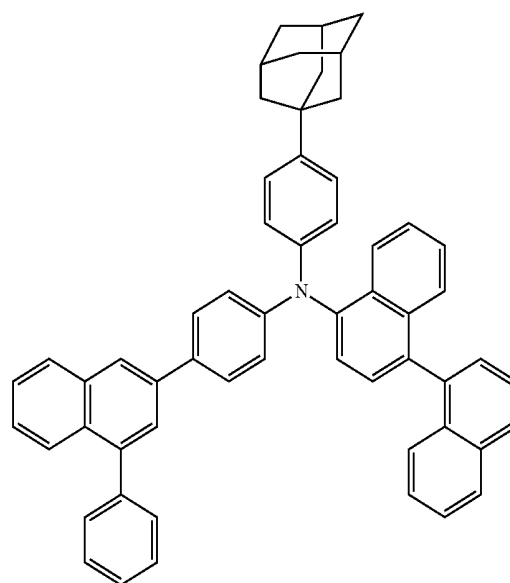
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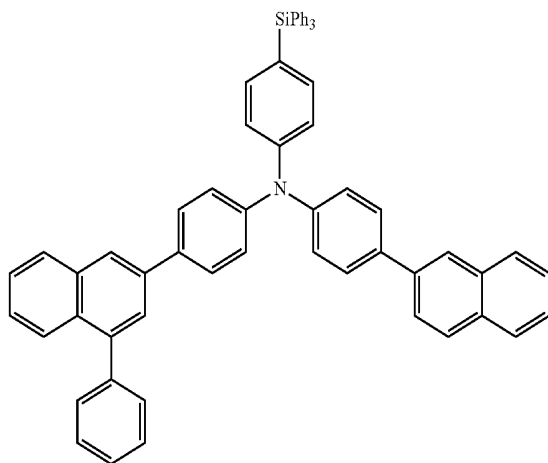
E12



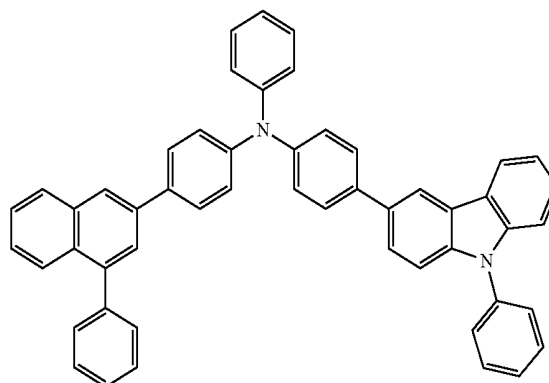
E15



E13

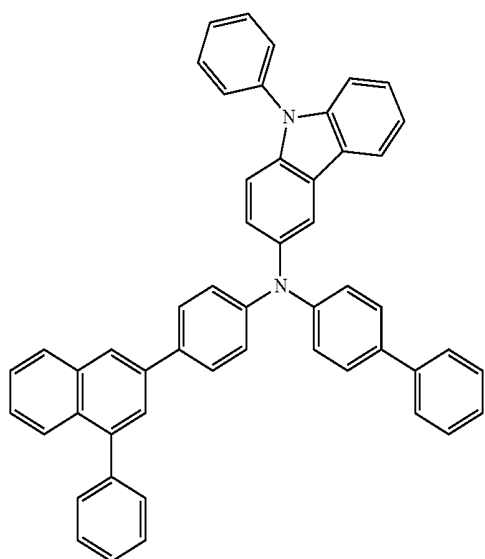


E16



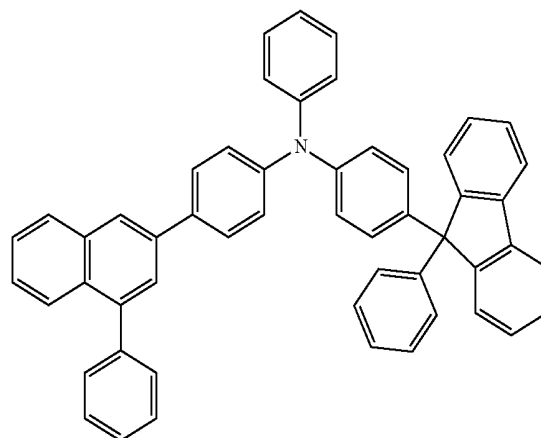
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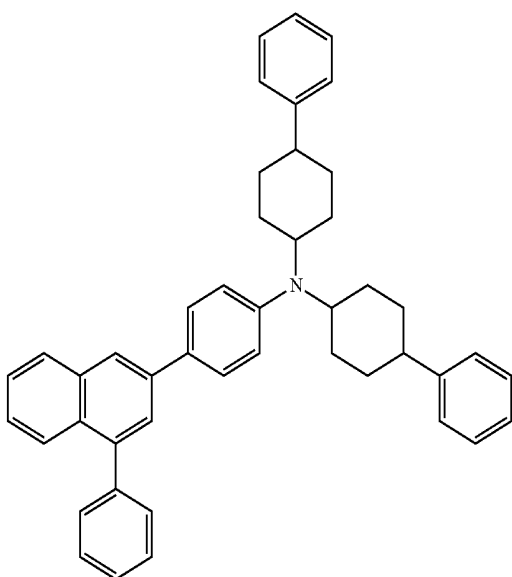
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E20



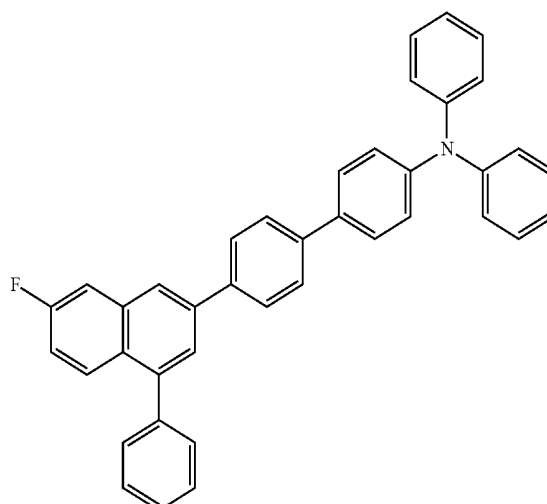
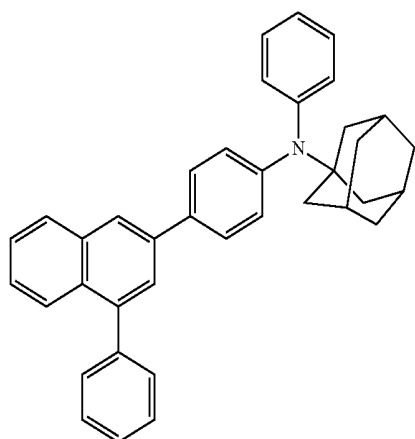
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E18



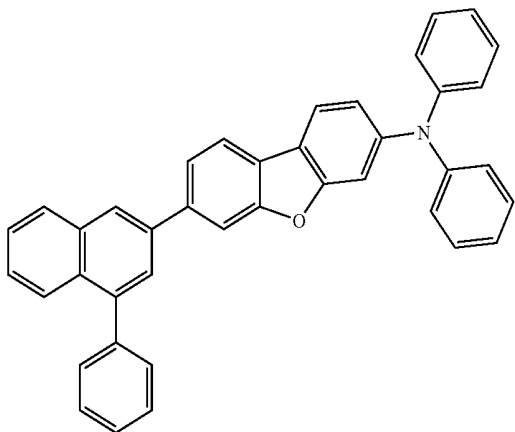
E22

E19



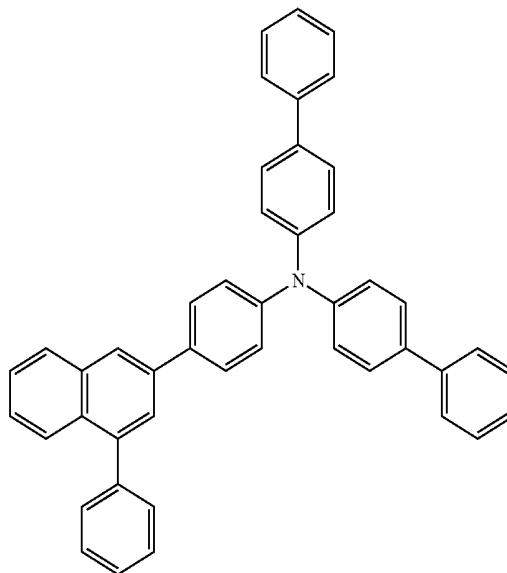
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E23

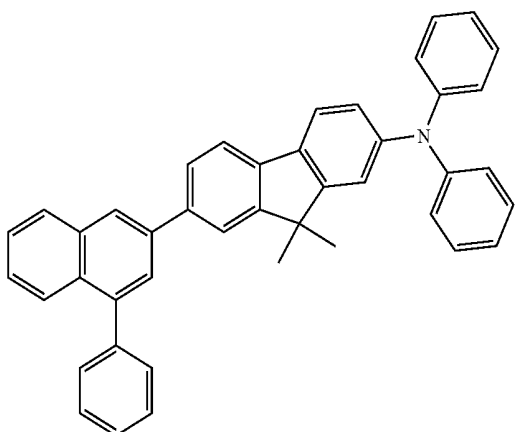


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E26

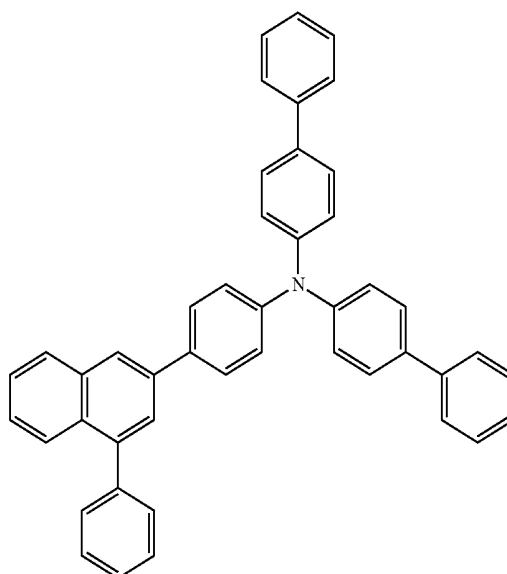
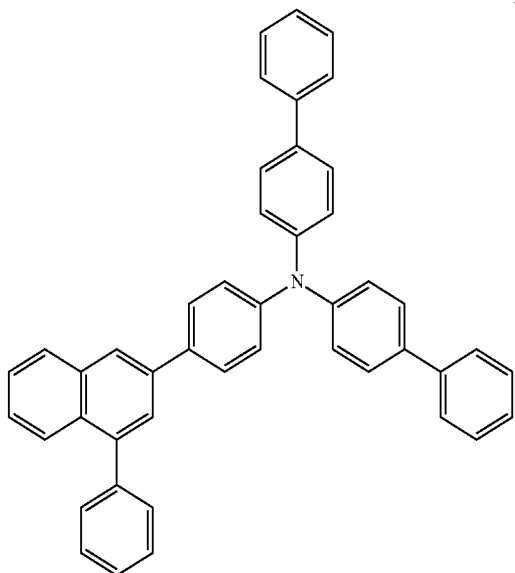


E24



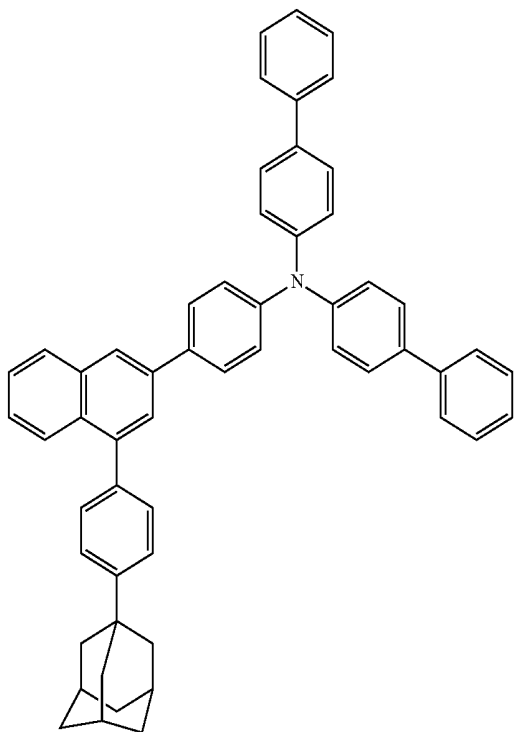
E27

E25



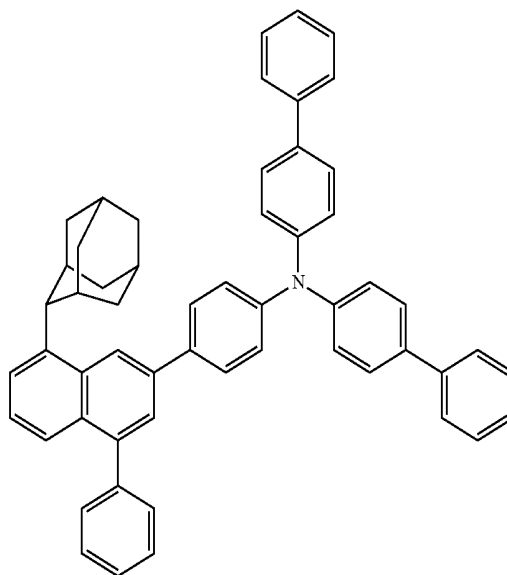
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E28

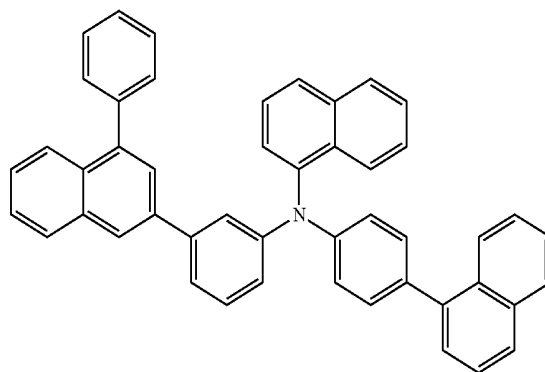


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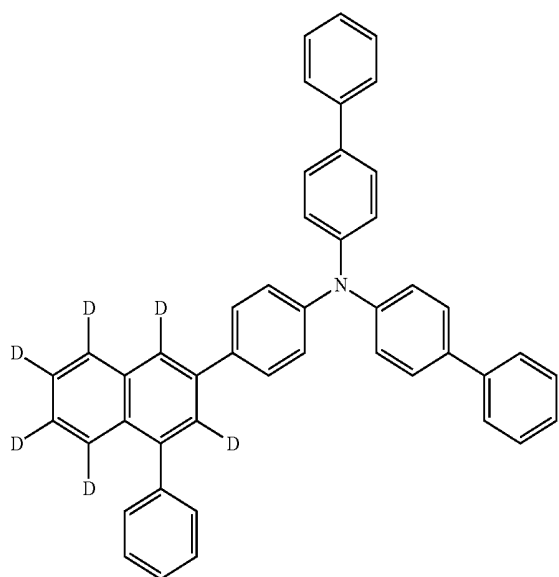
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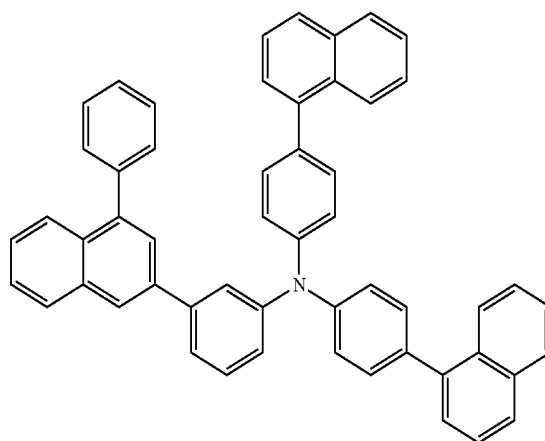
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E29

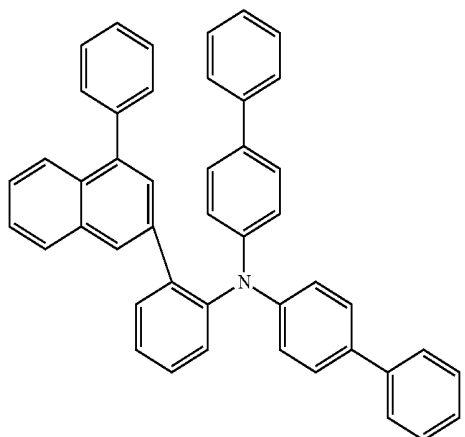


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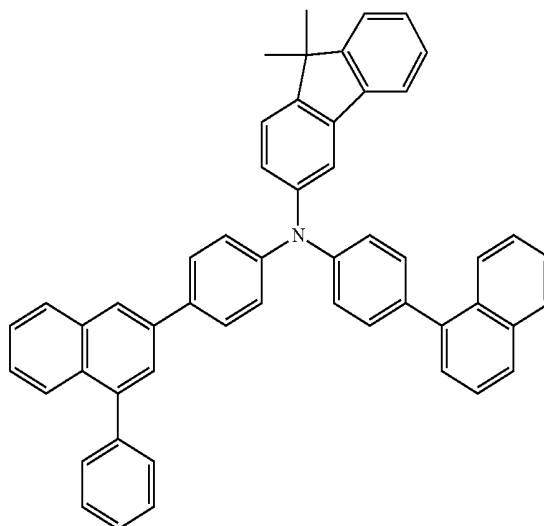
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E33



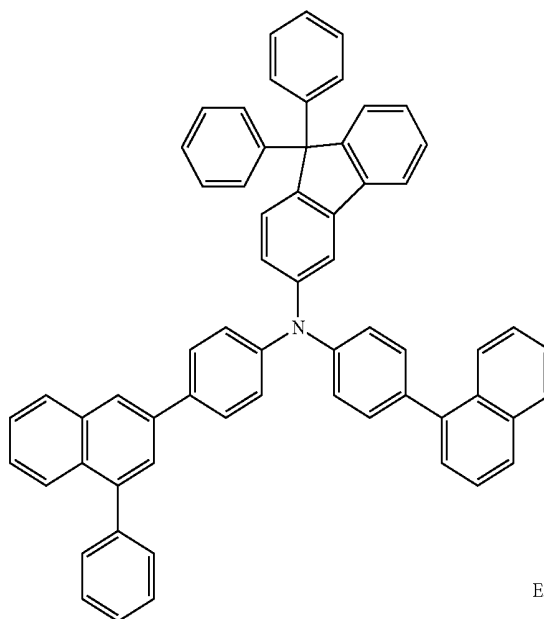
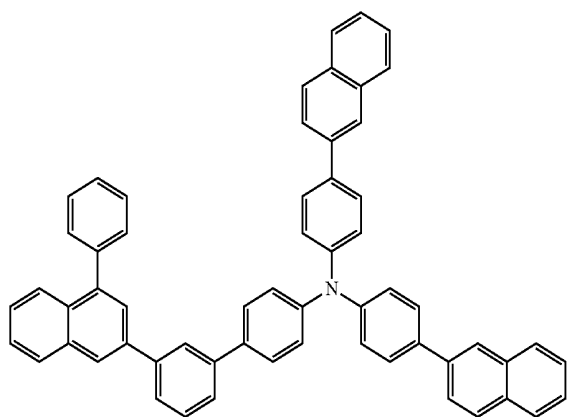
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E36



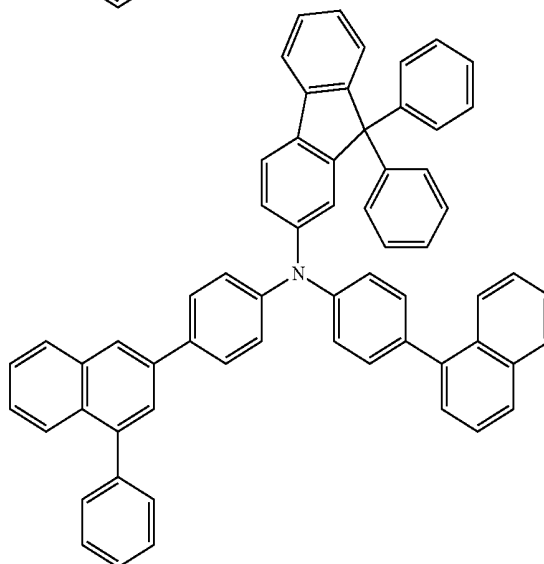
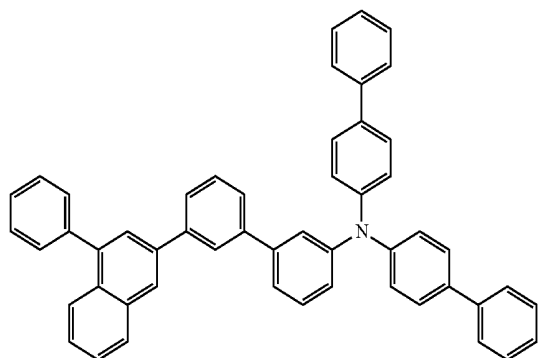
E37

E34



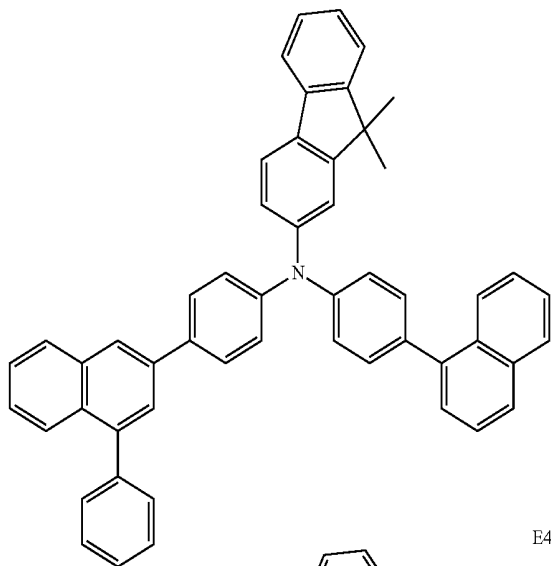
E38

E35



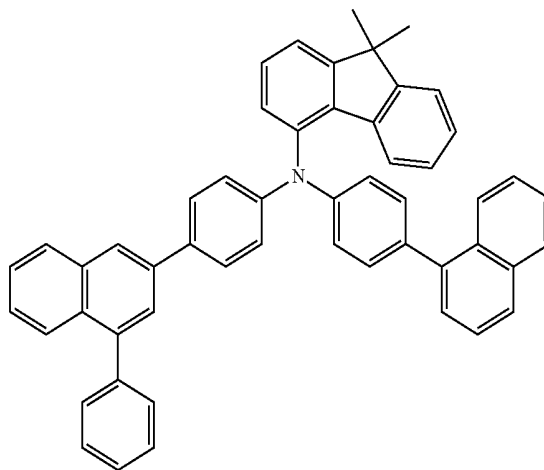
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E39

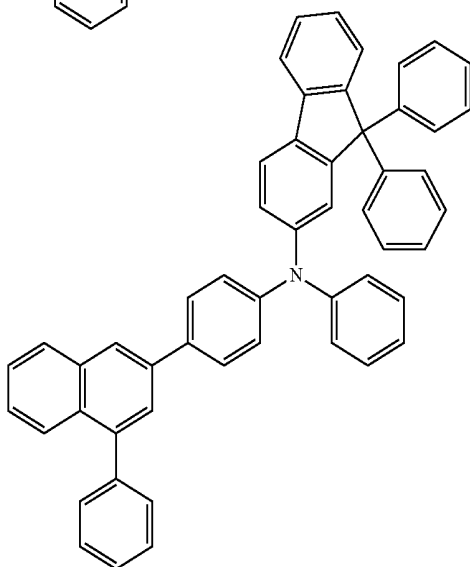


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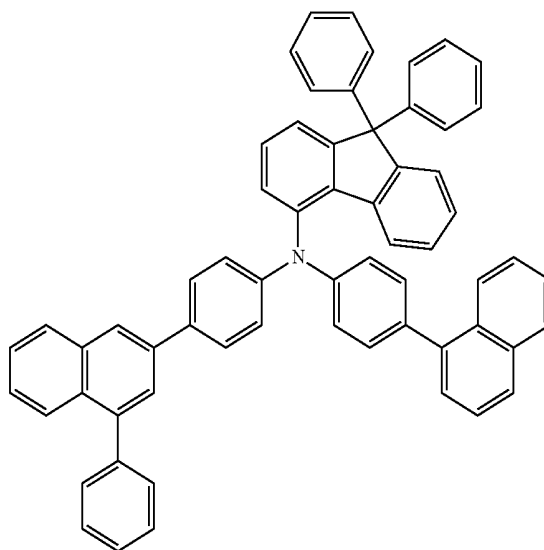
E42



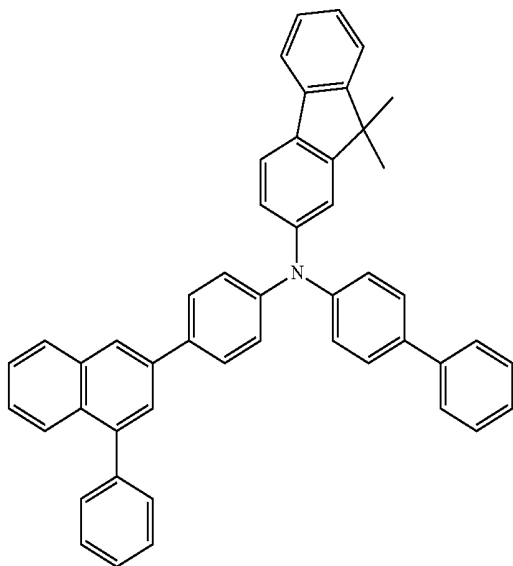
E40



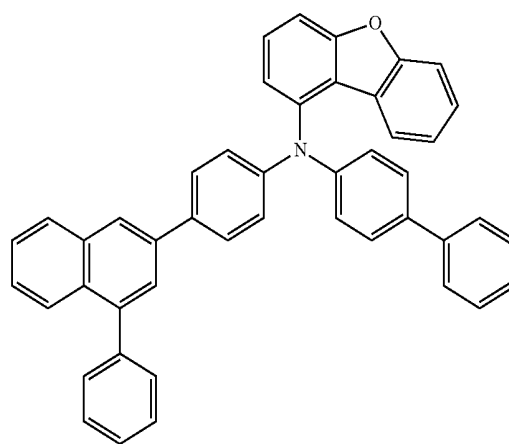
E43



E41

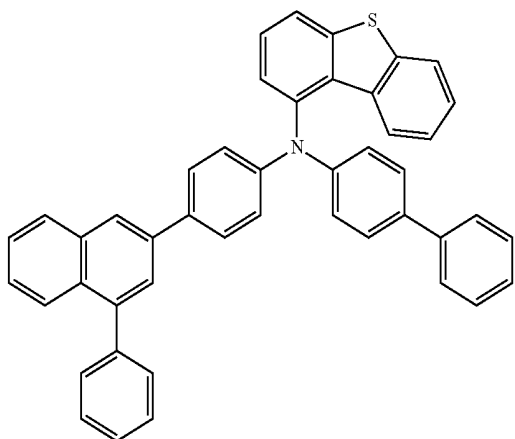


E44



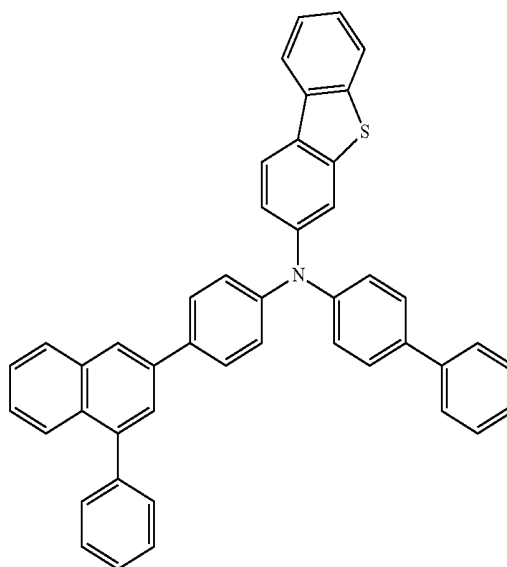
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E45

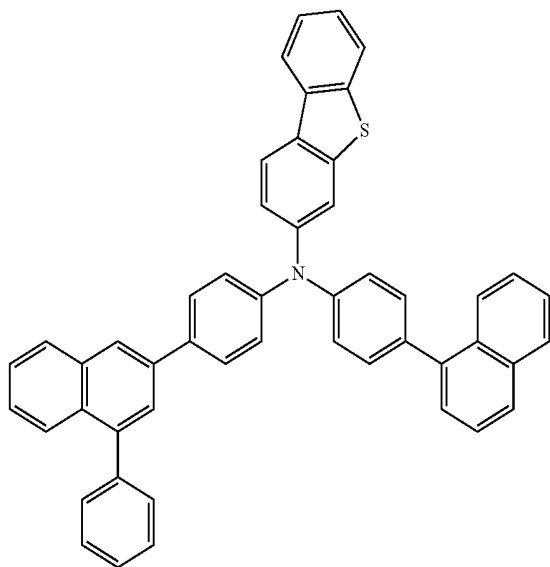


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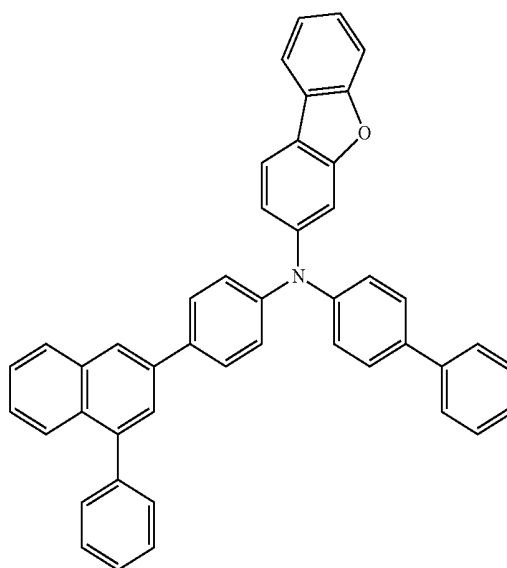
E48



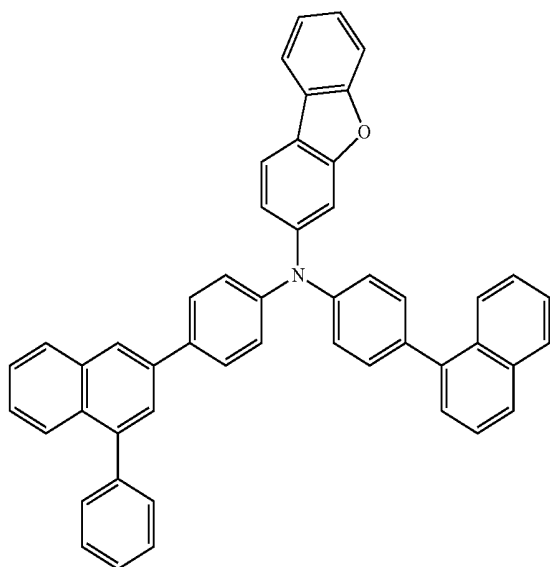
E46



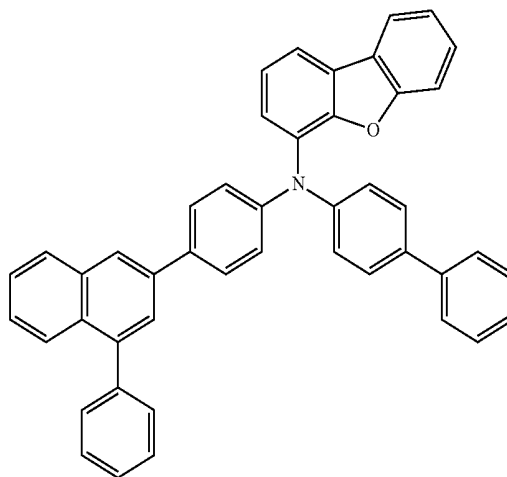
E49



E47

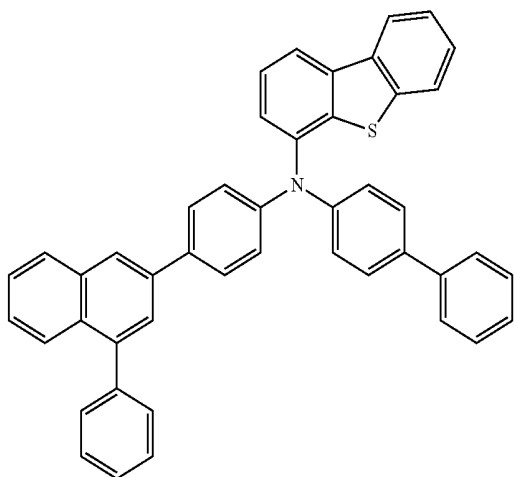


E50



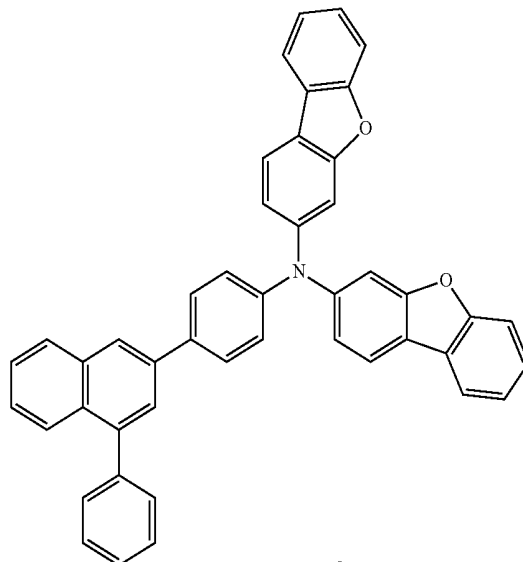
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E51



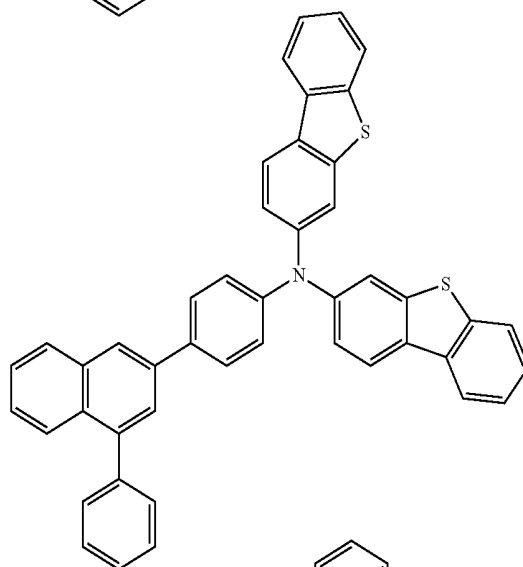
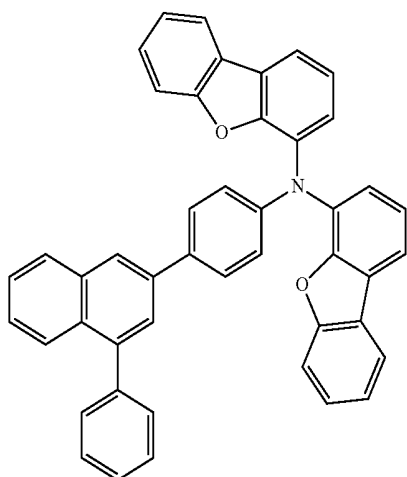
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E54



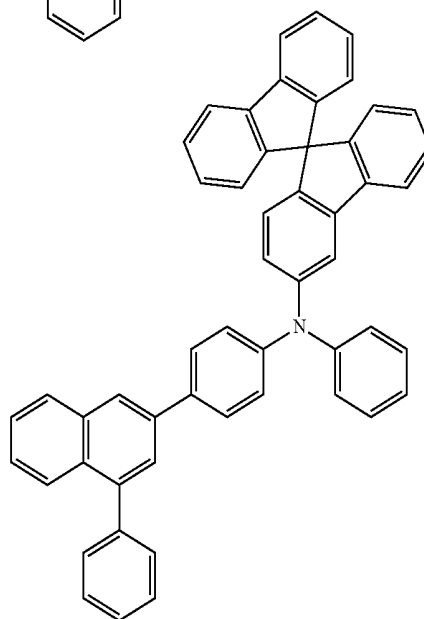
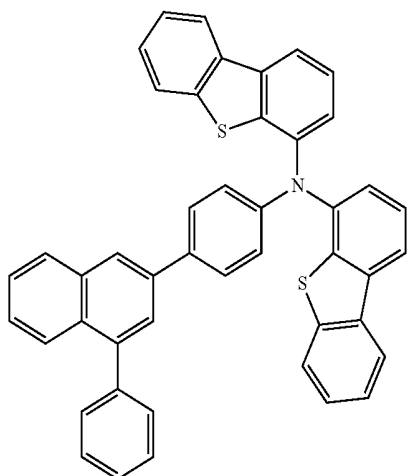
E55

E52

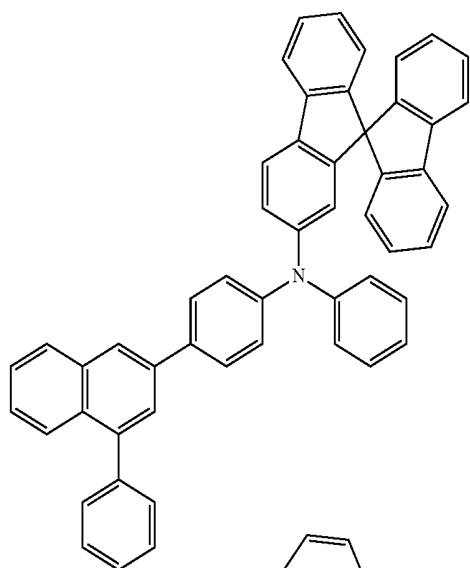


E56

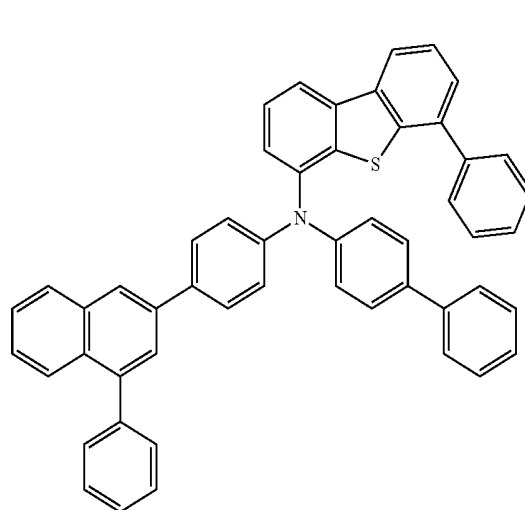
E53



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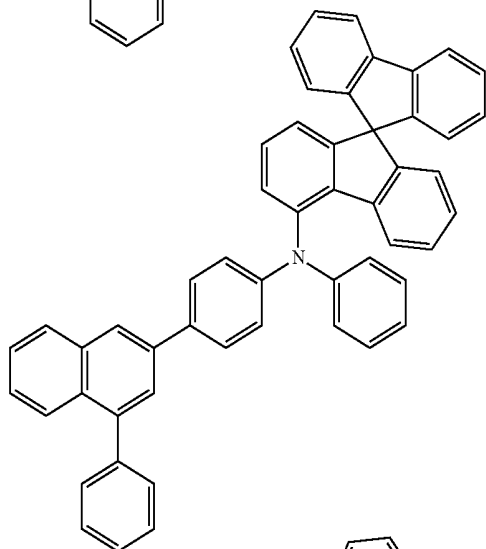


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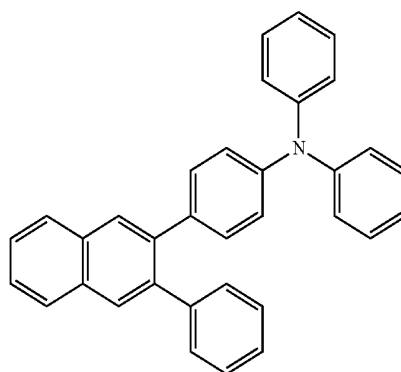


E58

[0062] [Compound Group 6]

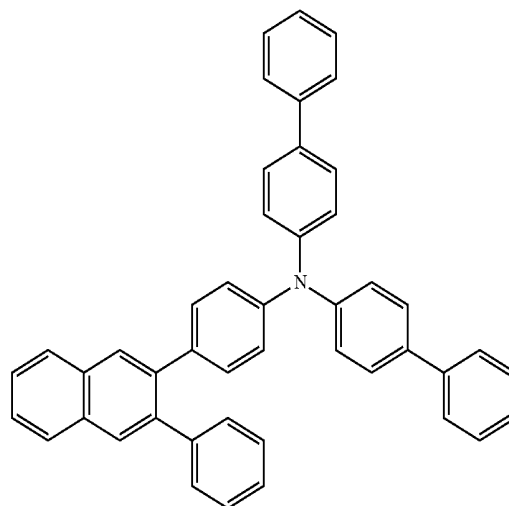
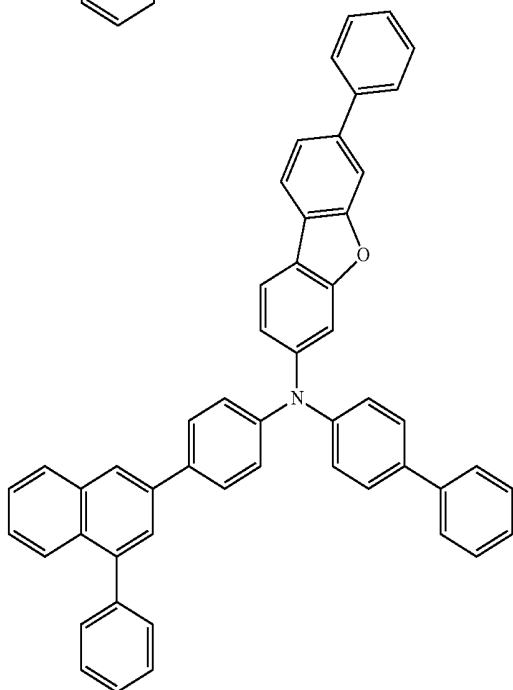


F1

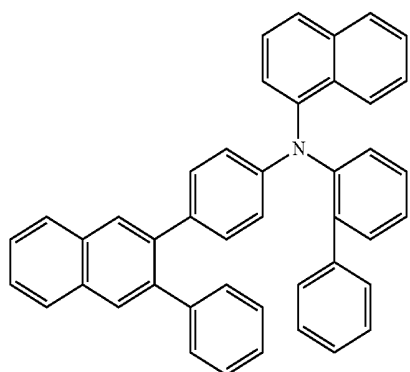


E59

F2

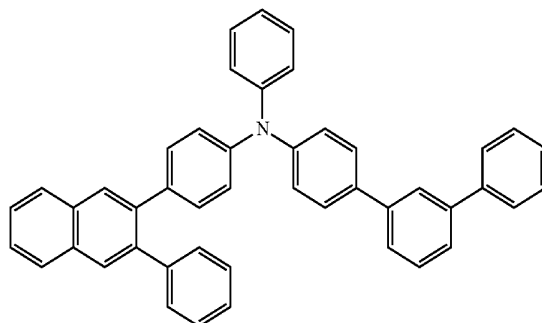


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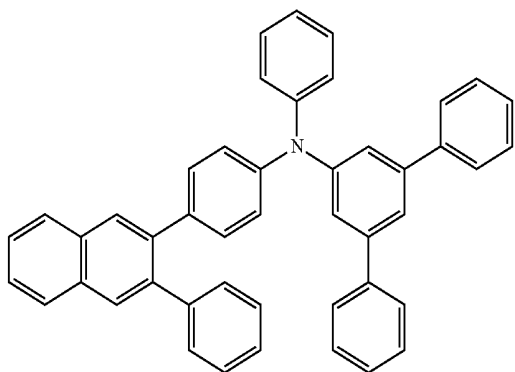


F3

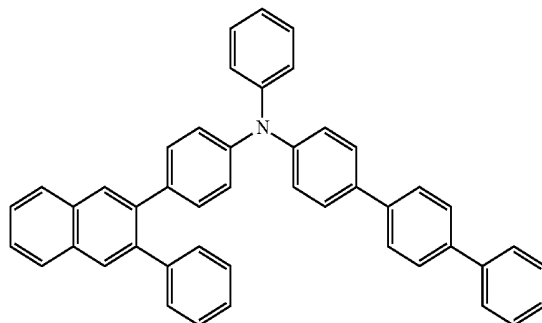
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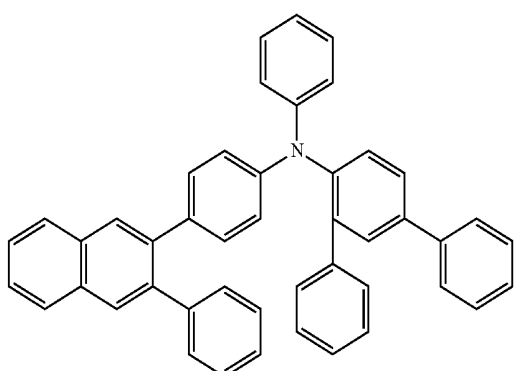
F7



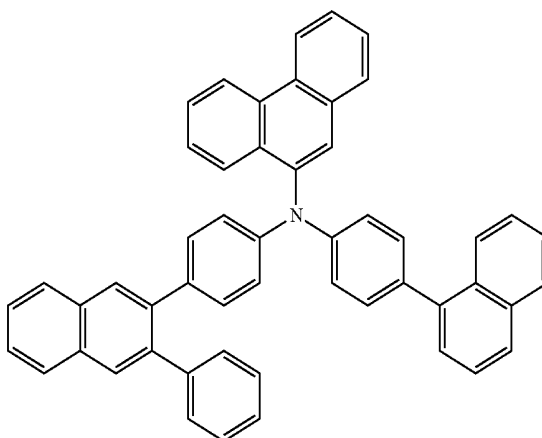
F4



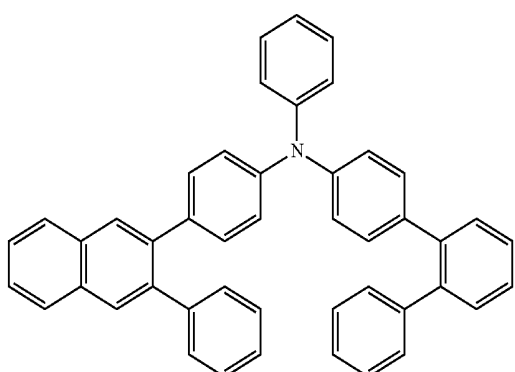
F8



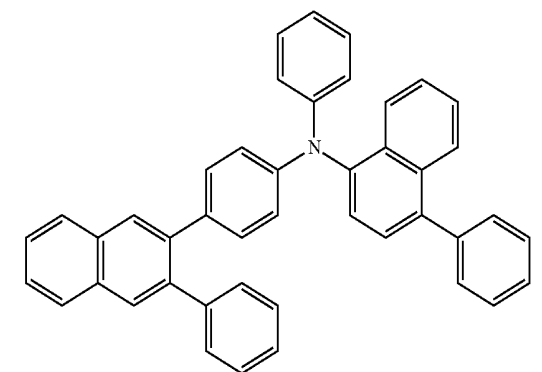
F5



F9



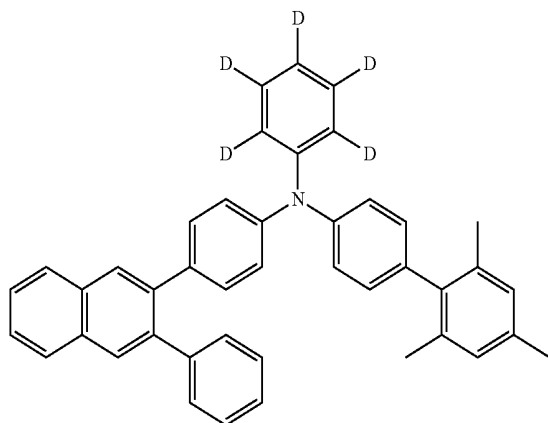
F6



F10

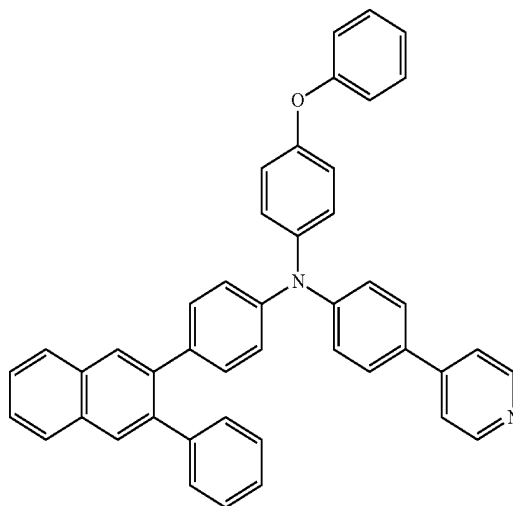
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F11

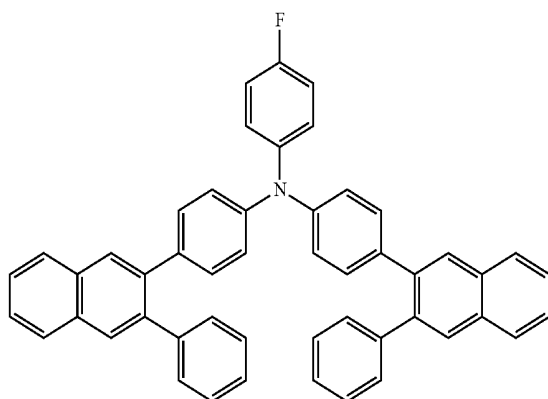


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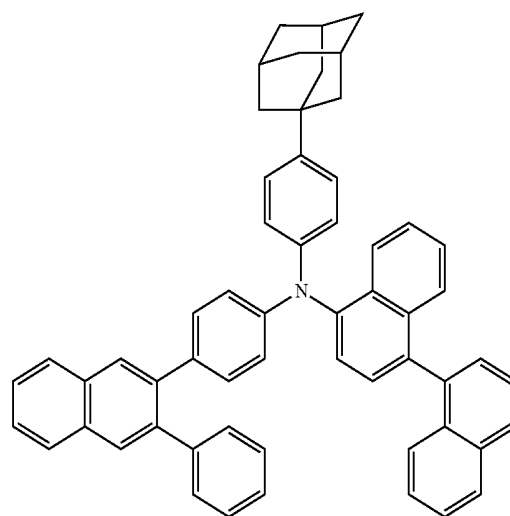
F14



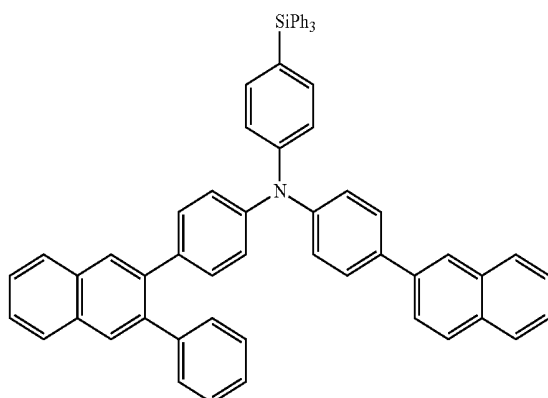
F12



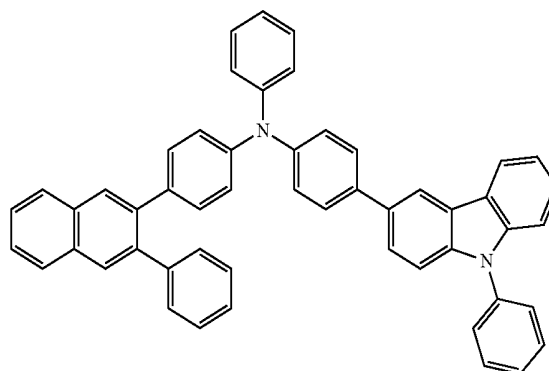
F15



F13

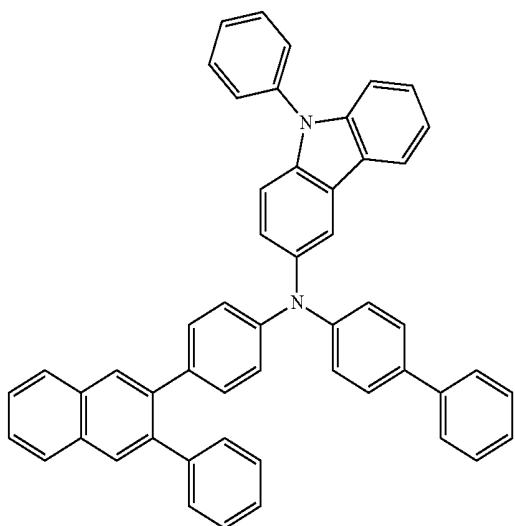


F16



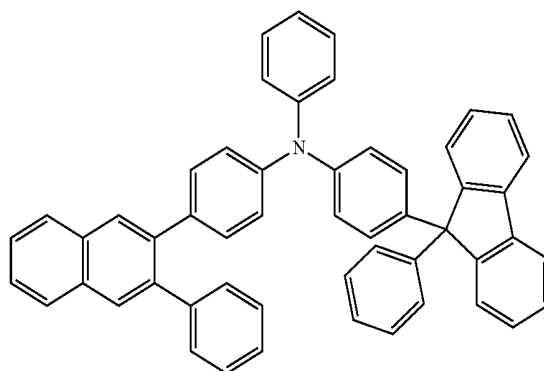
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F17

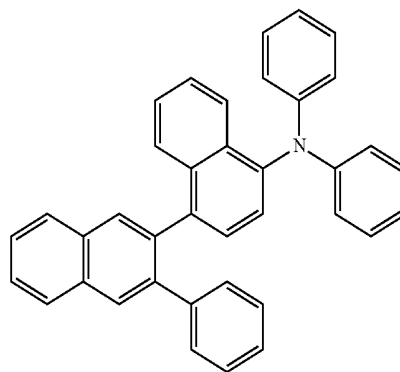


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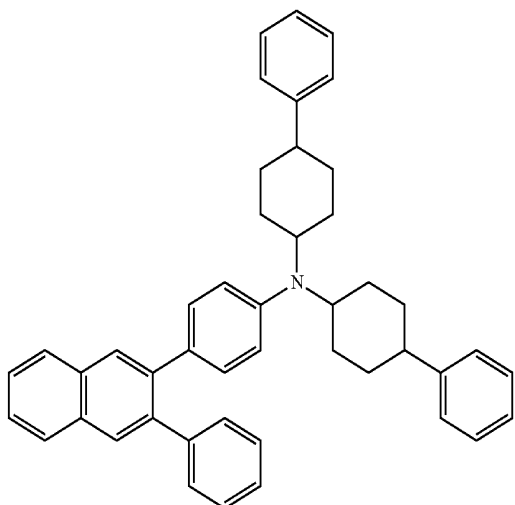
F20



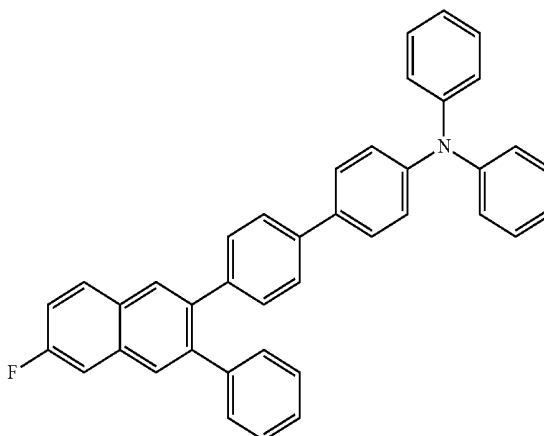
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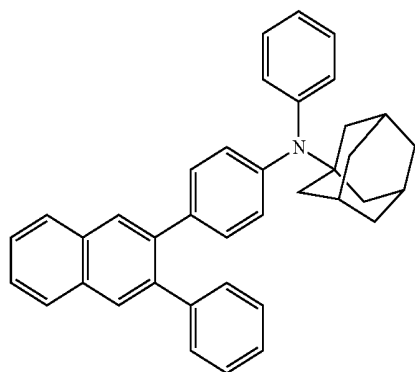
F18



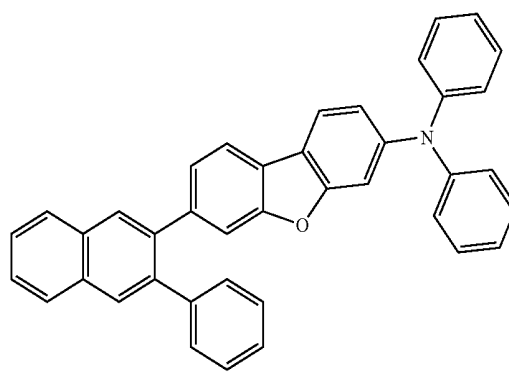
F22



F19

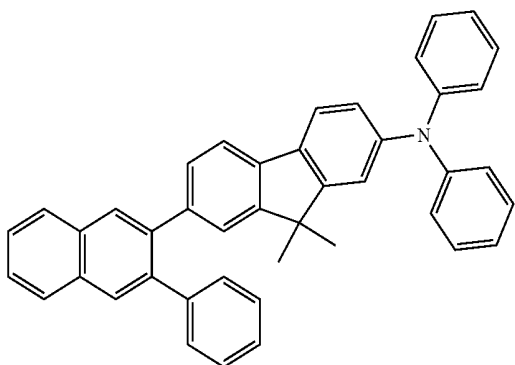


F23



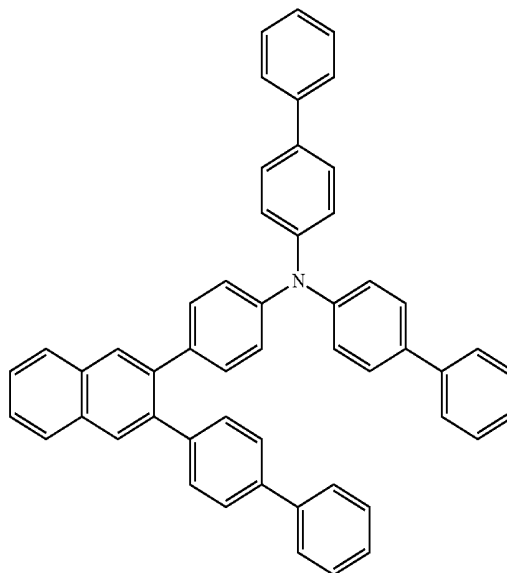
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F24

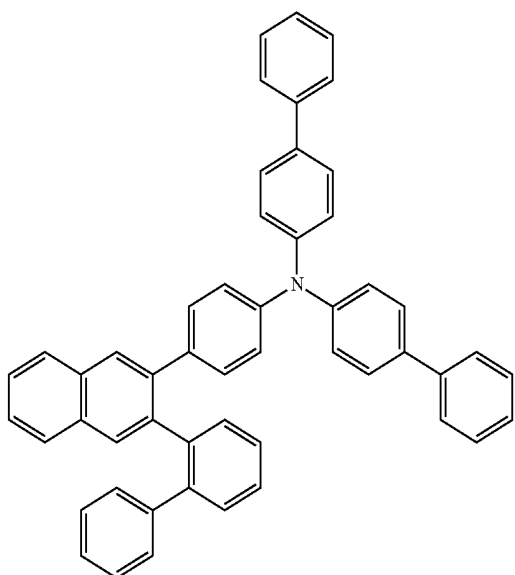


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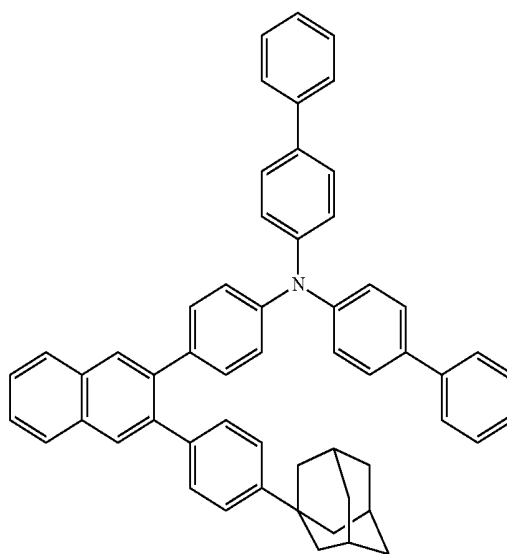
F27



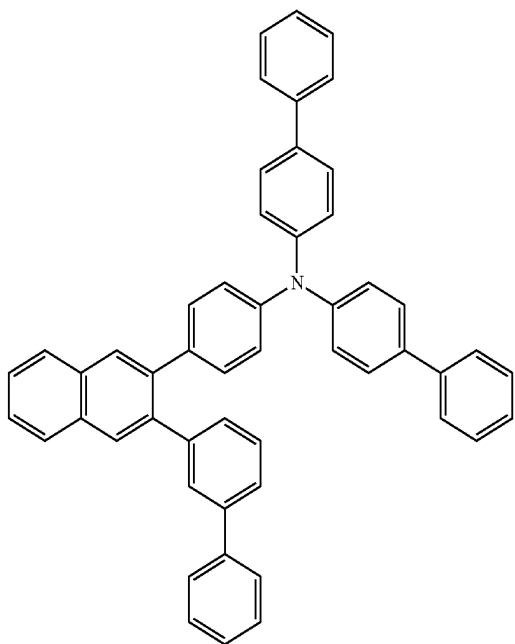
F25



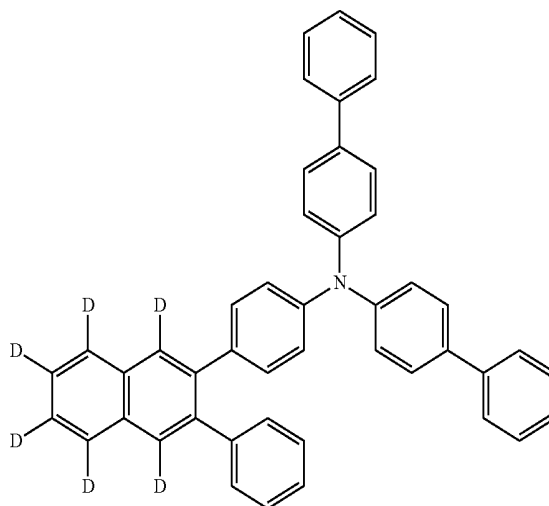
F28



F26

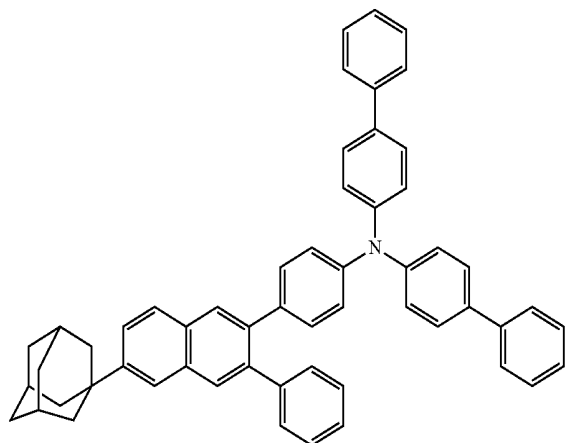


F29



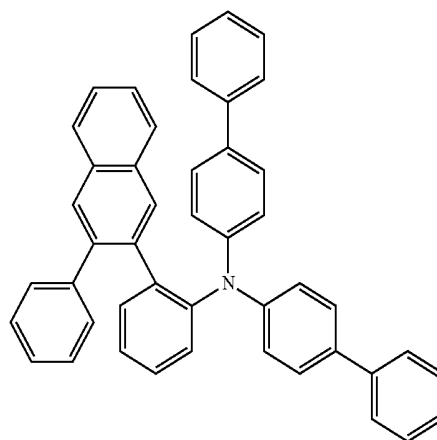
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F30

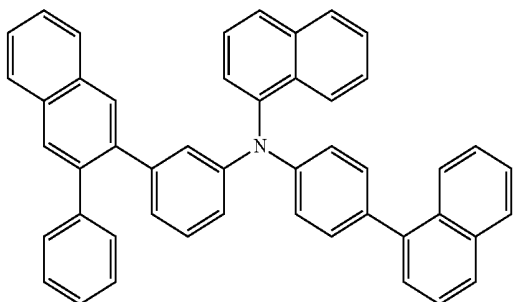


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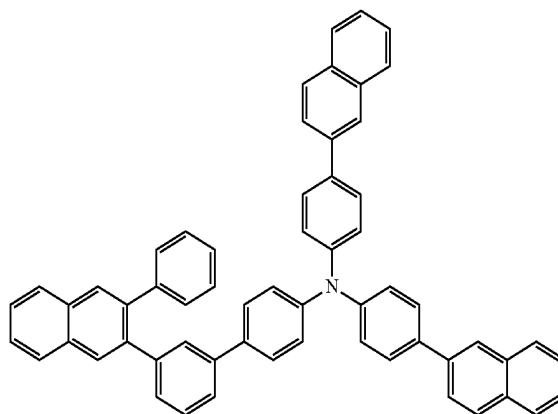
F33



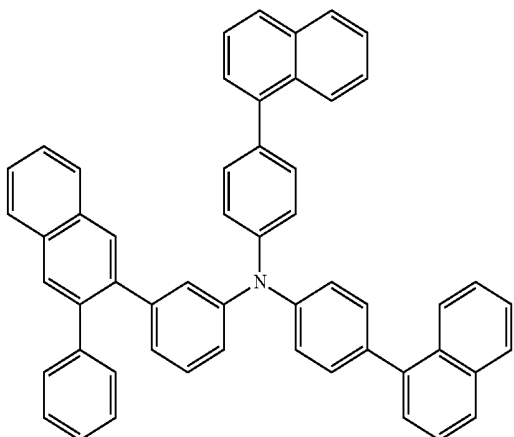
F31



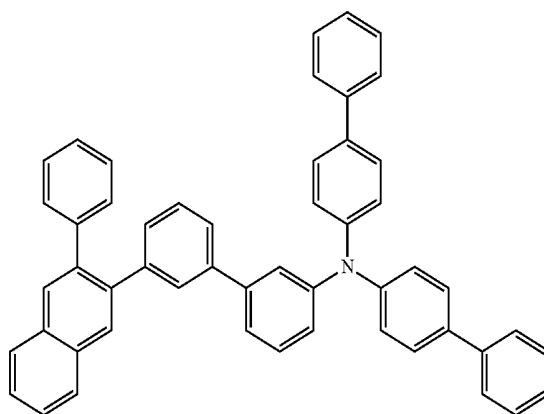
F34



F32

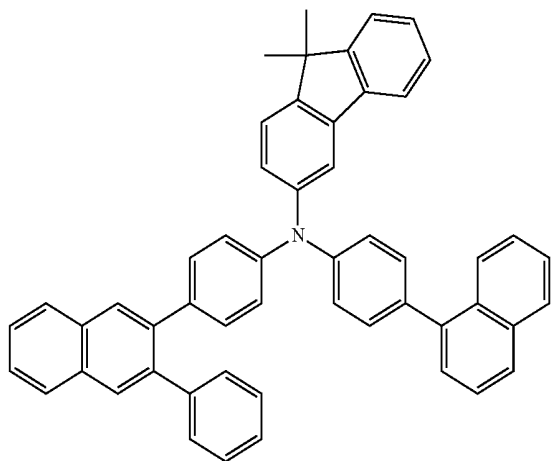


F35



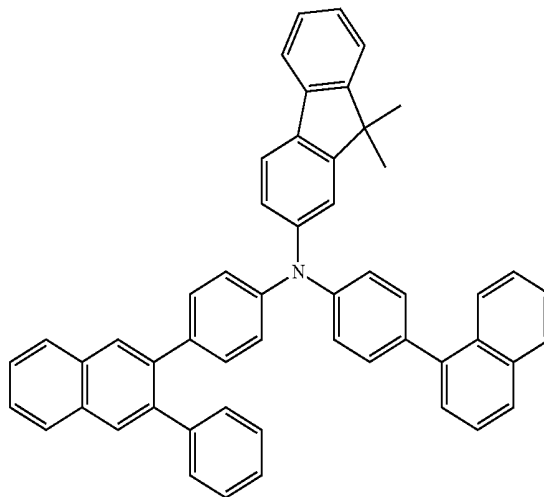
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F36

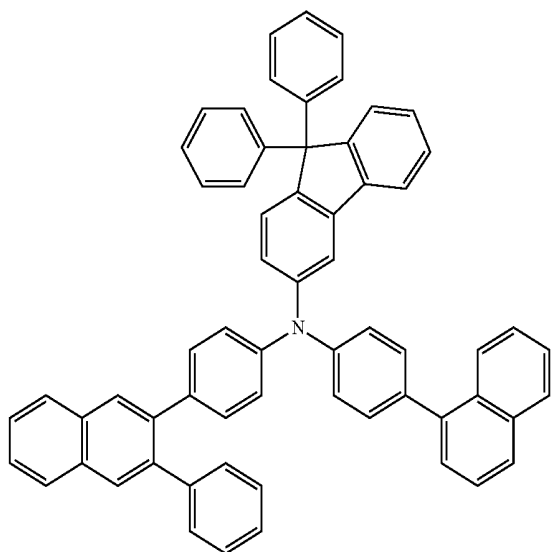


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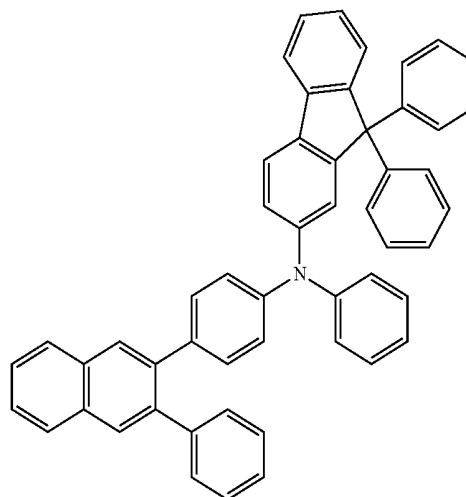
F39



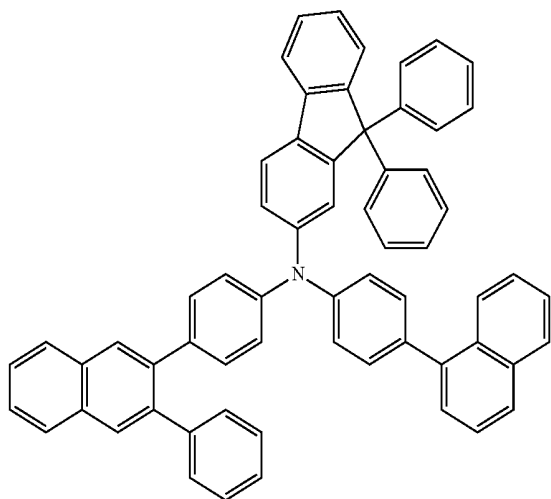
F37



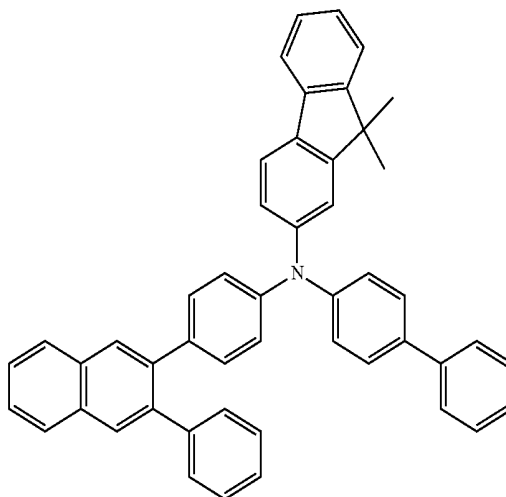
F40



F38

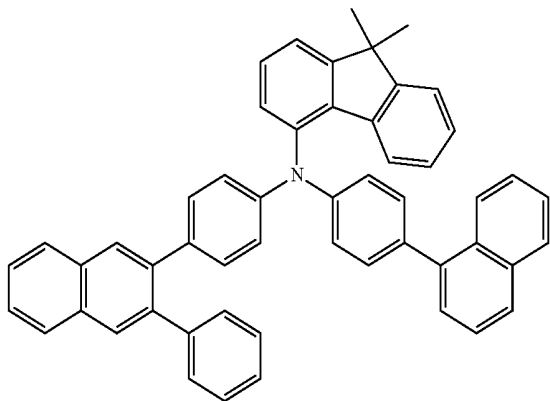


F41



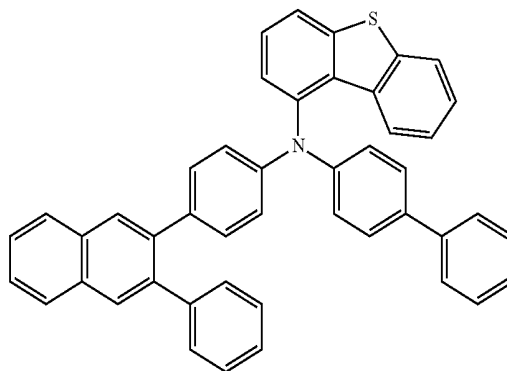
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F42



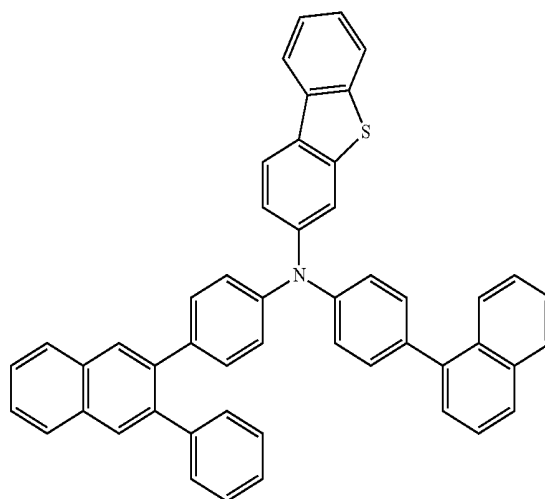
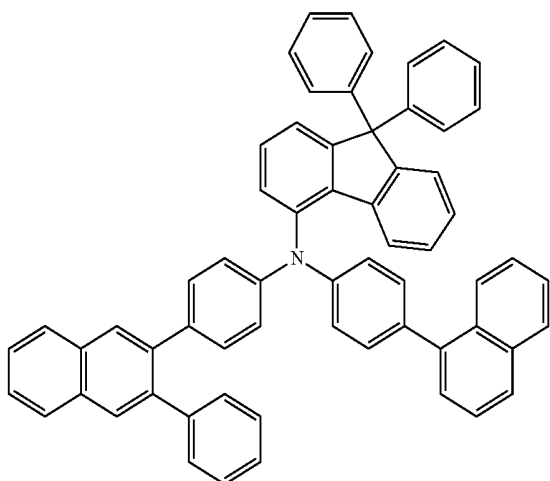
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F45



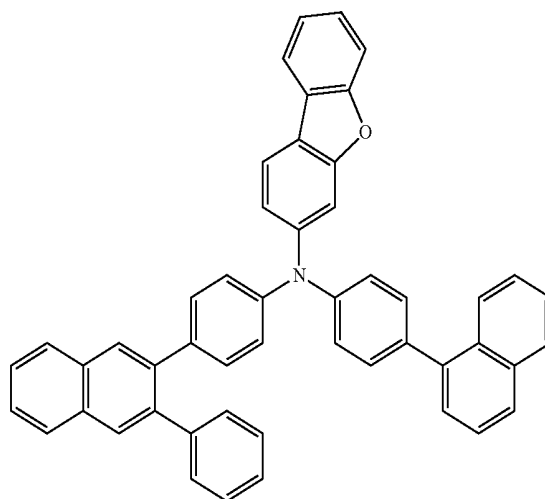
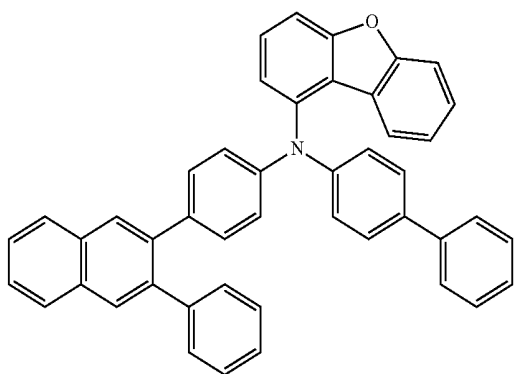
F46

F43



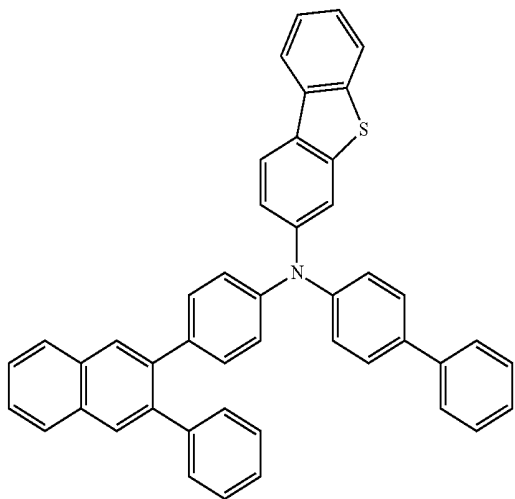
F47

F44



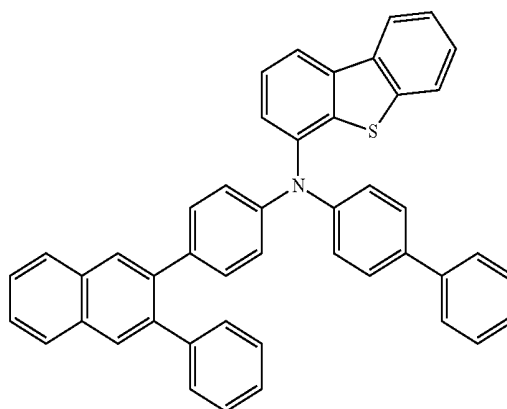
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F48

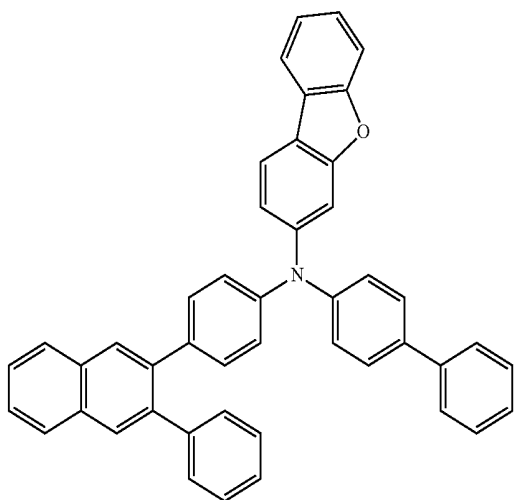


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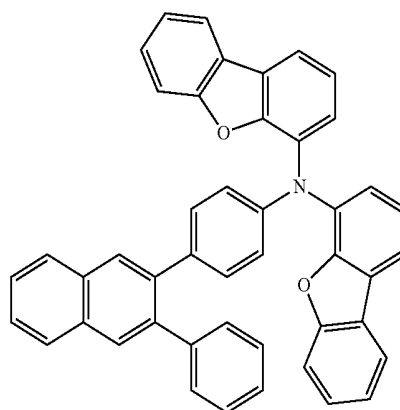
F51



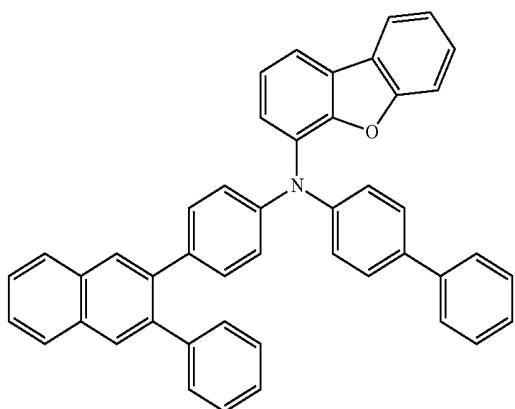
F49



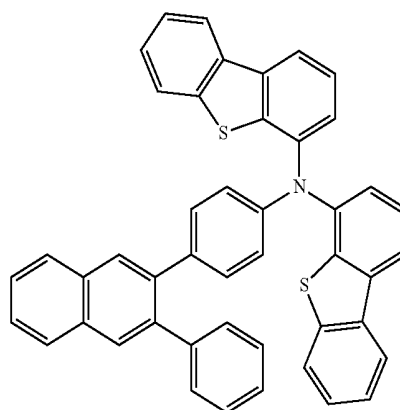
F52



F50

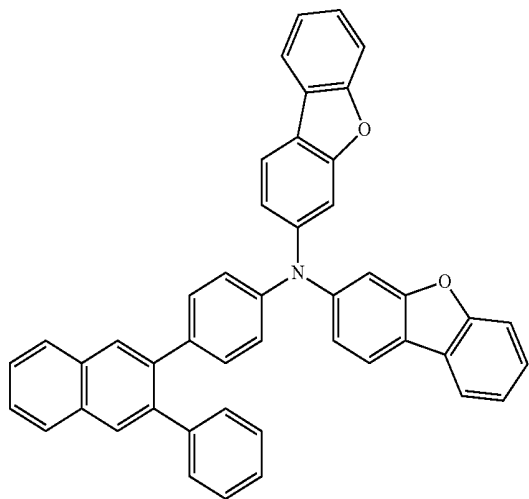


F53



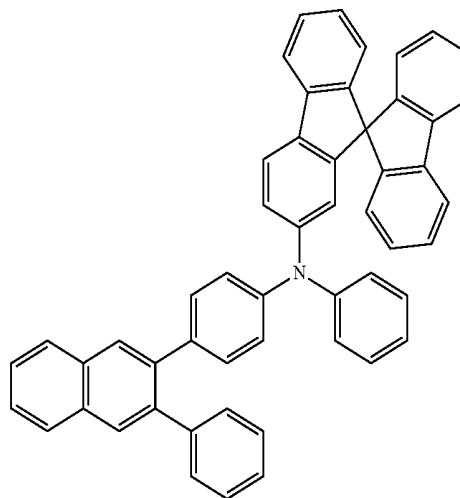
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F54

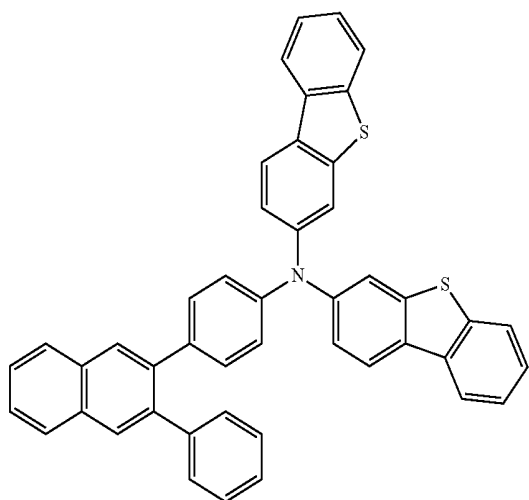


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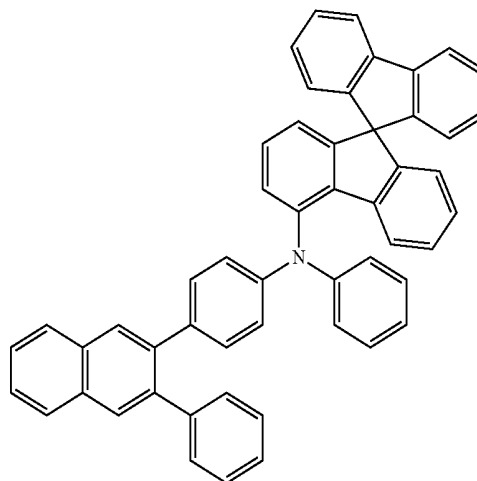
F57



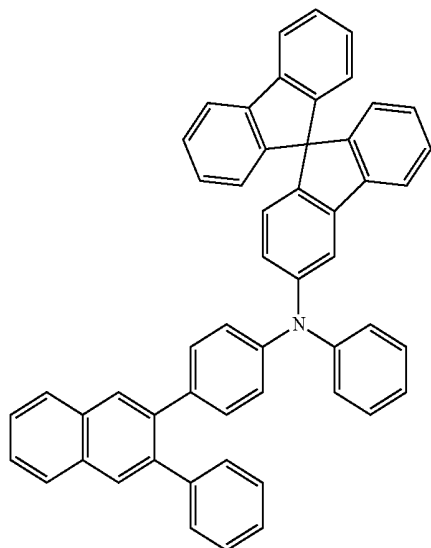
F55



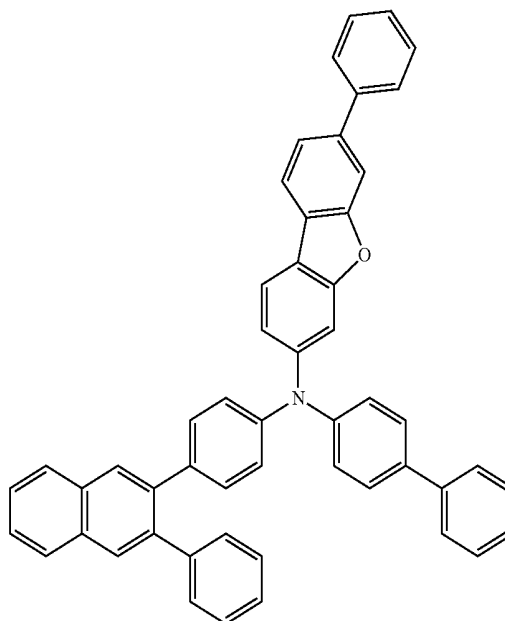
F58



F56

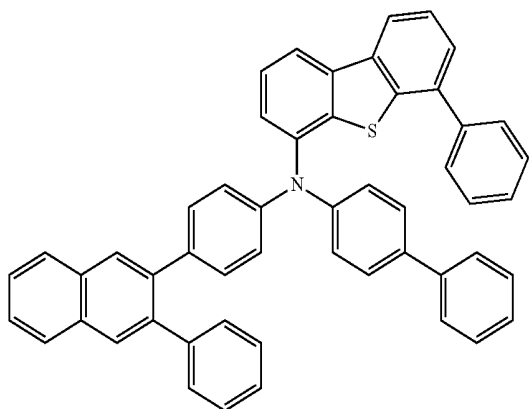


F59



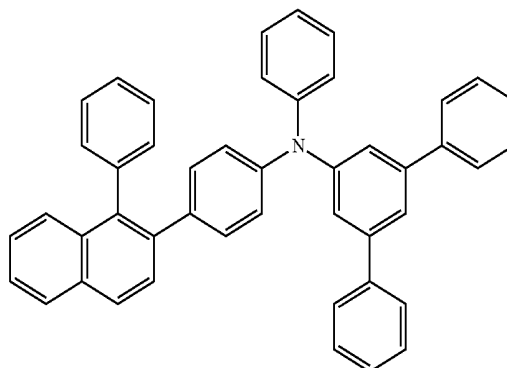
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F60



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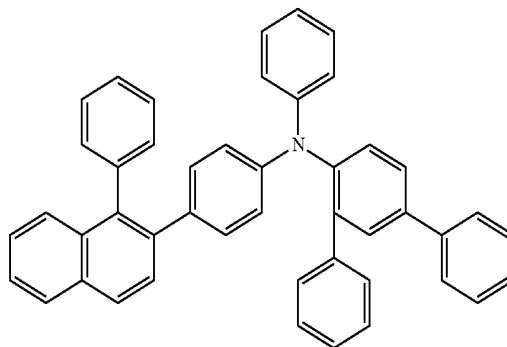
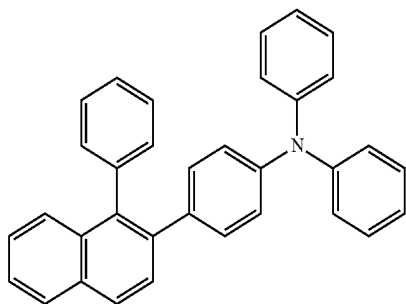
G4



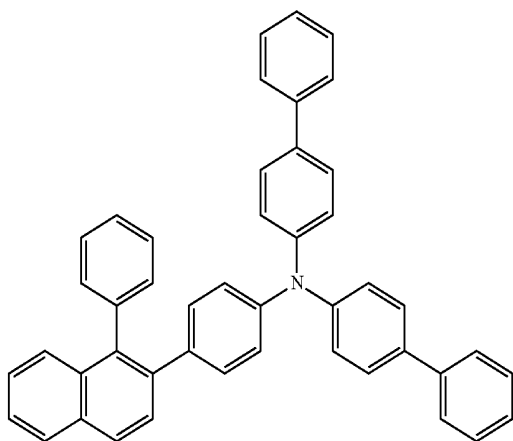
[0063] [Compound Group 7]

G5

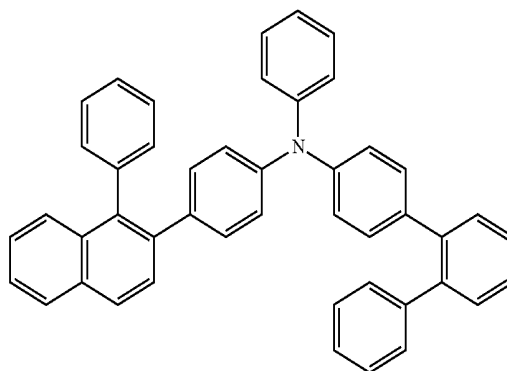
G1



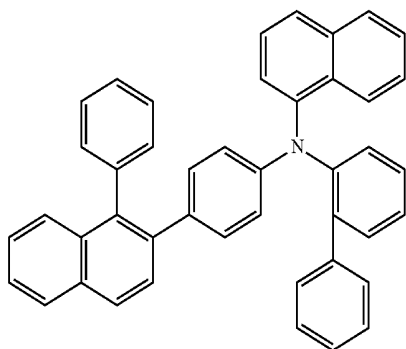
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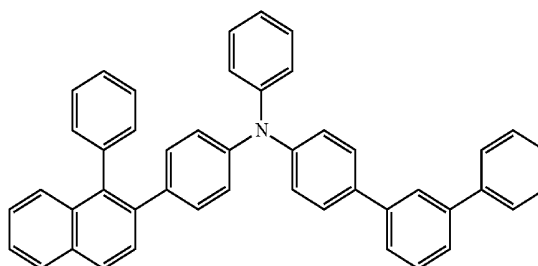
G6



G3

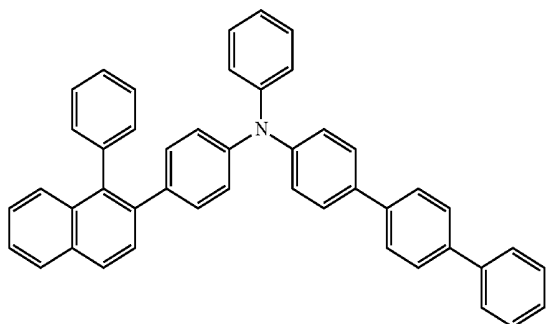


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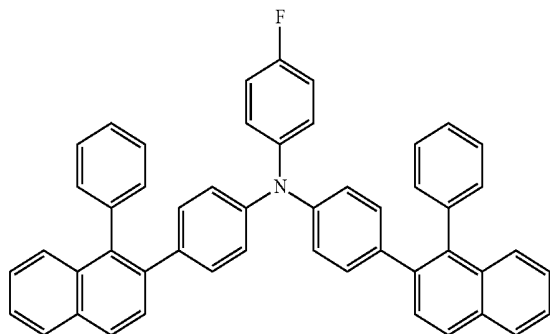
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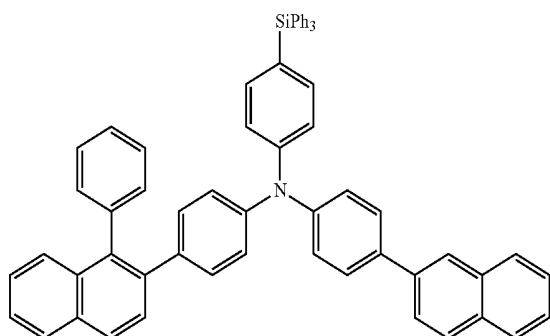
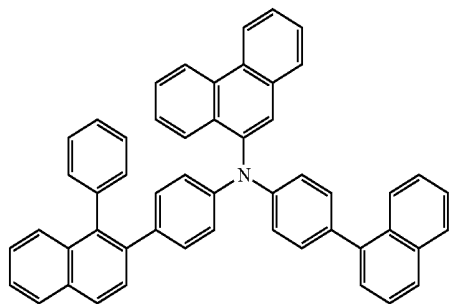
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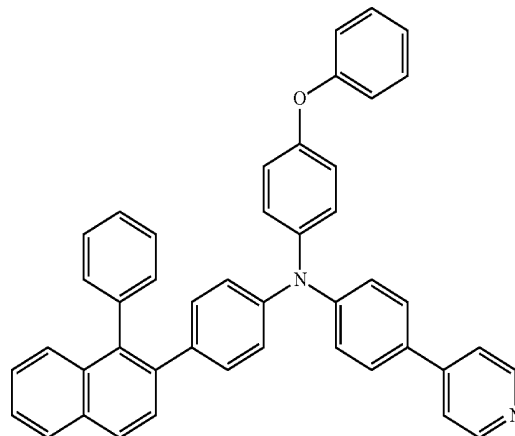
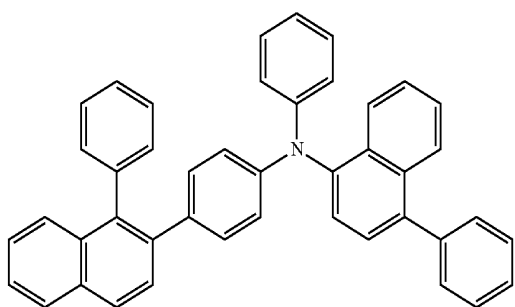
G13

G9



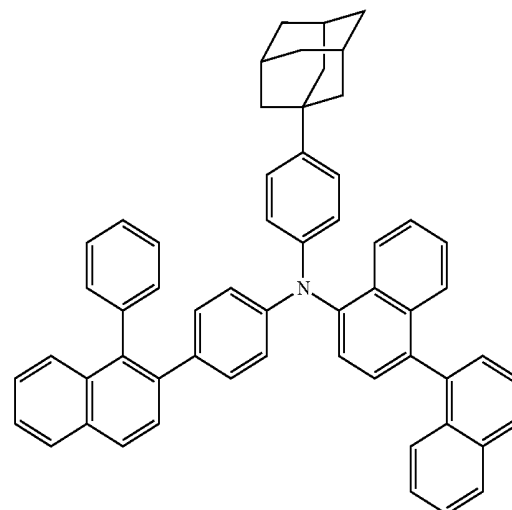
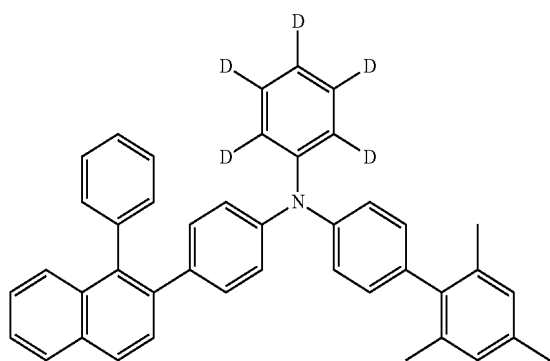
G14

G10



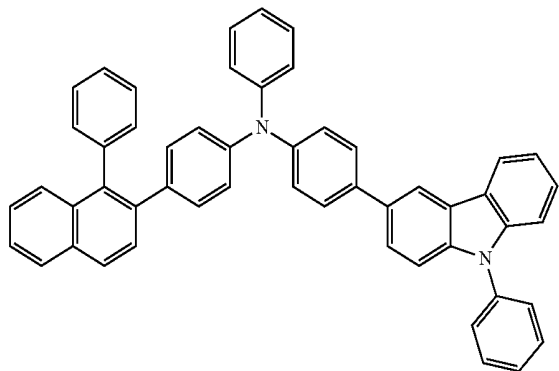
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G11

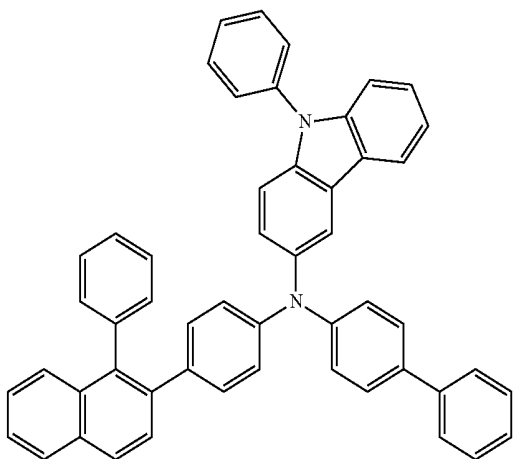


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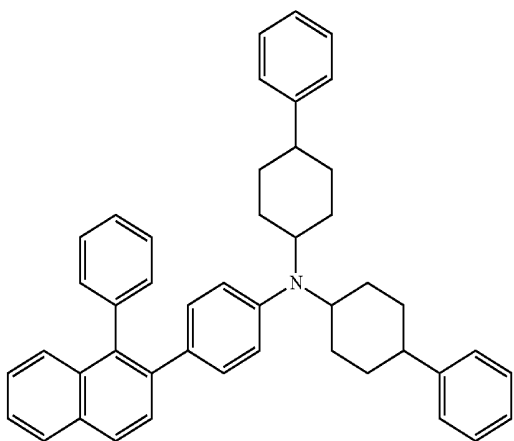
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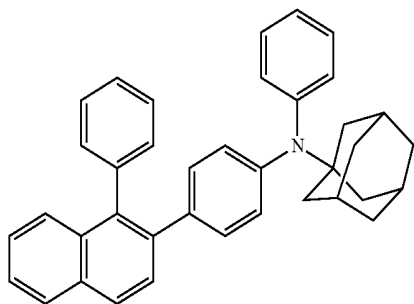
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G18

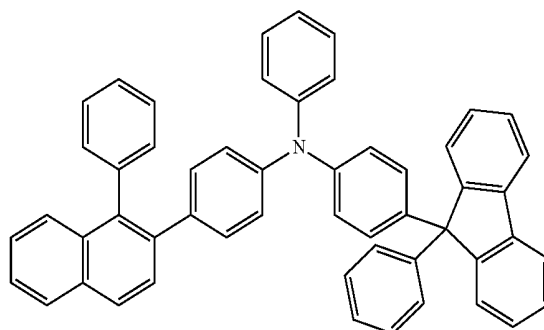


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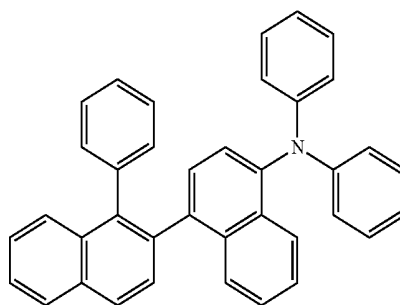


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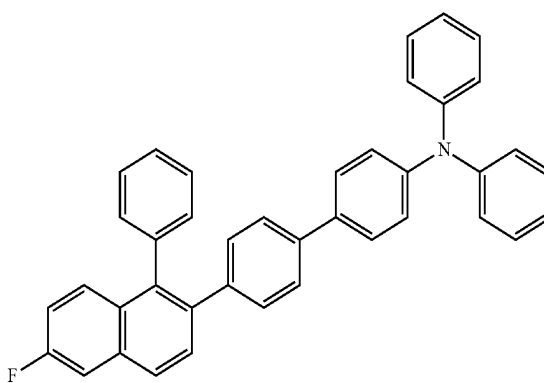
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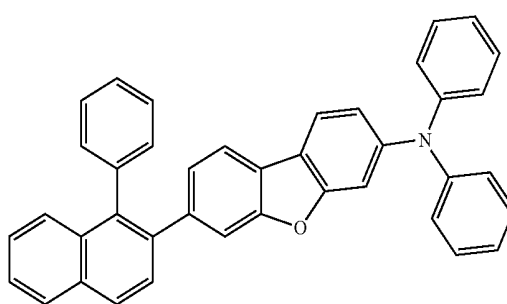
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G22

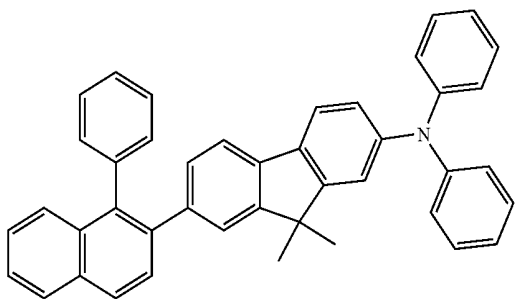


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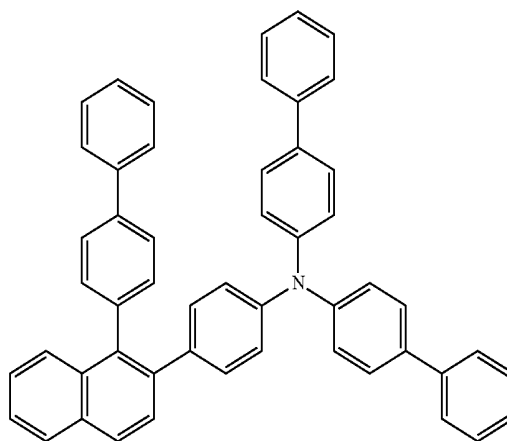
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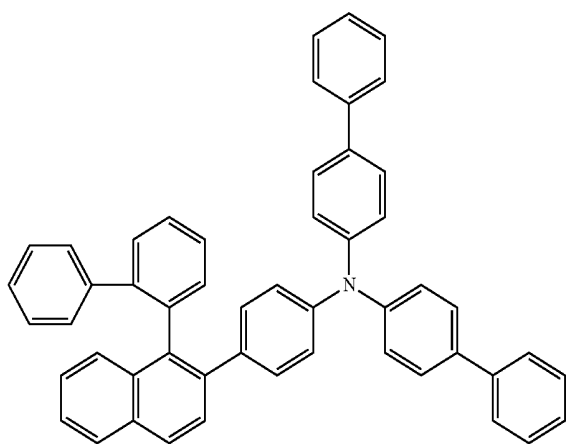


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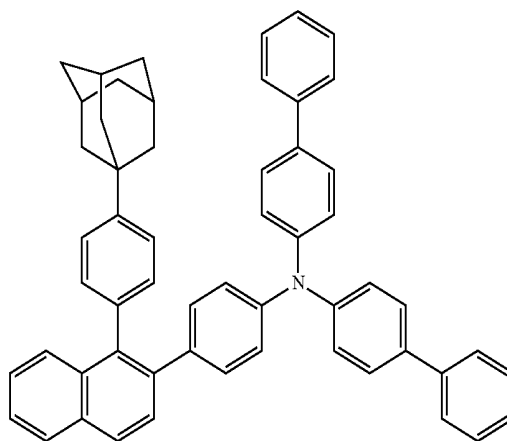
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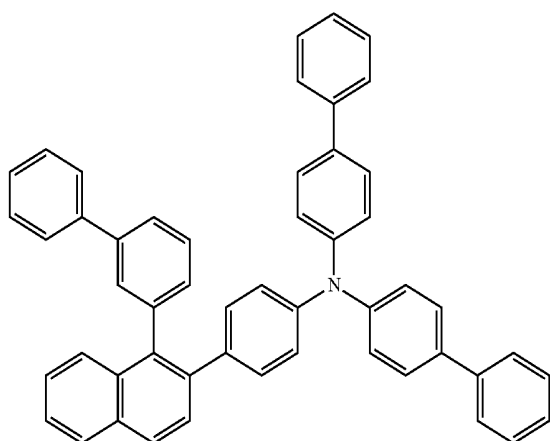
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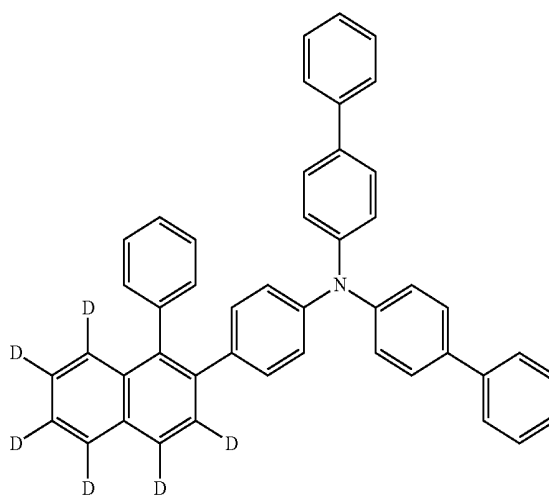
G28



G26

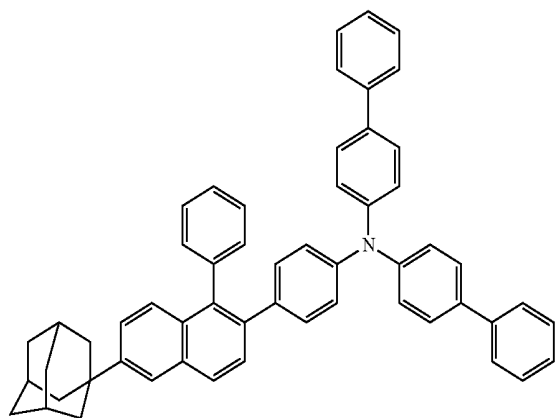


G29



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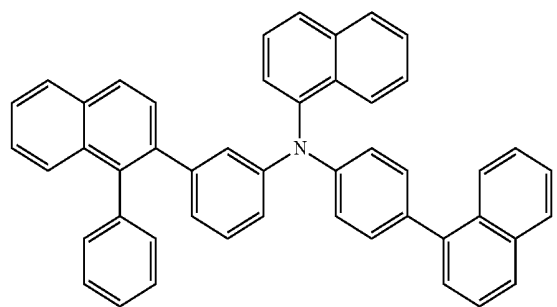
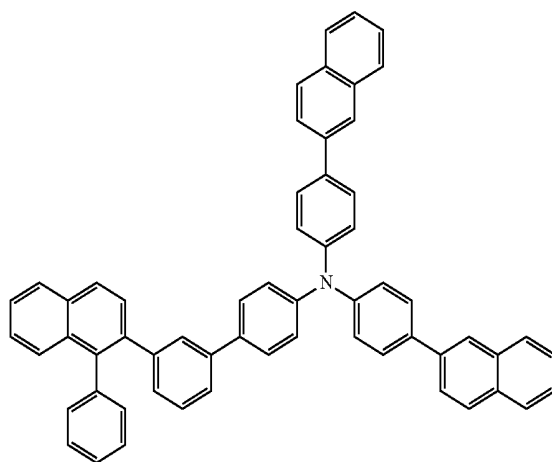
G30



G31

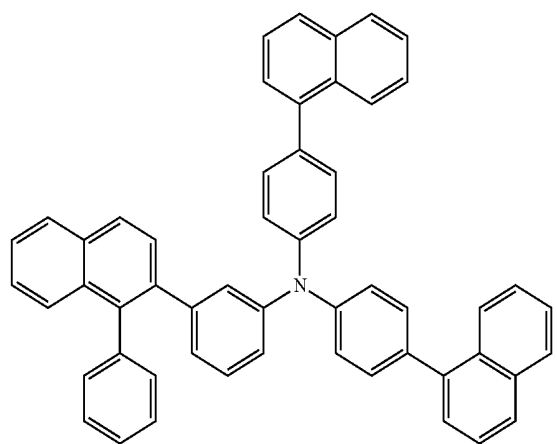
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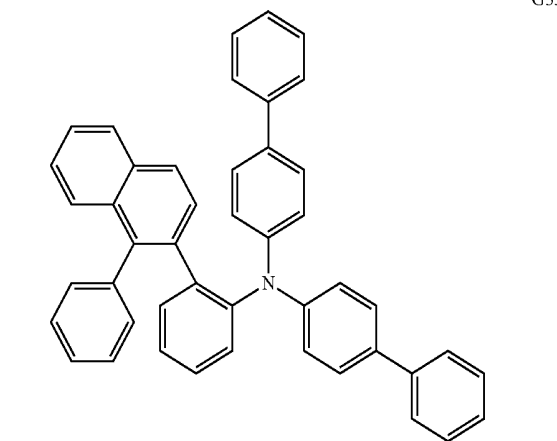
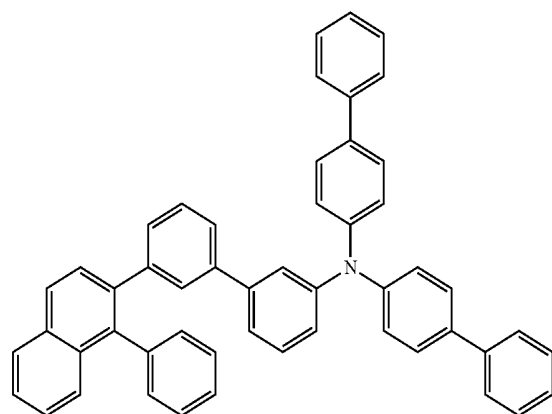


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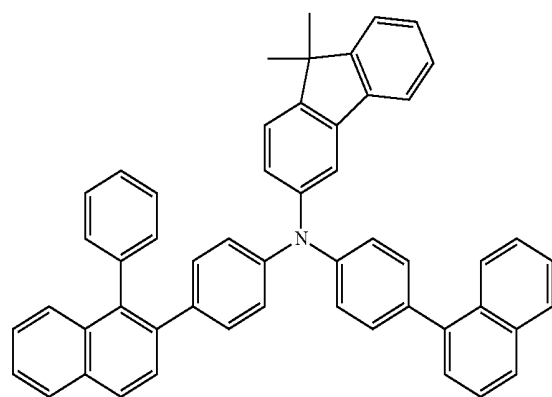
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G33

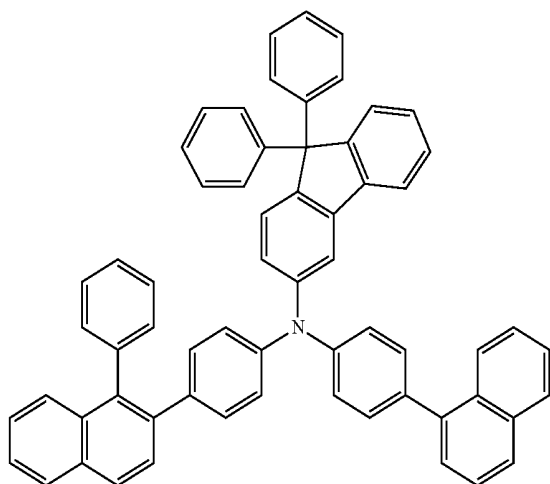


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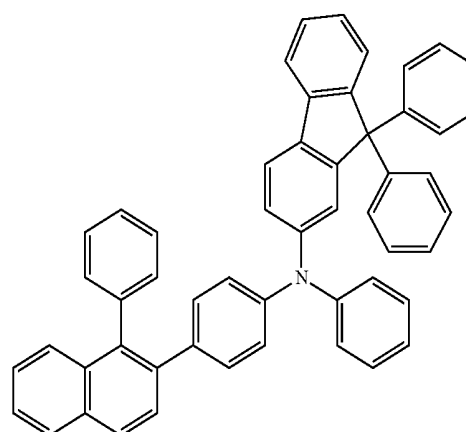
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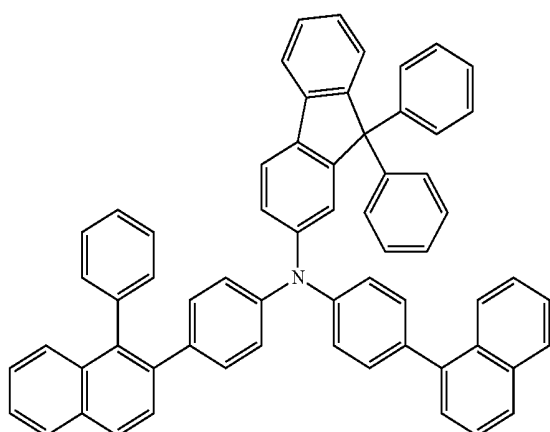


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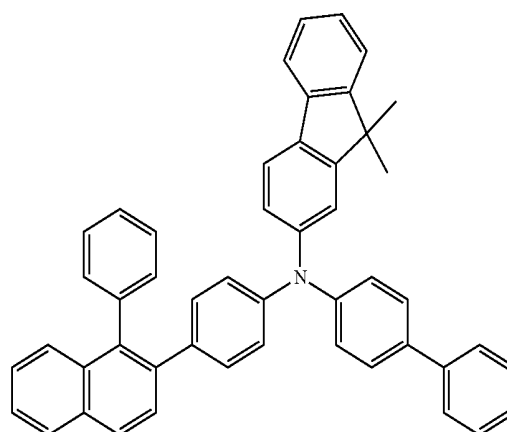
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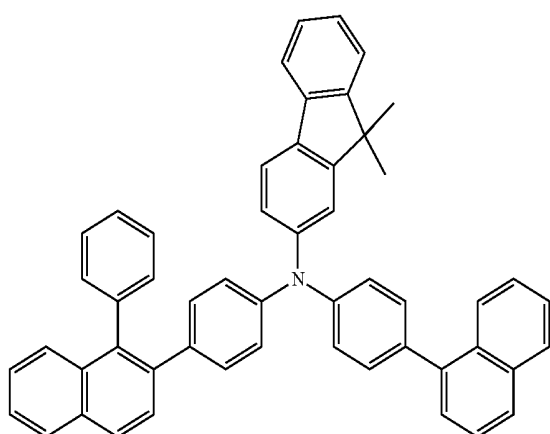
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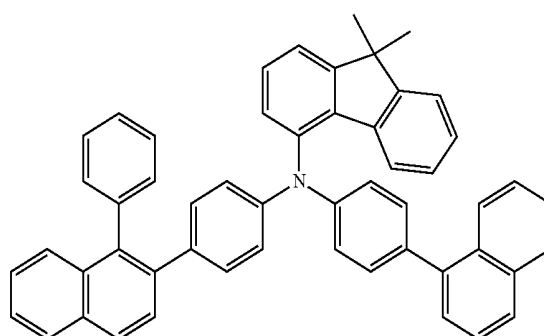
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G39

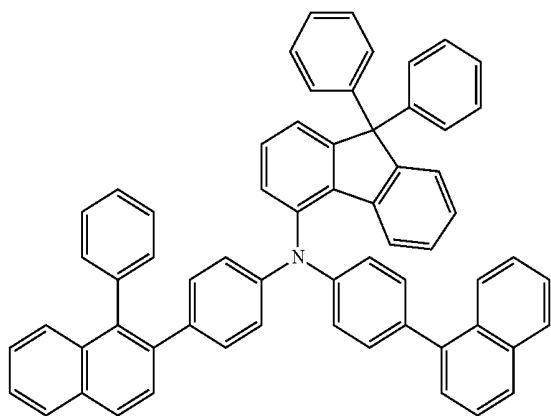


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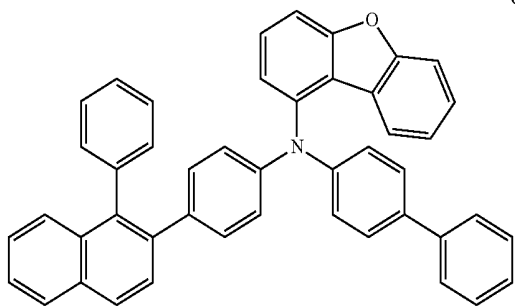


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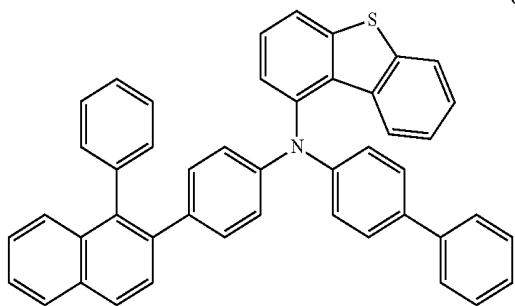
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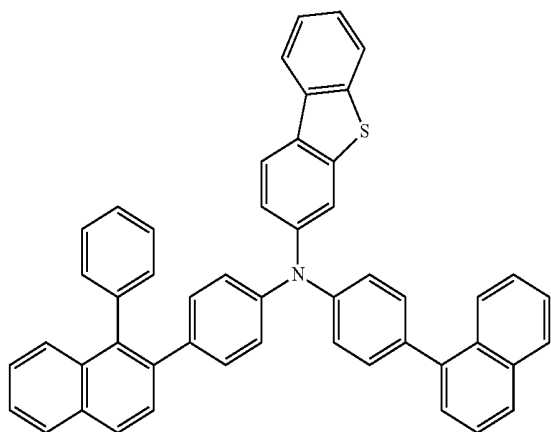
G44



G45

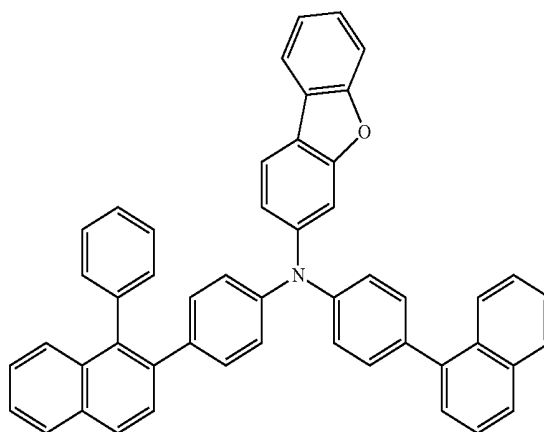


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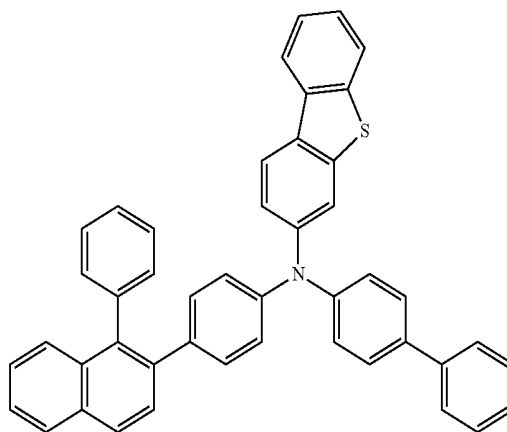


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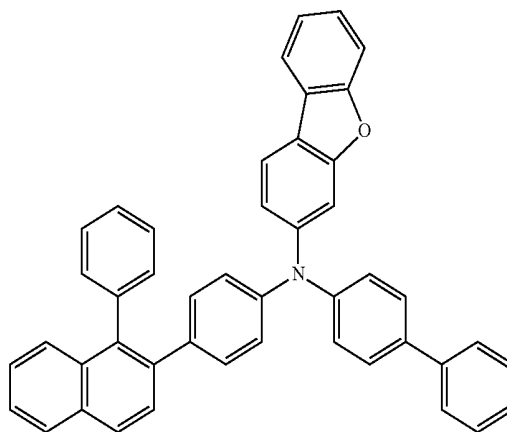
G47



G48

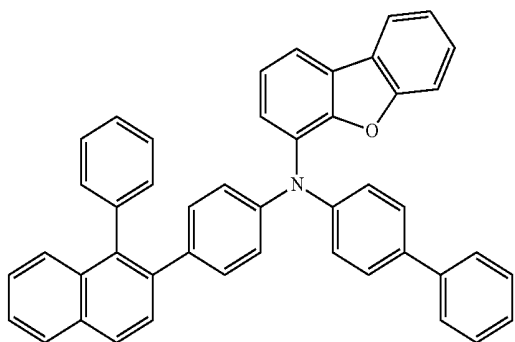


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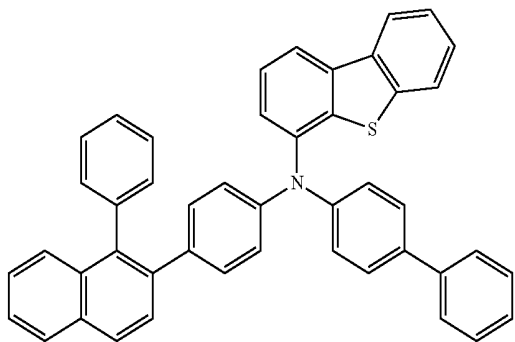


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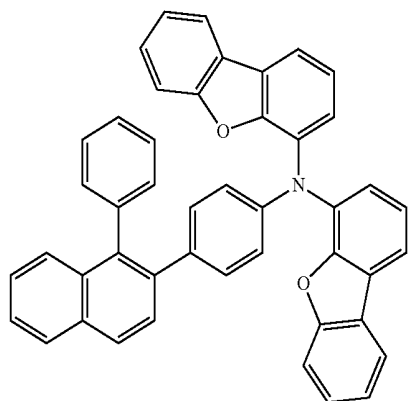
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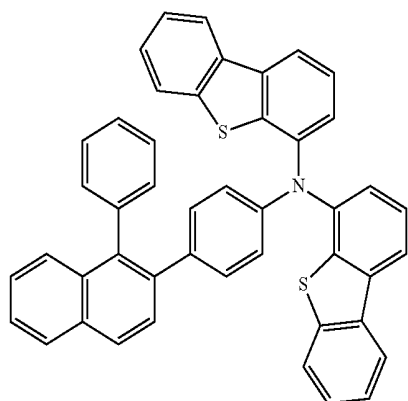
G51



G52

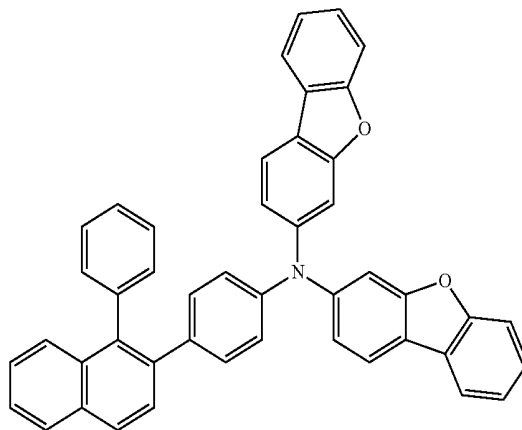


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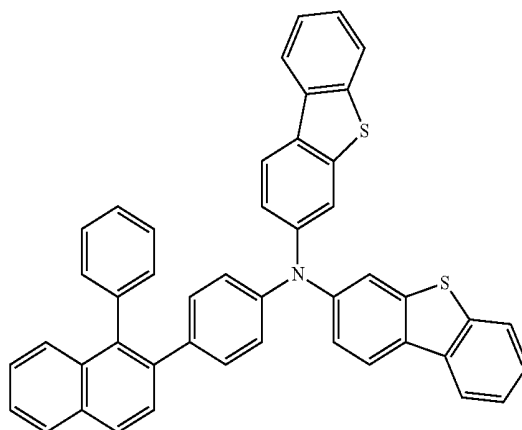


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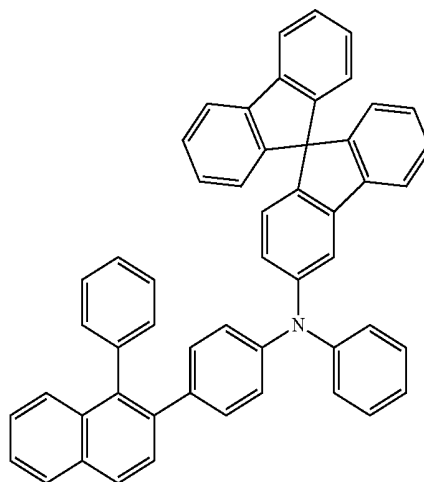
G54



G55

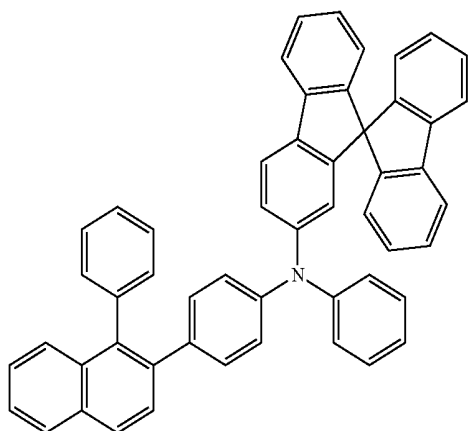


G56



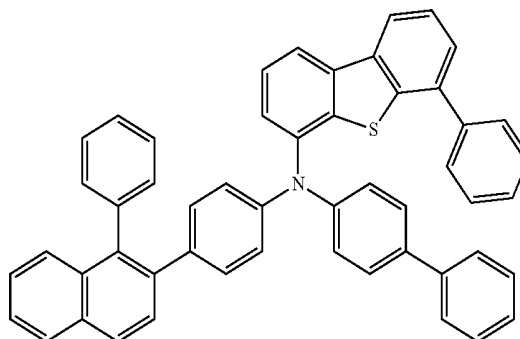
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G57



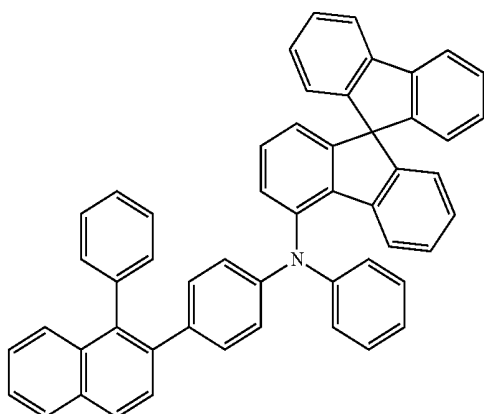
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G60



[0064] The monoamine compound according to an example embodiment includes may include a fused ring and a phenyl-naphthyl group with a high thermal resistance and electric charge resistance, and may help to extend a device life when used as a material for an organic electroluminescence device. When used as a material for an organic electroluminescence device, the monoamine compound may enhance the quality of layers due to the bulky phenyl-naphthyl group which decreases symmetry of molecule and inhibits crystallization, thereby contributing to securing high efficiency.

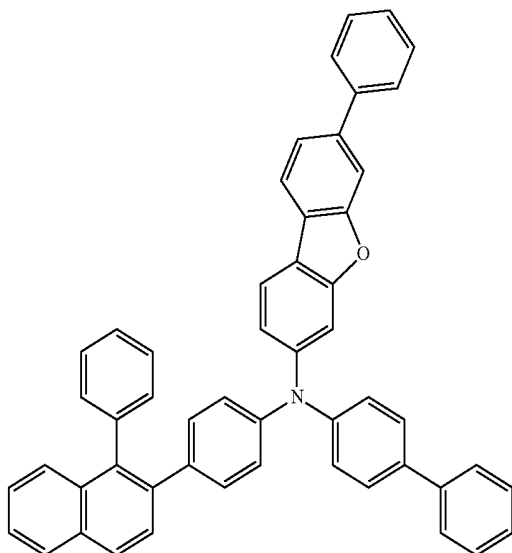
G58



[0065] Hereinafter, an organic electroluminescence device according to an example embodiment will be explained, referring to FIGS. 1 to 3. The organic electroluminescence device according to an example embodiment includes the monoamine compound according to an example embodiment. For example, a hole transport region HTR includes the monoamine compound represented by Formula 1.

[0066] The following explanation will be mainly given with features different from the monoamine compound according to an example embodiment, and unexplained parts will follow the above description on the monoamine compound according to an example embodiment.

G59



[0067] The first electrode EL1 has conductivity. The first electrode EL1 may be a pixel electrode or an anode. The first electrode EL1 may be a transmissive electrode, a transreflective electrode, or a reflective electrode. In case the first electrode EL1 is the transmissive electrode, the first electrode EL1 may include a transparent metal oxide such as indium tin oxide (ITO), indium zinc oxide (IZO), zinc oxide (ZnO), or indium tin zinc oxide (ITZO). In case the first electrode EL1 is the transreflective electrode or reflective electrode, the first electrode EL1 may include Ag, Mg, Cu, Al, Pt, Pd, Au, Ni, Nd, Ir, Cr, Li, Ca, LiF/Ca, LiF/Al, Mo, Ti, a compound thereof, or a mixture thereof (for example, a mixture of Ag and Mg). Also, the first electrode EL1 may have a structure including a plurality of layers including a reflective layer or transreflective layer formed using the above materials, and a transparent conductive layer formed using ITO, IZO, ZnO, or ITZO. For example, the first electrode EL1 may have a triple-layer structure of ITO/Ag/ITO.

[0068] The thickness of the first electrode EL1 may be from about 1,000 Å to about 10,000 Å, for example, from about 1,000 Å to about 3,000 Å.

[0069] The hole transport region HTR is on the first electrode EL1. The hole transport region HTR may include

at least one of a hole injection layer HIL, a hole transport layer HTL, a hole buffer layer, or an electron blocking layer EBL.

[0070] The hole transport region HTR includes the monoamine compound according to an example embodiment, as described above.

[0071] The hole transport region HTR may have a single layer formed using a single material, a single layer formed using a plurality of different materials, or a multilayer structure including a plurality of layers formed using a plurality of different materials.

[0072] For example, the hole transport region HTR may have a single layer structure of a hole injection layer HIL or a hole transport layer HTL, or may have a single layer structure formed using a hole injection material and a hole transport material. In addition, the hole transport region HTR may have a single layer structure formed using a plurality of different materials, or a laminated structure of hole injection layer HIL/hole transport layer HTL, hole injection layer HIL/hole transport layer HTL/hole buffer layer, hole injection layer HIL/hole buffer layer, hole transport layer HTL/hole buffer layer, or hole injection layer HIL/hole transport layer HTL/electron blocking layer EBL, laminated in order from the first electrode EL1, without limitation.

[0073] As described above, the hole transport region HTR may have a multilayer structure having a plurality of layers, and a layer of the plurality of layers contacting the emission layer EML may include the monoamine compound represented by Formula 1. For example, the hole transport region HTR may include a hole injection layer HIL on the first electrode EL1, a hole transport layer HTL on the hole injection layer HIL, and an electron blocking layer EBL on the hole transport layer HTL, and the electron blocking layer EBL may include the monoamine compound represented by Formula 1. In another example, the hole transport region HTR may include a hole injection layer HIL and a hole transport layer HTL, and the hole transport layer HTL may include the monoamine compound represented by Formula 1.

[0074] The hole transport region HTR may include one or more of the monoamine compound represented by Formula 1. For example, the hole transport region HTR may include at least one selected from the group of compounds represented in the above-described Compound Groups 1 to 7.

[0075] The hole transport region HTR may be formed using various methods such as a vacuum deposition method, a spin coating method, a cast method, a Langmuir-Blodgett (LB) method, an inkjet printing method, a laser printing method, and a laser induced thermal imaging (LITI) method.

[0076] Furthermore, the hole transport region HTR may include the following materials in each layer.

[0077] The hole injection layer HIL may include, for example, a phthalocyanine compound such as copper phthalocyanine; N,N'-diphenyl-N,N'-bis-[4-(phenyl-m-tolyl-amino)-phenyl]-biphenyl-4,4'-diamine (DNTPD), 4,4',4''-tris(3-methylphenylphenylamino)triphenylamine (m-MTDATA), 4,4',4''-tris(N,N-diphenylamino)triphenylamine (TDATA), 4,4',4''-tris{N-(2-naphthyl)-N-phenylamino}-triphenylamine (2-TNATA), poly(3,4-ethylenedioxythiophene)/poly(4-styrenesulfonate) (PEDOT/PSS), polyaniline/dodecylbenzenesulfonic acid (PANI/DBSA), polyaniline/camphor sulfonic acid (PANI/CSA), polyaniline/poly(4-styrenesulfonate) (PANI/PSS), N,N'-di(naphtha-

len-1-yl)-N,N'-diphenyl-benzidine (NPD), triphenylamine-containing polyether ketone (TPAPEK), 4-isopropyl-4'-methyl-diphenyliodonium tetrakis(pentafluorophenyl)borate, dipyrazino[2,3-f:2',3'-h] quinoxaline-2,3,6,7,10,11-hexacarbonitrile (HAT-CN), etc.

[0078] The hole transport layer HTL may include, for example, carbazole derivatives such as N-phenyl carbazole, polyvinyl carbazole, fluorine-based derivatives, N,N'-bis(3-methylphenyl)-N,N'-diphenyl-[1,1-biphenyl]-4,4'-diamine (TPD), triphenylamine-based derivatives such as 4,4',4''-tris(N-carbazolyl)triphenylamine (TCTA), N,N'-di(naphthalen-1-yl)-N,N'-diphenyl-benzidine (NPD), 4,4'-cyclohexylidene bis[N,N-bis(4-methylphenyl)benzenamine] (TAPC), 4,4'-bis[N,N'-(3-tolyl)amino]-3,3'-dimethylbiphenyl (HMTPD), etc.

[0079] The electron blocking layer EBL may include the monoamine compound represented by Formula 1, as described above. The electron blocking layer EBL may include a suitable material. The electron blocking layer EBL may include, for example, carbazole derivatives such as N-phenyl carbazole, polyvinyl carbazole, fluorine-based derivatives, N,N'-bis(3-methylphenyl)-N,N'-diphenyl-[1,1-biphenyl]-4,4'-diamine (TPD), triphenylamine-based derivatives such as 4,4',4''-tris(N-carbazolyl)triphenylamine (TCTA), N,N'-di(naphthalen-1-yl)-N,N'-diphenyl-benzidine (NPD), 4,4'-cyclohexylidene bis[N,N-bis(4-methylphenyl)benzenamine] (TAPC), 4,4'-bis[N,N'-(3-tolyl)amino]-3,3'-dimethylbiphenyl (HMTPD) or mCP, etc.

[0080] The thickness of the hole transport region HTR may be from about 100 Å to about 10,000 Å, for example, from about 100 Å to about 5,000 Å. The thickness of the hole injection layer HIL may be, for example, from about 30 Å to about 1,000 Å, and the thickness of the hole transport layer HTL may be from about 30 Å to about 1,000 Å. For example, the thickness of the electron blocking layer EBL may be from about 10 Å to about 1,000 Å. In case the thicknesses of the hole transport region HTR, the hole injection layer HIL, the hole transport layer HTL and the electron blocking layer EBL satisfy the above-described ranges, satisfactory hole transport properties may be obtained without substantial increase of a driving voltage.

[0081] The hole transport region HTR may further include a charge generating material in addition to the above-described materials to improve conductivity. The charge generating material may be dispersed in the hole transport region HTR uniformly or non-uniformly. The charge generating material may be, for example, a p-dopant. The p-dopant may be one of quinone derivatives, metal oxides, or cyano group-containing compounds, without limitation. For example, non-limiting examples of the p-dopant may include quinone derivatives such as tetracyanoquinodimethane (TCNQ), and 2,3,5,6-tetrafluoro-tetracyanoquinodimethane (F4-TCNQ), metal oxides such as tungsten oxide and molybdenum oxide, without limitation.

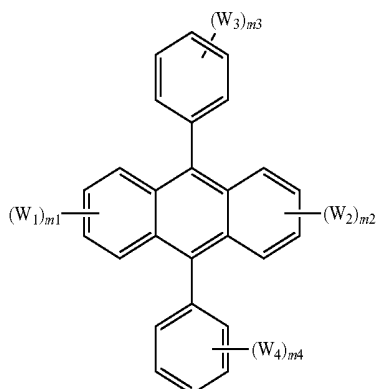
[0082] As described above, the hole transport region HTR may further include at least one of a hole buffer layer or an electron blocking layer EBL. The hole buffer layer may compensate an optical resonance distance according to the wavelength of light emitted from the emission layer EML and increase light emission efficiency. Materials included in the hole transport region HTR may be used as materials included in the hole buffer layer. The electron blocking layer

EBL is a layer preventing electron injection from the electron transport region ETR into the hole transport region HTR.

[0083] The emission layer EML is on the hole transport region HTR. The thickness of the emission layer EML may be, for example, from about 100 Å to about 1,000 Å, or from about 100 Å to about 600 Å. The emission layer EML may have a single layer formed using a single material, a single layer formed using a plurality of different materials, or a multilayer structure having a plurality of layers formed using a plurality of different materials.

[0084] A suitable emission material may be used as a material for the emission layer EML. The material for the emission layer EML may be selected from, for example, fluoranthene derivatives, pyrene derivatives, arylacetylene derivatives, anthracene derivatives, fluorene derivatives, perylene derivatives, chrysene derivatives, or the like, and preferably, from pyrene derivatives, perylene derivatives, or anthracene derivatives. For example, as the host material of the emission layer EML, anthracene derivatives represented by the following Formula 10 may be used.

[Formula 10]

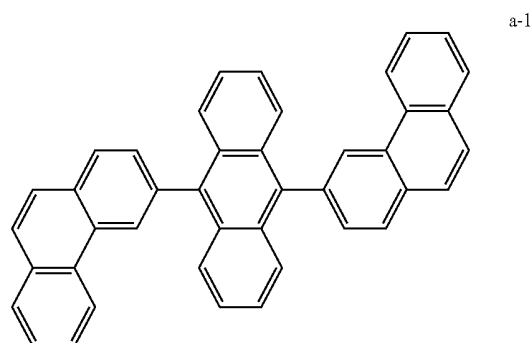


[0085] In Formula 10, W_1 to W_4 are each independently a hydrogen atom, a deuterium atom, a halogen atom, a substituted or unsubstituted silyl group, a substituted or unsubstituted alkyl group having 1 to 20 carbon atoms, a substituted or unsubstituted aryl group having 6 to 30 ring carbon atoms, or a substituted or unsubstituted heteroaryl group having 2 to 30 ring carbon atoms, or may form a ring by combining adjacent groups with each other, m_1 and m_2 are each independently an integer of 0 to 4, and m_3 and m_4 are each independently an integer of 0 to 5.

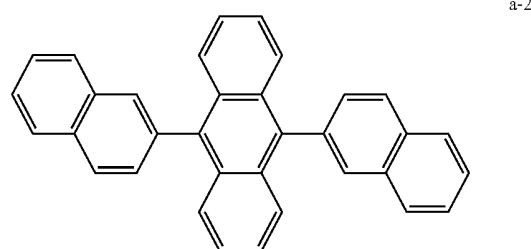
[0086] When m_1 is 1, W_1 may not be a hydrogen atom. When m_2 is 1, W_2 may not be a hydrogen atom. When m_3 is 1, W_3 may not be a hydrogen atom. When m_4 is 1, W_4 may not be a hydrogen atom.

[0087] When m_1 is an integer of 2 or more, a plurality of W_1 may be the same or different from each other. When m_2 is an integer of 2 or more, a plurality of W_2 may be the same or different from each other. When m_3 is an integer of 2 or more, a plurality of W_3 may be the same or different from each other. When m_4 is an integer of 2 or more, a plurality of W_4 may be the same or different from each other.

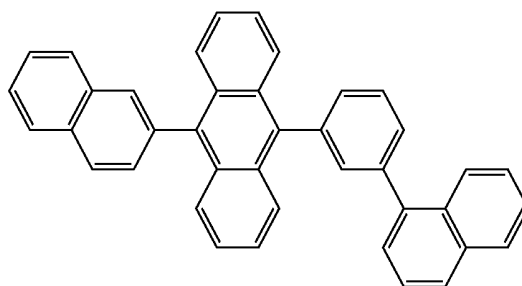
[0088] The compound represented by Formula 10 may include the compounds represented by the following structures, for example.



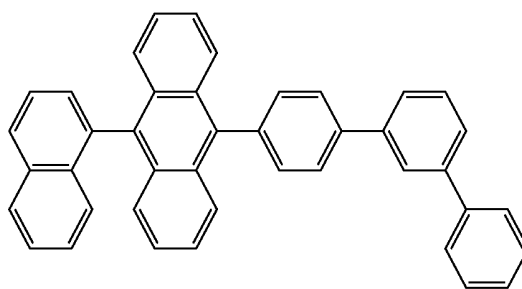
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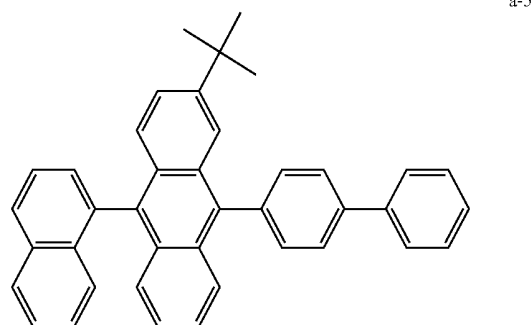
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a-3

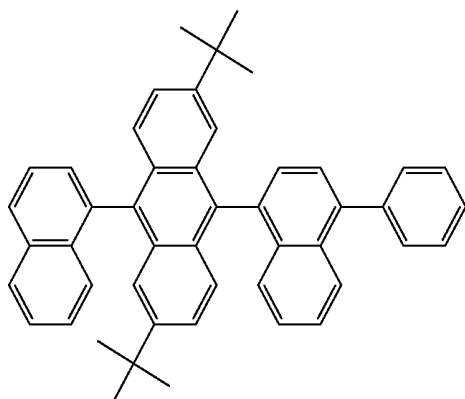


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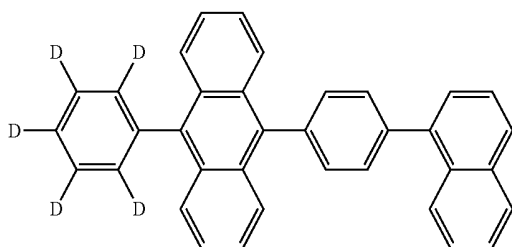


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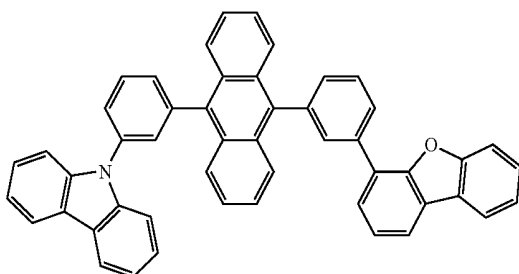
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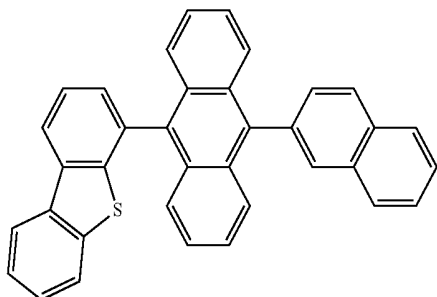
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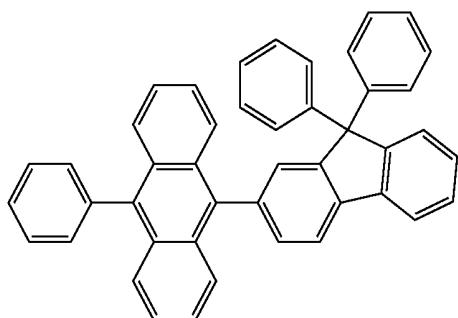
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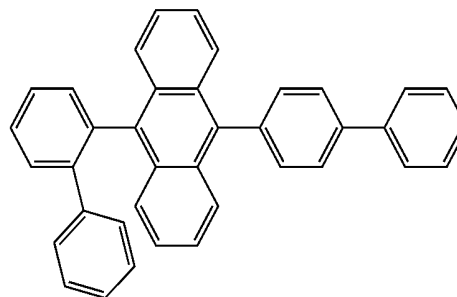


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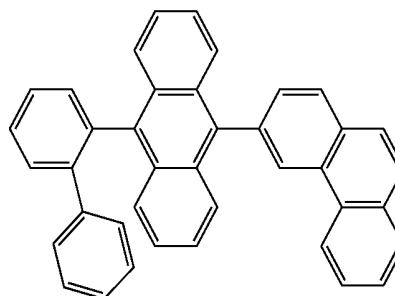


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a-11



a-12

[0089] The emission layer EML may include a fluorescent material including any one selected from the group of spiro-DPVBi, 2,2',7,7'-tetrakis(biphenyl-4-yl)-9,9'-spirobifluorene(spiro-sexiphenyl) (spiro-6P), distyryl-benzene (DSB), distyryl-arylene (DSA), polyfluorene (PFO)-based polymer and poly(p-phenylene vinylene) (PPV)-based polymer, for example.

[0090] The emission layer EML may further include a dopant, and the dopant may be a suitable material. For example, styryl derivatives (for example, 1,4-bis[2-(3-N-ethylcarbazolyl)vinyl]benzene (BCzVB), 4-(di-p-tolylamino)-4'-[(di-p-tolylamino)styryl]stilbene (DPAVB), N-(4-((E)-2-(6-((E)-4-(diphenylamino)styryl)naphthalen-2-yl)vinyl)phenyl)-N-phenylbenzenamine (N-BDAVB)), perylene and the derivatives thereof (for example, 2,5,8,11-tetra-t-butylperylene (TBPe)), pyrene and the derivatives thereof (for example, 1,1-dipyrene, 1,4-dipyrenylbenzene, 1,4-bis(N,N-diphenylamino)pyrene, 1,6-bis(N,N-diphenylamino)pyrene), 2,5,8,11-tetra-t-butylperylene (TBP), 1,3,5-tris(N-phenylbenzimidazole-2-yl)benzene (TPBi), etc., may be used as a dopant.

[0091] The emission layer EML may include, for example, tris(8-hydroxyquinolino)aluminum (Alq_3), 4,4'-bis(N-carbazolyl)-1,1'-biphenyl (CBP), poly(N-vinylcarbazole) (PVK), 9,10-di(naphthalen-2-yl)anthracene (ADN), 4,4',4''-tris(carbazol-9-yl)-triphenylamine (TCTA), 1,3,5-tris(N-phenylbenzimidazol-2-yl)benzene (TPBi), 3-tert-butyl-9,10-di(naphth-2-yl)anthracene (TBADN), distyrylarylene (DSA), 4,4'-bis(9-carbazolyl)-2,2'-dimethyl-biphenyl (CDBP), 2-methyl-9,10-bis(naphthalen-2-yl)anthracene (MADN), bis[2-(diphenylphosphino)phenyl]ether oxide (DPEPO), hexaphenyl cyclotriphosphazene (CP1), 1,4-bis(triphenylsilyl)benzene (UGH2), hexaphenylcyclotrisiloxane (DPSiO_3), octaphenylcyclotetrasiloxane (DPSiO_4), 2,8-bis(diphenylphosphoryl)dibenzofuran (PPF), etc.

[0092] The electron transport region ETR is provided on the emission layer EML. The electron transport region ETR

may include at least one of a hole blocking layer HBL, an electron transport layer ETL or an electron injection layer EIL, for example.

[0093] The electron transport region ETR may have a single layer formed using a single material, a single layer formed using a plurality of different materials, or a multi-layer structure having a plurality of layers formed using a plurality of different materials.

[0094] For example, the electron transport region ETR may have a single layer structure of an electron injection layer EIL or an electron transport layer ETL, or a single layer structure formed using an electron injection material and an electron transport material. In addition, the electron transport region ETR may have a single layer structure having a plurality of different materials, or a laminated structure of electron transport layer ETL/electron injection layer EIL, or hole blocking layer HBL/electron transport layer ETL/electron injection layer EIL, laminated in order from the emission layer EML, without limitation. The thickness of the electron transport region ETR may be, for example, from about 100 Å to about 1,500 Å.

[0095] The electron transport region ETR may be formed using various methods such as a vacuum deposition method, a spin coating method, a cast method, a Langmuir-Blodgett (LB) method, an inkjet printing method, a laser printing method, and a laser induced thermal imaging (LITI) method.

[0096] In case the electron transport region ETR includes the electron transport layer ETL, the electron transport region ETR may include tris(8-hydroxyquinolino)aluminum (Alq₃), 1,3,5-tri[(3-pyridyl)-phen-3-yl]benzene, 2,4,6-tris(3'-pyridin-3-yl)biphenyl-3-yl)-1,3,5-triazine, bis[2-(diphenylphosphino)phenyl] ether oxide (DPEPO), 2-(4-(N-phenylbenzimidazolyl-1-yl)phenyl)-9,10-dinaphthylanthracene, 1,3,5-tri(1-phenyl-1H-benzo[d]imidazol-2-yl)phenyl (TPBi), 2,9-dimethyl-4,7-diphenyl-1,10-phenanthroline (BCP), 4,7-diphenyl-1,10-phenanthroline (Bphen), 3-(4-biphenyl)-4-phenyl-5-tert-butylphenyl-1,2,4-triazole (TAZ), 4-(naphthalen-1-yl)-3,5-diphenyl-4H-1,2,4-triazole (NTAZ), 2-(4-biphenyl)-5-(4-tert-butylphenyl)-1,3,4-oxadiazole (tBu-PBD), bis(2-methyl-8-quinolinolato-N1,O8)-(1,1'-Biphenyl-4-olato)aluminum (BALq), beryllium bis(benzoquinolin-10-olate) (Bebq₂), 9,10-di(naphthalen-2-yl)anthracene (ADN), or a mixture thereof, for example. The thickness of the electron transport layer ETL may be from about 100 Å to about 1,000 Å, for example, from about 150 Å to about 500 Å. If the thickness of the electron transport layer ETL satisfies the above-described range, satisfactory electron transport properties may be obtained without substantial increase of a driving voltage.

[0097] When the electron transport region ETR includes the electron injection layer EIL, the electron transport region ETR may use LiF, lithium quinolate (LIQ), Li₂O, BaO, NaCl, CsF, a metal in lanthanides such as Yb, or a metal halide such as RbCl and RbI, without limitation. The electron injection layer EIL also may be formed using a mixture material of an electron transport material and an insulating organo metal salt. The organo metal salt may be a material having an energy band gap of about 4 eV or more. The organo metal salt may include, for example, a metal acetate, a metal benzoate, a metal acetoacetate, a metal acetylacetonate, or a metal stearate. The thickness of the electron injection layer EIL may be from about 1 Å to about 100 Å, for example, from about 3 Å to about 90 Å. In case the

thickness of the electron injection layer EIL satisfies the above described range, satisfactory electron injection properties may be obtained without inducing the substantial increase of a driving voltage.

[0098] The electron transport region ETR may include a hole blocking layer HBL, as described above. The hole blocking layer HBL may include, for example, 2,9-dimethyl-4,7-diphenyl-1,10-phenanthroline (BCP), 4,7-diphenyl-1,10-phenanthroline (Bphen), or bis[2-(diphenylphosphino)phenyl]ether oxide (DPEPO), etc.

[0099] The second electrode EL2 is on the electron transport region ETR. The second electrode EL2 may be a common electrode or a cathode. The second electrode EL2 may be a transmissive electrode, a transfective electrode or a reflective electrode. In case the second electrode EL2 is the transmissive electrode, the second electrode EL2 may be formed using transparent metal oxides, for example, ITO, IZO, ZnO, ITZO, etc.

[0100] In case the second electrode EL2 is the transfective electrode or the reflective electrode, the second electrode EL2 may include Ag, Mg, Cu, Al, Pt, Pd, Au, Ni, Nd, Ir, Cr, Li, Ca, LiF/Ca, LiF/Al, Mo, Ti, a compound thereof, or a mixture thereof (for example, a mixture of Ag and Mg). The second electrode EL2 may have a multilayer structure including a reflective layer or a transfective layer formed using the above-described materials and a transparent conductive layer formed using ITO, IZO, ZnO, ITZO, etc.

[0101] The second electrode EL2 may be connected with an auxiliary electrode. In case the second electrode EL2 is connected with the auxiliary electrode, the resistance of the second electrode EL2 may decrease.

[0102] In the organic electroluminescence device 10, according to the application of a voltage to each of the first electrode EL1 and the second electrode EL2, holes injected from the first electrode EL1 may move via the hole transport region HTR to the emission layer EML, and electrons injected from the second electrode EL2 may move via the electron transport region ETR to the emission layer EML. The electrons and the holes are recombined in the emission layer EML to generate excitons, and light may be emitted via the transition of the excitons from an excited state to a ground state.

[0103] In case the organic electroluminescence device 10 is a top emission type, the first electrode EL1 may be a reflective electrode, and the second electrode EL2 may be a transmissive electrode or a transfective electrode. In case the organic electroluminescence device 10 is a bottom emission type, the first electrode EL1 may be a transmissive electrode or a transfective electrode, and the second electrode EL2 may be a reflective electrode.

[0104] The organic electroluminescence device 10 according to an example embodiment includes the monoamine compound represented by Formula 1, thereby securing high efficiency and a long device life, as well as a decreased driving voltage.

[0105] The following Examples and Comparative Examples are provided in order to highlight characteristics of one or more embodiments, but it will be understood that the Examples and Comparative Examples are not to be construed as limiting the scope of the embodiments, nor are the Comparative Examples to be construed as being outside the scope of the embodiments. Further, it will be understood that the embodiments are not limited to the particular details described in the Examples and Comparative Examples.

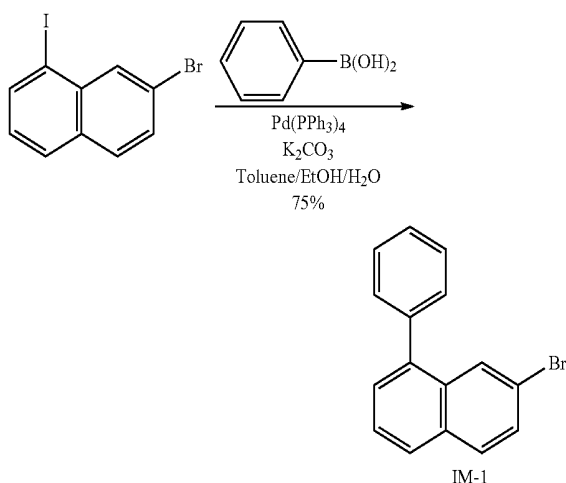
Synthesis Examples

[0106] The monoamine compound according to an example embodiment may be synthesized, for example, as follows.

[0107] 1. Synthesis of Compound A4

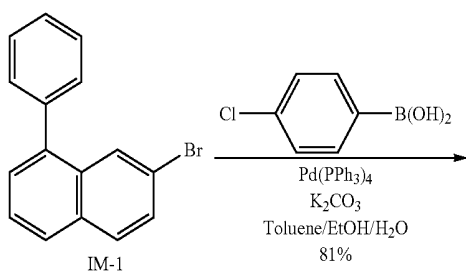
[0108] Compound A4, a monoamine compound according to an example embodiment may be synthesized, for example, as follows.

[0109] (Synthesis of Intermediate IM-1)

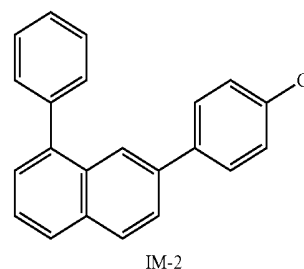


[0110] Under an Ar atmosphere, 7-bromo-1-iodonaphthalene (25.00 g, 75.1 mmol), phenylboronic acid (10.07 g, 1.1 equiv., 82.6 mmol), K_2CO_3 (31.13 g, 3.0 equiv., 225.2 mmol), $Pd(PPh_3)_4$ (4.34 g, 0.05 eq., 3.8 mmol), and a mixture solution of toluene/EtOH/ H_2O (4/2/1) (525 mL) were added in order to an 1 L three-neck flask, and the mixture was stirred and heated at about 80° C. After cooling in air to room temperature, the reaction solution was extracted with toluene. After removing aqueous layer, organic layer was washed with saturated brine, and then dried over $MgSO_4$. $MgSO_4$ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Intermediate IM-1 (15.95 g, yield 75%). Intermediate IM-1 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass $m/z=283$.

[0111] (Synthesis of Intermediate IM-2)

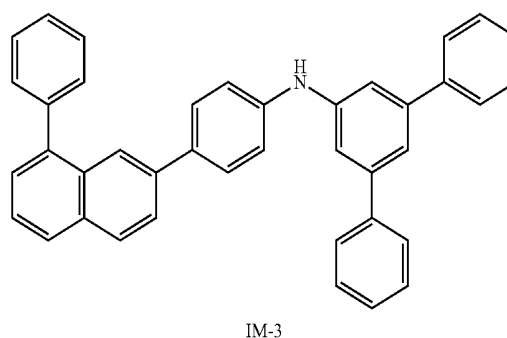
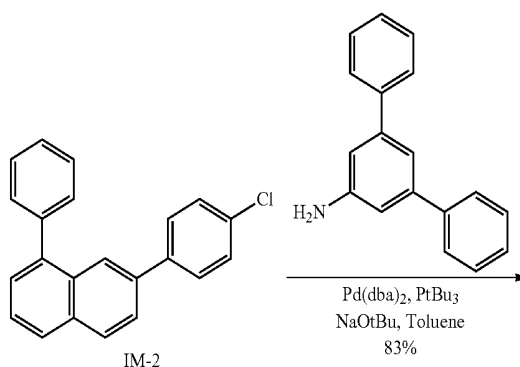


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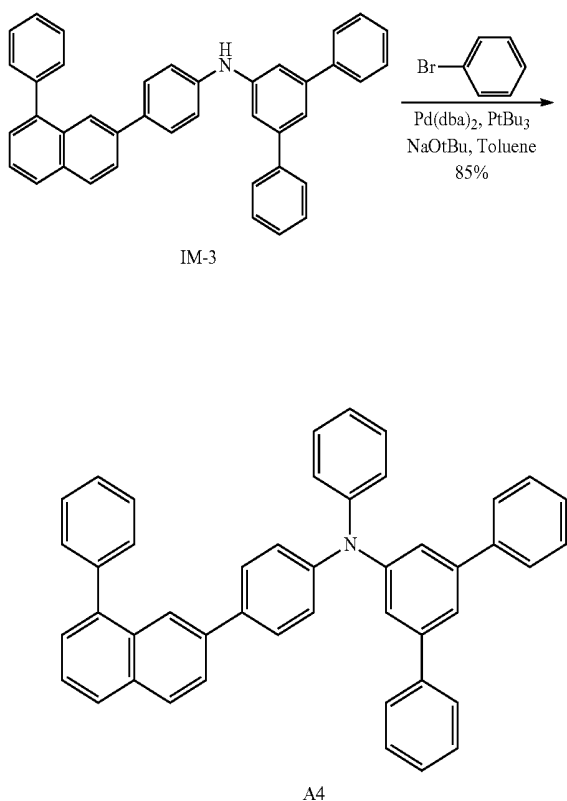
[0112] Under an Ar atmosphere, IM-1 (13.00 g, 45.9 mmol), 4-chlorophenylboronic acid (7.90 g, 1.1 equiv., 50.5 mmol), K_2CO_3 (19.04 g, 3.0 equiv., 60.7 mmol), $Pd(PPh_3)_4$ (2.65 g, 0.05 eq., 2.3 mmol), and a mixture solution of toluene/EtOH/ H_2O (4/2/1) (321 mL) were added in order to an 1 L three-neck flask, and the mixture was stirred and heated at about 80° C. After cooling in air to room temperature, the reaction solution was extracted with toluene. After removing aqueous layer, organic layer was washed with saturated brine, and then dried over $MgSO_4$. $MgSO_4$ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Intermediate IM-2 (11.71 g, yield 81%). Intermediate IM-2 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass $m/z=314$.

[0113] (Synthesis of Intermediate IM-3)



[0114] Under an Ar atmosphere, IM-2 (10.00 g, 31.8 mmol), Pd(dba)₂ (0.55 g, 0.03 equiv., 1.0 mmol), NaOtBu (3.05 g, 1.0 equiv., 31.8 mmol), toluene (159 mL), 3,5-diphenylaniline (8.57 g, 1.1 equiv., 34.9 mmol) and tBu₃P (0.64 g, 0.1 equiv., 3.2 mmol) were added in order to a 300 mL three-neck flask, and the mixture was stirred and heated to reflux. After cooling in air to room temperature, water was added to the reaction solvent and an organic layer was separated and taken. Toluene was added to the remaining aqueous layer, followed by extraction of the aqueous layer to obtain another organic layer. Organic layers were combined and washed with brine, and then dried over MgSO₄. MgSO₄ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Intermediate IM-3 (13.81 g, yield 83%). Intermediate IM-3 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass m/z=523.

[0115] (Synthesis of Compound A4)



[0116] Under an Ar atmosphere, IM-3 (8.00 g, 15.3 mmol), Pd(dba)₂ (0.26 g, 0.03 equiv., 0.5 mmol), NaOtBu (2.94 g, 2.0 equiv., 30.6 mmol), toluene (76 mL), bromobenzene (2.64 g, 1.1 equiv., 16.8 mmol) and tBu₃P (0.31 g, 0.1 equiv., 1.5 mmol) were added in order to a 300 mL three-neck flask, and the mixture was stirred and heated to reflux. After cooling in air to room temperature, water was added to the reaction solvent and an organic layer was separated and taken. Toluene was added to the remaining aqueous layer, followed by extraction of the aqueous layer to obtain another organic layer. Organic layers were combined and

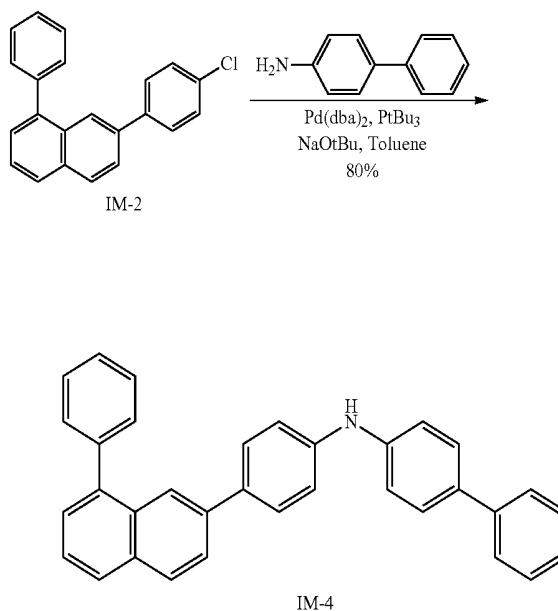
washed with brine, and then dried over MgSO₄. MgSO₄ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Compound A4 (7.79 g, yield 85%).

[0117] Compound A4 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass m/z=599.

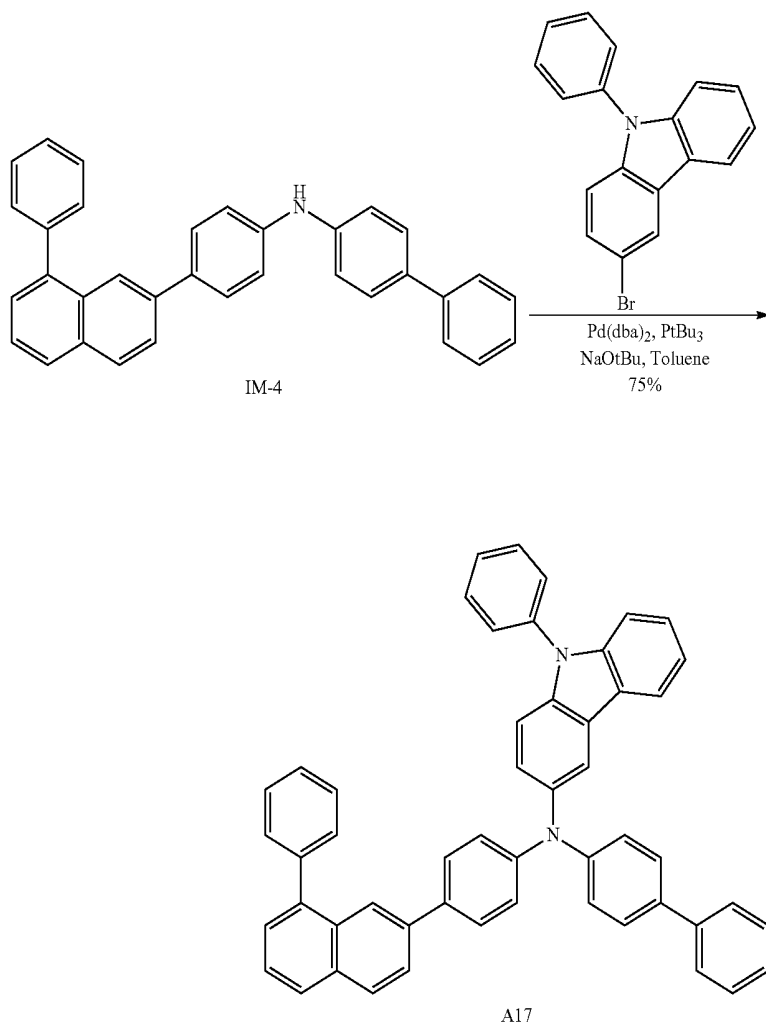
[0118] 2. Synthesis of Compound A17

[0119] Compound A17, a monoamine compound according to an example embodiment may be synthesized, for example, as follows.

[0120] (Synthesis of Intermediate IM-4)



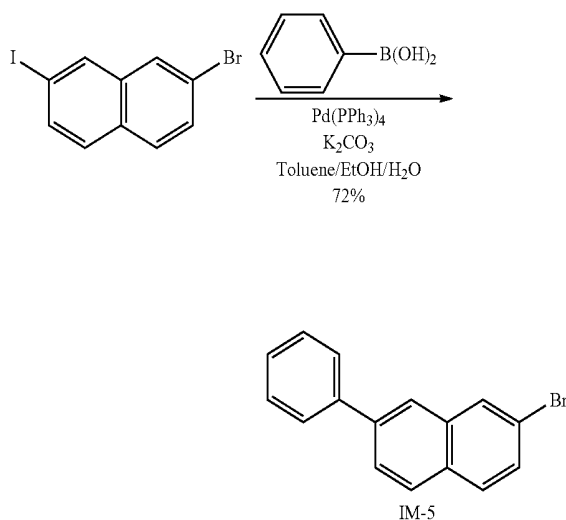
[0121] Under an Ar atmosphere, IM-2 (10.00 g, 31.8 mmol), Pd(dba)₂ (0.55 g, 0.03 equiv., 1.0 mmol), NaOtBu (3.05 g, 1.0 equiv., 31.8 mmol), toluene (159 mL), p-biphenylamine (5.91 g, 1.1 equiv., 34.9 mmol) and tBu₃P (0.64 g, 0.1 equiv., 3.2 mmol) were added in order to a 300 mL three-neck flask, and the mixture was stirred and heated to reflux. After cooling in air to room temperature, water was added to the reaction solvent and an organic layer was separated and taken. Toluene was added to the remaining aqueous layer, followed by extraction of the aqueous layer to obtain another organic layer. Organic layers were combined and washed with brine, and then dried over MgSO₄. MgSO₄ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Intermediate IM-4 (11.37 g, yield 80%). Intermediate IM-4 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass m/z=447.

[0122] (Synthesis of Compound A17)

[0123] Under an Ar atmosphere, IM-4 (8.00 g, 17.9 mmol), Pd(dba)₂ (0.31 g, 0.03 equiv., 0.5 mmol), NaOtBu (3.44 g, 2.0 equiv., 35.7 mmol), toluene (89 mL), 3-bromo-9-phenyl-9H-carbazole (6.33 g, 1.1 equiv., 19.7 mmol) and tBu₃P (0.36 g, 0.1 equiv., 1.8 mmol) were added in order to a 300 mL three-neck flask, and the mixture was stirred and heated to reflux. After cooling in air to room temperature, water was added to the reaction solvent and an organic layer was separated and taken. Toluene was added to the remaining aqueous layer, followed by extraction of the aqueous layer to obtain another organic layer. Organic layers were combined and washed with brine, and then dried over MgSO₄. MgSO₄ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Compound A17 (9.23 g, yield 75%). Compound A17 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass m/z=688.

[0124] 3. Synthesis of Compound B13

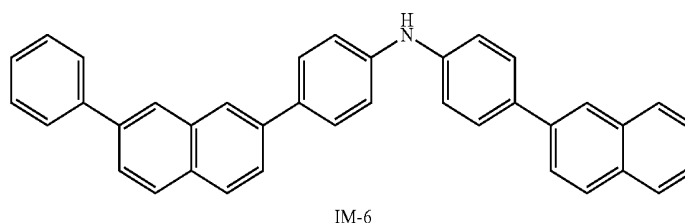
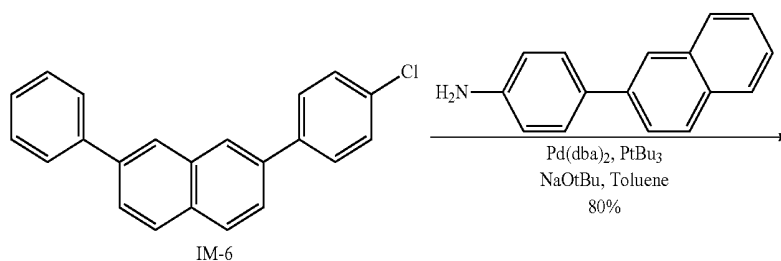
[0125] Compound B13, a monoamine compound according to an example embodiment may be synthesized, for example, as follows.

[0126] (Synthesis of Intermediate IM-5)

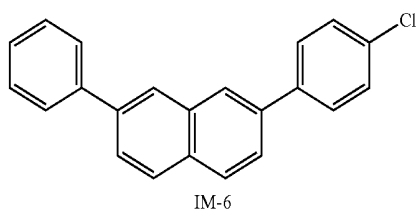
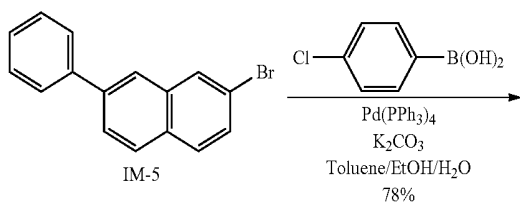
[0127] Under an Ar atmosphere, 7-bromo-2-iodonaphthalene (25.00 g, 75.1 mmol), phenylboronic acid (10.07 g, 1.1 equiv., 82.6 mmol), K_2CO_3 (31.13 g, 3.0 equiv., 225.2 mmol), $Pd(PPh_3)_4$ (4.34 g, 0.05 eq., 3.8 mmol), and a mixture solution of toluene/EtOH/H₂O (4/2/1) (525 mL) were added in order to an 1 L three-neck flask, and the mixture was stirred and heated at about 80° C. After cooling in air to room temperature, the reaction solution was extracted with toluene. After removing aqueous layer, organic layer was washed with saturated brine, and then dried over $MgSO_4$. $MgSO_4$ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Intermediate IM-5 (15.31 g, yield 72%). Intermediate IM-5 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass $m/z=283$.

[0129] Under an Ar atmosphere, IM-5 (13.00 g, 45.9 mmol), 4-chlorophenylboronic acid (7.90 g, 1.1 equiv., 50.5 mmol), K_2CO_3 (19.04 g, 3.0 equiv., 60.7 mmol), $Pd(PPh_3)_4$ (2.65 g, 0.05 eq., 2.3 mmol), and a mixture solution of toluene/EtOH/H₂O (4/2/1) (321 mL) were added in order to an 1 L three-neck flask, and the mixture was stirred and heated at about 80° C. After cooling in air to room temperature, the reaction solution was extracted with toluene. After removing aqueous layer, organic layer was washed with saturated brine, and then dried over $MgSO_4$. $MgSO_4$ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Intermediate IM-6 (11.27 g, yield 78%). Intermediate IM-6 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass $m/z=314$.

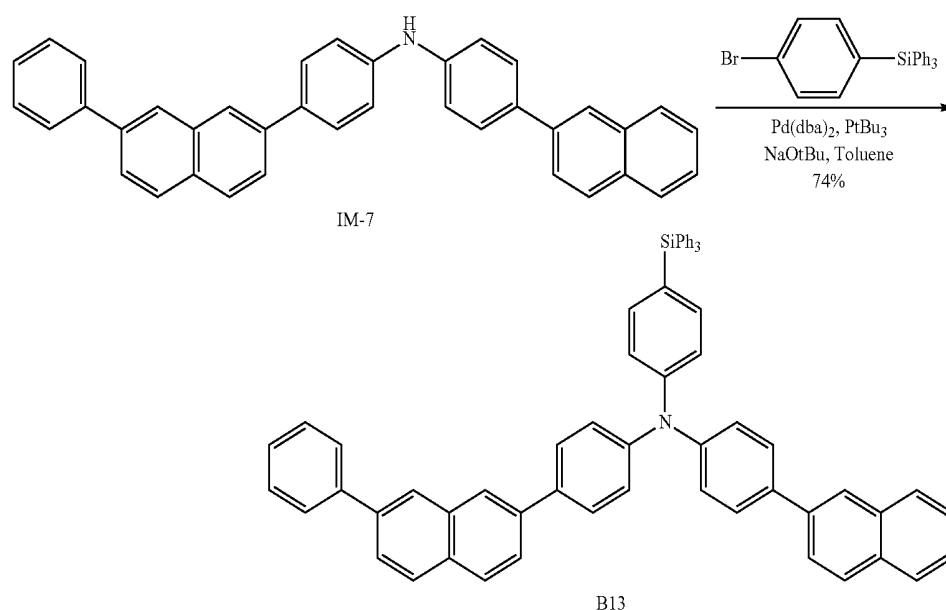
[0130] (Synthesis of Intermediate IM-7)



[0128] (Synthesis of Intermediate IM-6)



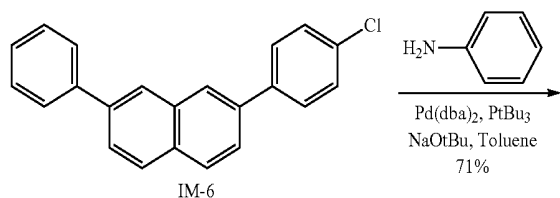
[0131] Under an Ar atmosphere, IM-6 (10.00 g, 31.8 mmol), $Pd(dba)_2$ (0.55 g, 0.03 equiv., 1.0 mmol), NaOtBu (3.05 g, 1.0 equiv., 31.8 mmol), toluene (159 mL), 4-(naphthalen-2-yl)aniline (7.66 g, 1.1 equiv., 34.9 mmol) and tBu_3P (0.64 g, 0.1 equiv., 3.2 mmol) were added in order to a 300 mL three-neck flask, and the mixture was stirred and heated to reflux. After cooling in air to room temperature, water was added to the reaction solvent and an organic layer was separated and taken. Toluene was added to the remaining aqueous layer, followed by extraction of the aqueous layer to obtain another organic layer. Organic layers were combined and washed with brine, and then dried over $MgSO_4$. $MgSO_4$ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Intermediate IM-7 (12.65 g, yield 80%). Intermediate IM-7 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass $m/z=497$.

[0132] (Synthesis of Compound B13)

[0133] Under an Ar atmosphere, IM-7 (8.00 g, 16.1 mmol), Pd(dba)₂ (0.27 g, 0.03 equiv., 0.5 mmol), NaOtBu (3.09 g, 2.0 equiv., 32.2 mmol), toluene (80 mL), 1-bromo-4-(trimethylsilyl)benzene (7.35 g, 1.1 equiv., 17.7 mmol) and tBu₃P (0.33 g, 0.1 equiv., 1.6 mmol) were added in order to a 300 mL three-neck flask, and the mixture was stirred and heated to reflux. After cooling in air to room temperature, water was added to the reaction solvent and an organic layer was separated and taken. Toluene was added to the remaining aqueous layer, followed by extraction of the aqueous layer to obtain another organic layer. Organic layers were combined and washed with brine, and then dried over MgSO₄. MgSO₄ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Compound B13 (9.90 g, yield 74%). Compound B13 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass $m/z=832$.

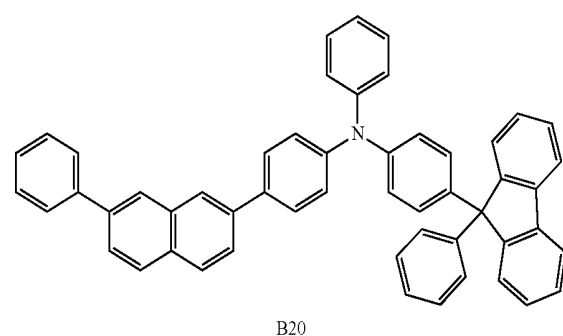
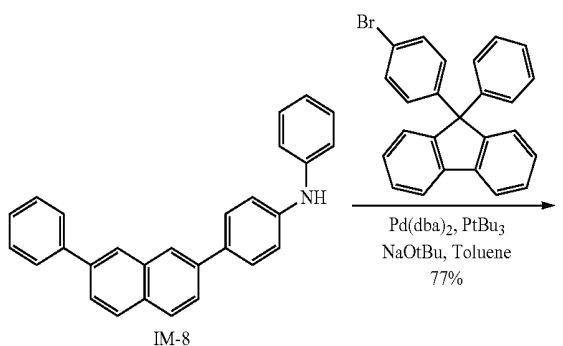
[0134] 4. Synthesis of Compound B20

[0135] Compound B20, a monoamine compound according to an example embodiment may be synthesized, for example, as follows.

[0136] (Synthesis of Intermediate IM-8)

-continued

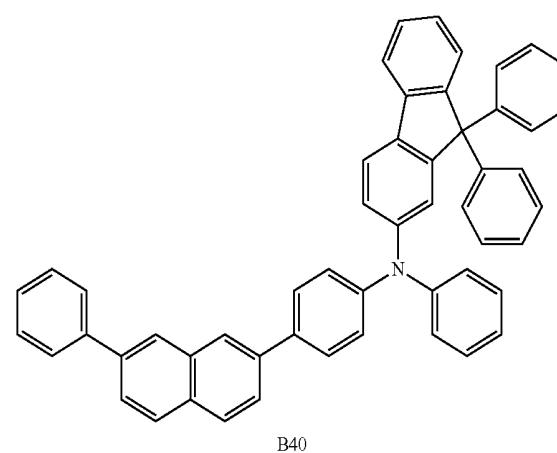
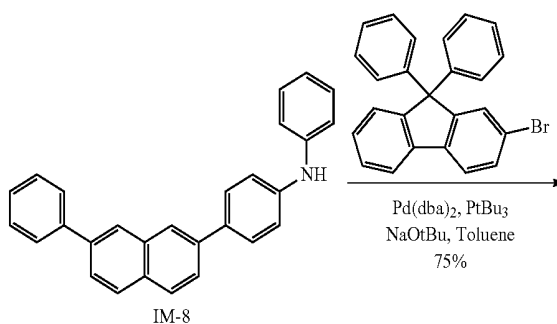
[0137] Under an Ar atmosphere, IM-6 (10.00 g, 31.8 mmol), Pd(dba)₂ (0.55 g, 0.03 equiv., 1.0 mmol), NaOtBu (3.05 g, 1.0 equiv., 31.8 mmol), toluene (159 mL), aniline (3.25 g, 1.1 equiv., 34.9 mmol) and tBu₃P (0.64 g, 0.1 equiv., 3.2 mmol) were added in order to a 300 mL three-neck flask, and the mixture was stirred and heated to reflux. After cooling in air to room temperature, water was added to the reaction solvent and an organic layer was separated and taken. Toluene was added to the remaining aqueous layer, followed by extraction of the aqueous layer to obtain another organic layer. Organic layers were combined and washed with brine, and then dried over MgSO₄. MgSO₄ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Intermediate IM-8 (8.38 g, yield 71%). Intermediate IM-8 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass $m/z=371$.

[0138] (Synthesis of Compound B20)

[0139] Under an Ar atmosphere, IM-8 (8.00 g, 21.5 mmol), Pd(dba)₂ (0.37 g, 0.03 equiv., 0.6 mmol), NaOtBu (4.14 g, 2.0 equiv., 43.1 mmol), toluene (108 mL), 9-(4-bromophenyl)-9-phenyl-9H-fluorene (9.41 g, 1.1 equiv., 23.7 mmol) and tBu₃P (0.44 g, 0.1 equiv., 2.1 mmol) were added in order to a 300 mL three-neck flask, and the mixture was stirred and heated to reflux. After cooling in air to room temperature, water was added to the reaction solvent and an organic layer was separated and taken. Toluene was added to the remaining aqueous layer, followed by extraction of the aqueous layer to obtain another organic layer. Organic layers were combined and washed with brine, and then dried over MgSO₄. MgSO₄ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Compound B20 (11.41 g, yield 77%). Compound B20 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass m/z=687.

[0140] 5. Synthesis of Compound B40

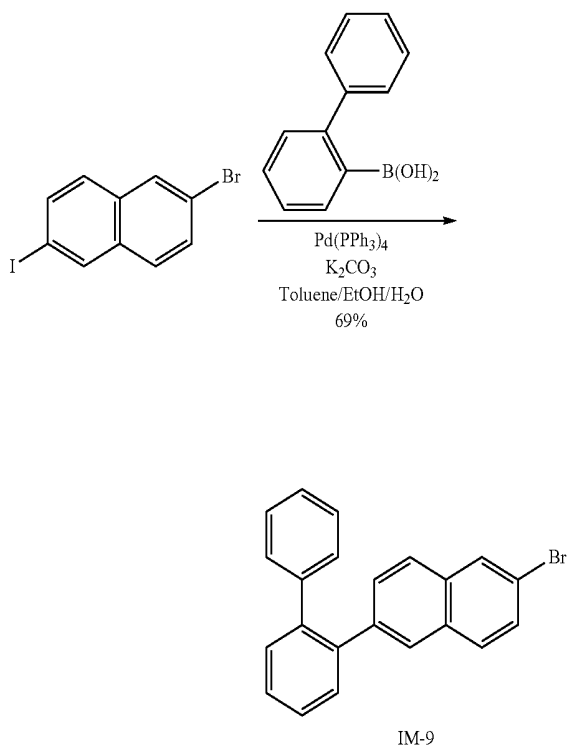
[0141] Compound B40, a monoamine compound according to an example embodiment may be synthesized, for example, as follows.

[0142] (Synthesis of Compound B40)

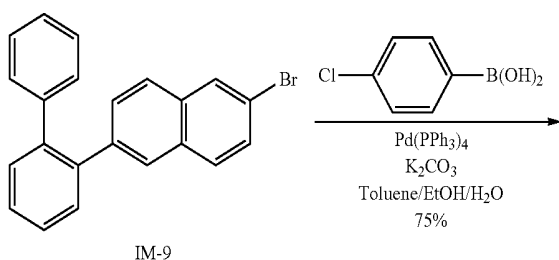
[0143] Under an Ar atmosphere, IM-8 (8.00 g, 21.5 mmol), Pd(dba)₂ (0.37 g, 0.03 equiv., 0.6 mmol), NaOtBu (4.14 g, 2.0 equiv., 43.1 mmol), toluene (108 mL), 2-bromo-9,9-diphenyl-9H-fluorene (9.41 g, 1.1 equiv., 23.7 mmol) and tBu₃P (0.44 g, 0.1 equiv., 2.1 mmol) were added in order to a 300 mL three-neck flask, and the mixture was stirred and heated to reflux. After cooling in air to room temperature, water was added to the reaction solvent and an organic layer was separated and taken. Toluene was added to the remaining aqueous layer, followed by extraction of the aqueous layer to obtain another organic layer. Organic layers were combined and washed with brine, and then dried over MgSO₄. MgSO₄ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Compound B40 (11.42 g, yield 75%). Compound B40 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass m/z=687.

[0144] 6. Synthesis of Compound C25

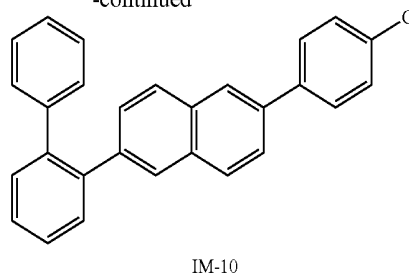
[0145] Compound C25, a monoamine compound according to an example embodiment may be synthesized, for example, as follows.

[0146] (Synthesis of Intermediate IM-9)

[0147] Under an Ar atmosphere, 2-bromo-6-iodonaphthalene (25.00 g, 75.1 mmol), 2-biphenylboronic acid (16.35 g, 1.1 equiv., 82.6 mmol), K_2CO_3 (31.13 g, 3.0 equiv., 225.2 mmol), $\text{Pd}(\text{PPh}_3)_4$ (4.34 g, 0.05 eq., 3.8 mmol), and a mixture solution of toluene/EtOH/ H_2O (4/2/1) (525 mL) were added in order to an 1 L three-neck flask, and the mixture was stirred and heated at about 80° C. After cooling in air to room temperature, the reaction solution was extracted with toluene. After removing aqueous layer, organic layer was washed with saturated brine, and then dried over MgSO_4 . MgSO_4 was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Intermediate IM-9 (18.61 g, yield 69%). Intermediate IM-9 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass $m/z=359$.

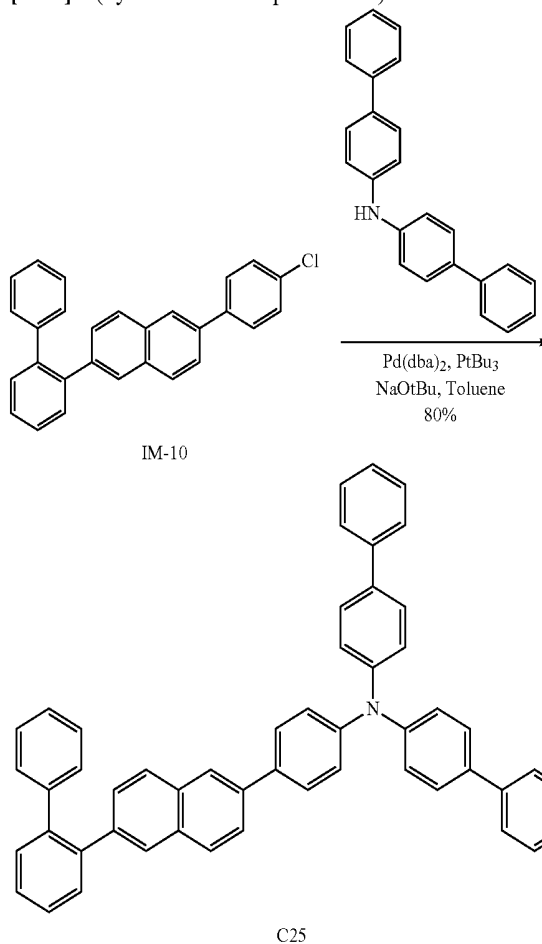
[0148] (Synthesis of Intermediate IM-10)

-continued



IM-10

[0149] Under an Ar atmosphere, IM-9 (15.00 g, 41.8 mmol), 4-chlorophenylboronic acid (7.18 g, 1.1 equiv., 45.9 mmol), K_2CO_3 (17.31 g, 3.0 equiv., 125.3 mmol), $\text{Pd}(\text{PPh}_3)_4$ (2.41 g, 0.05 eq., 3.8 mmol), and a mixture solution of toluene/EtOH/ H_2O (4/2/1) (525 mL) were added in order to an 1 L three-neck flask, and the mixture was stirred and heated at about 80° C. After cooling in air to room temperature, the reaction solution was extracted with toluene. After removing aqueous layer, organic layer was washed with saturated brine, and then dried over MgSO_4 . MgSO_4 was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Intermediate IM-10 (12.24 g, yield 75%). Intermediate IM-10 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass $m/z=390$.

[0150] (Synthesis of Compound C25)

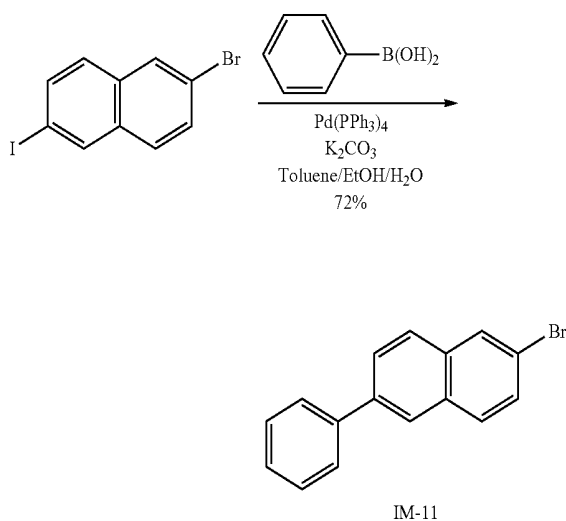
C25

[0151] Under an Ar atmosphere, IM-10 (10.00 g, 25.6 mmol), Pd(dba)₂ (0.44 g, 0.03 equiv., 0.6 mmol), NaOtBu (4.92 g, 2.0 equiv., 51.2 mmol), toluene (128 mL), bis(4-biphenyl)amine (9.04 g, 1.1 equiv., 28.1 mmol) and tBu₃P (0.52 g, 0.1 equiv., 2.6 mmol) were added in order to a 300 mL three-neck flask, and the mixture was stirred and heated to reflux. After cooling in air to room temperature, water was added to the reaction solvent and an organic layer was separated and taken. Toluene was added to the remaining aqueous layer, followed by extraction of the aqueous layer to obtain another organic layer. Organic layers were combined and washed with brine, and then dried over MgSO₄. MgSO₄ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Compound C25 (13.83 g, yield 80%). Compound C25 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass *m/z*=675.

[0152] 7. Synthesis of Compound C51

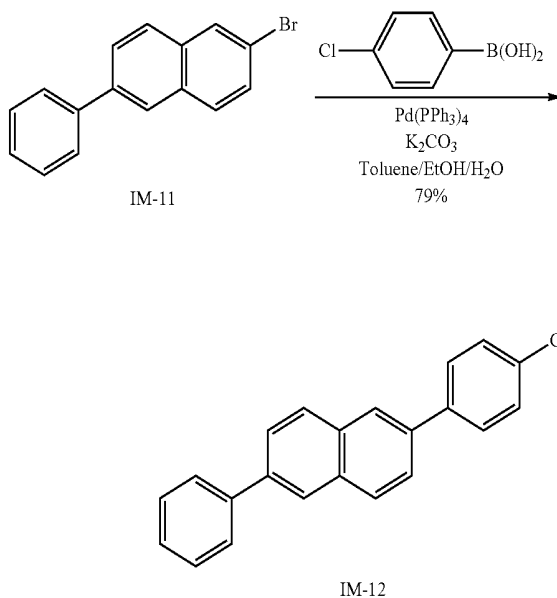
[0153] Compound C51, a monoamine compound according to an example embodiment may be synthesized, for example, as follows.

[0154] (Synthesis of Intermediate IM-11)



[0155] Under an Ar atmosphere, 2-bromo-6-iodonaphthalene (25.00 g, 75.1 mmol), phenylboronic acid (10.07 g, 1.1 equiv., 82.6 mmol), K₂CO₃ (31.13 g, 3.0 equiv., 225.2 mmol), Pd(PPh₃)₄ (4.34 g, 0.05 eq., 3.8 mmol), and a mixture solution of toluene/EtOH/H₂O (4/2/1) (525 mL) were added in order to an 1 L three-neck flask, and the mixture was stirred and heated at about 80° C. After cooling in air to room temperature, the reaction solution was extracted with toluene. After removing aqueous layer, organic layer was washed with saturated brine, and then dried over MgSO₄. MgSO₄ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Intermediate IM-11 (15.31 g, yield 72%). Intermediate IM-11 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass *m/z*=283.

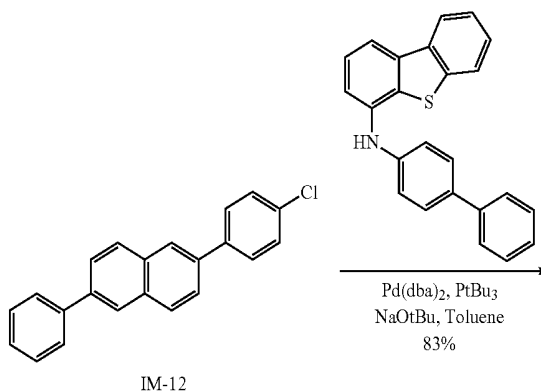
[0156] (Synthesis of Intermediate IM-12)



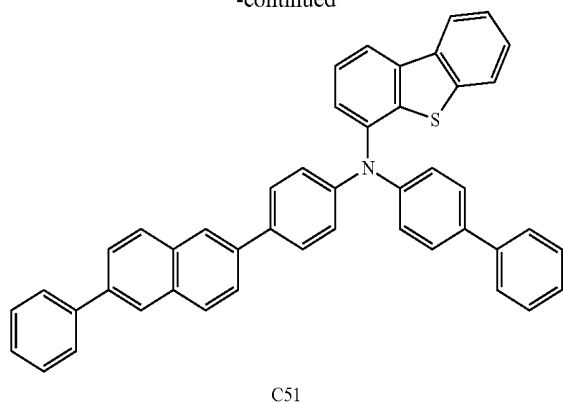
[0157] Under an Ar atmosphere, IM-11 (13.00 g, 45.9 mmol), 4-chlorophenylboronic acid (7.90 g, 1.1 equiv., 50.5 mmol), K₂CO₃ (19.04 g, 3.0 equiv., 60.7 mmol), Pd(PPh₃)₄ (2.65 g, 0.05 eq., 2.3 mmol), and a mixture solution of toluene/EtOH/H₂O (4/2/1) (321 mL) were added in order to an 1 L three-neck flask, and the mixture was stirred and heated at about 80° C. After cooling in air to room temperature, the reaction solution was extracted with toluene. After removing aqueous layer, organic layer was washed with saturated brine, and then dried over MgSO₄. MgSO₄ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Intermediate IM-12 (11.42 g, yield 79%).

[0158] Intermediate IM-12 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass *m/z*=314.

[0159] (Synthesis of Compound C51)



-continued

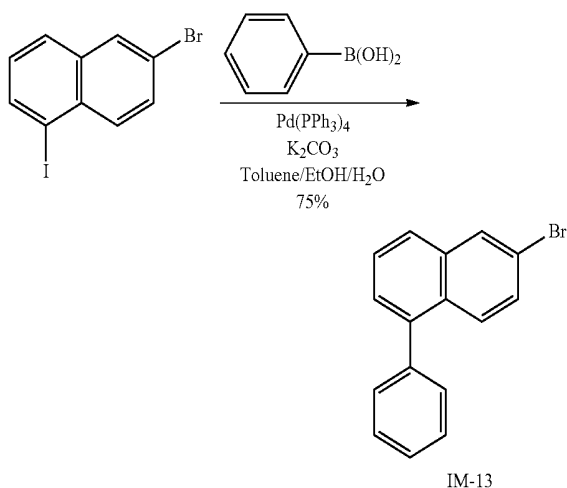


[0160] Under an Ar atmosphere, IM-12 (8.00 g, 25.4 mmol), Pd(dba)₂ (0.44 g, 0.03 equiv., 0.8 mmol), NaOtBu (4.88 g, 2.0 equiv., 50.8 mmol), toluene (128 mL), N-([1,1'-biphenyl]-4-yl)dibenzothiophen-4-amine (9.82 g, 1.1 equiv., 28.0 mmol) and tBu₃P (0.51 g, 0.1 equiv., 2.5 mmol) were added in order to a 300 mL three-neck flask, and the mixture was stirred and heated to reflux. After cooling in air to room temperature, water was added to the reaction solvent and an organic layer was separated and taken. Toluene was added to the remaining aqueous layer, followed by extraction of the aqueous layer to obtain another organic layer. Organic layers were combined and washed with brine, and then dried over MgSO₄. MgSO₄ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Compound C51 (13.28 g, yield 83%). Compound C51 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass m/z=629.

[0161] 8. Synthesis of Compound D12

[0162] Compound D12, a monoamine compound according to an example embodiment may be synthesized, for example, as follows.

[0163] (Synthesis of Intermediate IM-13)

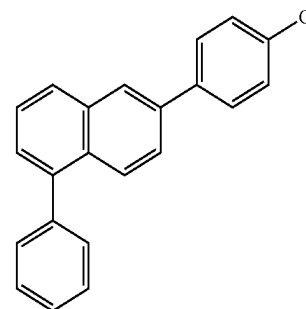
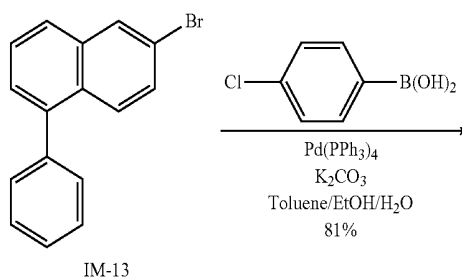


[0164] Under an Ar atmosphere, 2-bromo-5-iodonaphthalene (25.00 g, 75.1 mmol), phenylboronic acid (10.07 g, 1.1 equiv., 82.6 mmol), K₂CO₃ (31.13 g, 3.0 equiv., 225.2

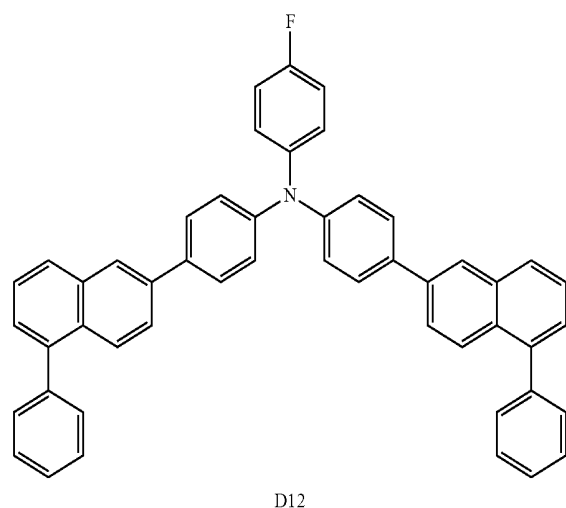
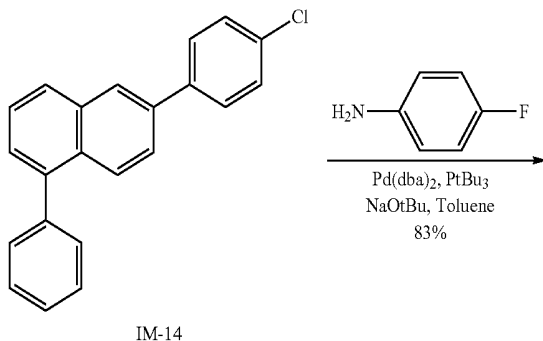
mmol), Pd(PPh₃)₄ (4.34 g, 0.05 eq., 3.8 mmol), and a mixture solution of toluene/EtOH/H₂O (4/2/1) (525 mL) were added in order to an 1 L three-neck flask, and the mixture was stirred and heated at about 80° C. After cooling in air to room temperature, the reaction solution was extracted with toluene. After removing aqueous layer, organic layer was washed with saturated brine, and then dried over MgSO₄. MgSO₄ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Intermediate IM-13 (15.95 g, yield 75%).

[0165] Intermediate IM-13 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass m/z=283.

[0166] (Synthesis of Intermediate IM-14)



[0167] Under an Ar atmosphere, IM-13 (13.00 g, 45.9 mmol), 4-chlorophenylboronic acid (7.90 g, 1.1 equiv., 50.5 mmol), K₂CO₃ (19.04 g, 3.0 equiv., 60.7 mmol), Pd(PPh₃)₄ (2.65 g, 0.05 eq., 2.3 mmol), and a mixture solution of toluene/EtOH/H₂O (4/2/1) (321 mL) were added in order to an 1 L three-neck flask, and the mixture was stirred and heated at about 80° C. After cooling in air to room temperature, the reaction solution was extracted with toluene. After removing aqueous layer, organic layer was washed with saturated brine, and then dried over MgSO₄. MgSO₄ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Intermediate IM-14 (11.71 g, yield 81%). Intermediate IM-14 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass m/z=314.

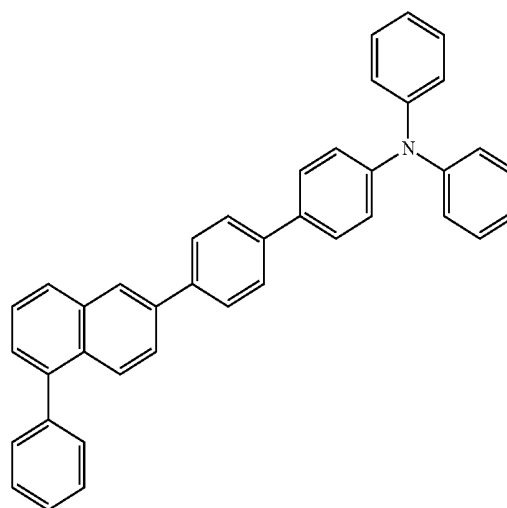
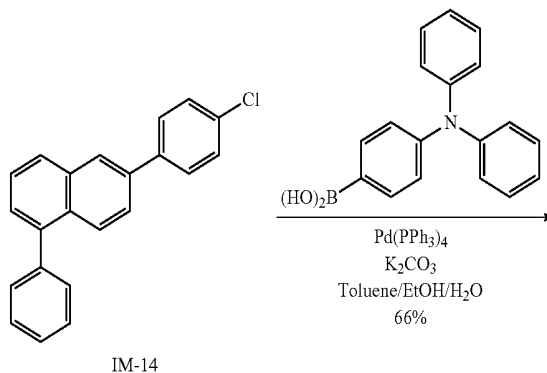
[0168] (Synthesis of Compound D12)

[0169] Under an Ar atmosphere, IM-14 (9.35 g, 2.2 equiv., 29.7 mmol), Pd(dba)₂ (0.23 g, 0.03 equiv., 0.4 mmol), NaOtBu (2.59 g, 2.0 equiv., 27.0 mmol), toluene (67 mL), 4-fluoroaniline (1.5 g, 13.5 mmol) and tBu₃P (0.27 g, 0.1 equiv., 1.3 mmol) were added in order to a 300 mL three-neck flask, and the mixture was stirred and heated to reflux. After cooling in air to room temperature, water was added to the reaction solvent and an organic layer was separated and taken. Toluene was added to the remaining aqueous layer, followed by extraction of the aqueous layer to obtain another organic layer. Organic layers were combined and washed with brine, and then dried over MgSO₄. MgSO₄ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Compound D12 (7.48 g, yield 83%).

[0170] Compound D12 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass $m/z=667$.

[0171] 9. Synthesis of Compound D22

[0172] Compound D22, a monoamine compound according to an example embodiment may be synthesized, for example, as follows.

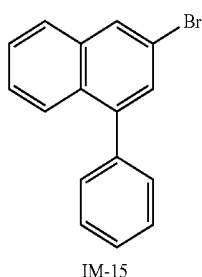
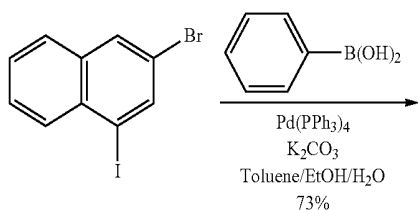
[0173] (Synthesis of Compound D22)

[0174] Under an Ar atmosphere, IM-14 (10.00 g, 31.8 mmol), (4-(diphenylamino)phenyl)boronic acid (10.10 g, 1.1 equiv., 34.9 mmol), K₂CO₃ (13.17 g, 3.0 equiv., 95.3 mmol), Pd(PPh₃)₄ (1.84 g, 0.05 eq., 1.6 mmol), and a mixture solution of toluene/EtOH/H₂O (4/2/1) (222 mL) were added in order to a 1 L three-neck flask, and the mixture was stirred and heated at about 80° C. After cooling in air to room temperature, the reaction solution was extracted with toluene. After removing aqueous layer, organic layer was washed with saturated brine, and then dried over MgSO₄. MgSO₄ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Compound D22 (10.98 g, yield 66%).

[0175] Compound D22 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass $m/z=523$.

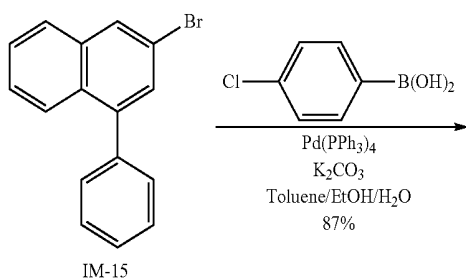
[0176] 10. Synthesis of Compound E3

[0177] Compound E3, a monoamine compound according to an example embodiment may be synthesized, for example, as follows.

[0178] (Synthesis of Intermediate IM-15)

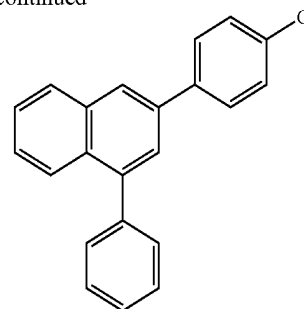
[0179] Under an Ar atmosphere, 3-bromo-1-iodonaphthalene (25.00 g, 75.1 mmol), phenylboronic acid (10.07 g, 1.1 equiv., 82.6 mmol), K₂CO₃ (31.13 g, 3.0 equiv., 225.2 mmol), Pd(PPh₃)₄ (4.34 g, 0.05 eq., 3.8 mmol), and a mixture solution of toluene/EtOH/H₂O (4/2/1) (525 mL) were added in order to an 1 L three-neck flask, and the mixture was stirred and heated at about 80° C. After cooling in air to room temperature, the reaction solution was extracted with toluene. After removing aqueous layer, organic layer was washed with saturated brine, and then dried over MgSO₄. MgSO₄ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Intermediate IM-15 (15.52 g, yield 73%).

[0180] Intermediate IM-15 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass m/z=283.

[0181] (Synthesis of Intermediate IM-16)

IM-15

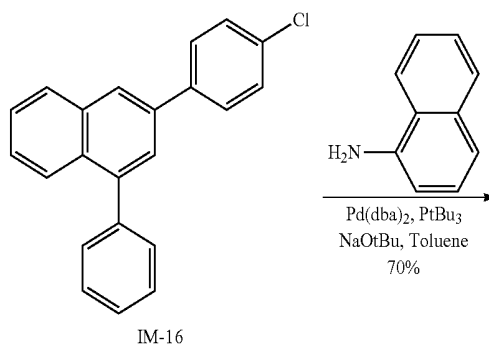
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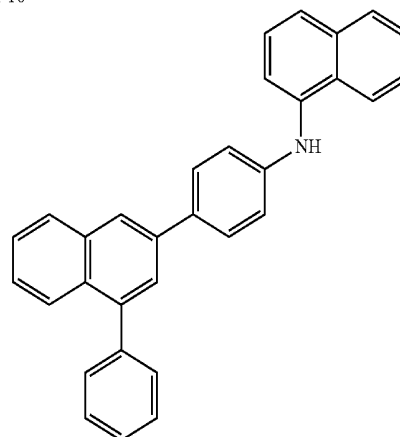
IM-16

[0182] Under an Ar atmosphere, IM-15 (13.00 g, 45.9 mmol), 4-chlorophenylboronic acid (7.90 g, 1.1 equiv., 50.5 mmol), K₂CO₃ (19.04 g, 3.0 equiv., 60.7 mmol), Pd(PPh₃)₄ (2.65 g, 0.05 eq., 2.3 mmol), and a mixture solution of toluene/EtOH/H₂O (4/2/1) (321 mL) were added in order to an 1 L three-neck flask, and the mixture was stirred and heated at about 80° C. After cooling in air to room temperature, the reaction solution was extracted with toluene. After removing aqueous layer, organic layer was washed with saturated brine, and then dried over MgSO₄. MgSO₄ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Intermediate IM-16 (12.57 g, yield 87%).

[0183] Intermediate IM-16 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass m/z=314.

[0184] (Synthesis of Intermediate IM-17)

IM-16

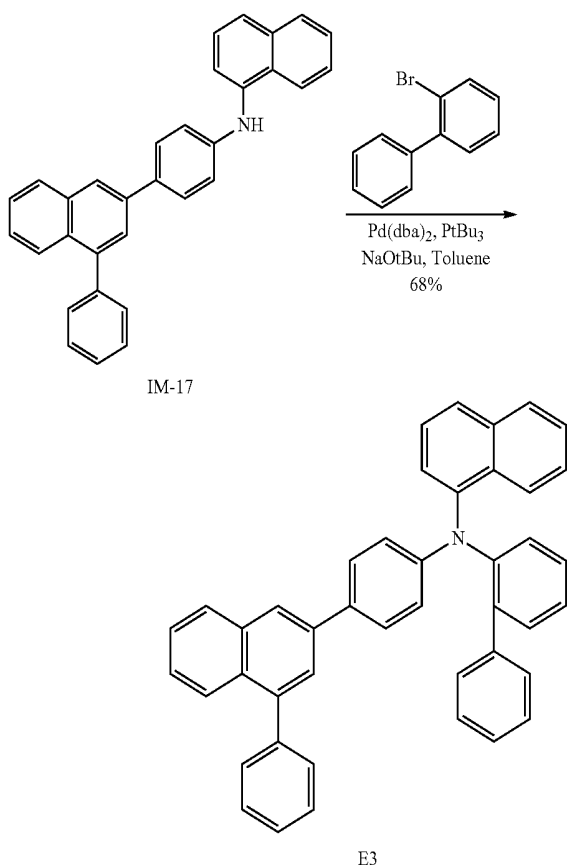


IM-17

[0185] Under an Ar atmosphere, IM-16 (10.00 g, 31.8 mmol), Pd(dba)₂ (0.55 g, 0.03 equiv., 1.0 mmol), NaOtBu (3.05 g, 1.0 equiv., 31.8 mmol), toluene (159 mL), 1-naphthylamine (5.00 g, 1.1 equiv., 34.9 mmol) and tBu₃P (0.64 g, 0.1 equiv., 3.2 mmol) were added in order to a 300 mL three-neck flask, and the mixture was stirred and heated to reflux. After cooling in air to room temperature, water was added to the reaction solvent and an organic layer was separated and taken. Toluene was added to the remaining aqueous layer, followed by extraction of the aqueous layer to obtain another organic layer. Organic layers were combined and washed with brine, and then dried over MgSO₄. MgSO₄ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Intermediate IM-17 (9.37 g, yield 70%).

[0186] Intermediate IM-17 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass m/z=421.

[0187] (Synthesis of Compound E3)



[0188] Under an Ar atmosphere, IM-17 (8.00 g, 19.0 mmol), Pd(dba)₂ (0.33 g, 0.03 equiv., 0.6 mmol), NaOtBu (3.65 g, 2.0 equiv., 38.0 mmol), toluene (95 mL), 2-bromobiphenyl (4.87 g, 1.1 equiv., 20.9 mmol) and tBu₃P (0.39 g, 0.1 equiv., 1.9 mmol) were added in order to a 300 mL three-neck flask, and the mixture was stirred and heated to reflux. After cooling in air to room temperature, water was added to the reaction solvent and an organic layer was separated and taken. Toluene was added to the remaining

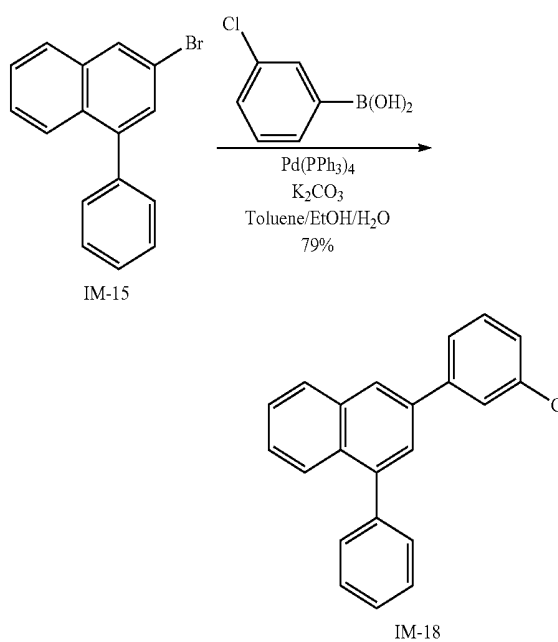
aqueous layer, followed by extraction of the aqueous layer to obtain another organic layer. Organic layers were combined and washed with brine, and then dried over MgSO₄. MgSO₄ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Compound E3 (7.40 g, yield 68%).

[0189] Compound E3 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass m/z=573.

[0190] 11. Synthesis of Compound E32

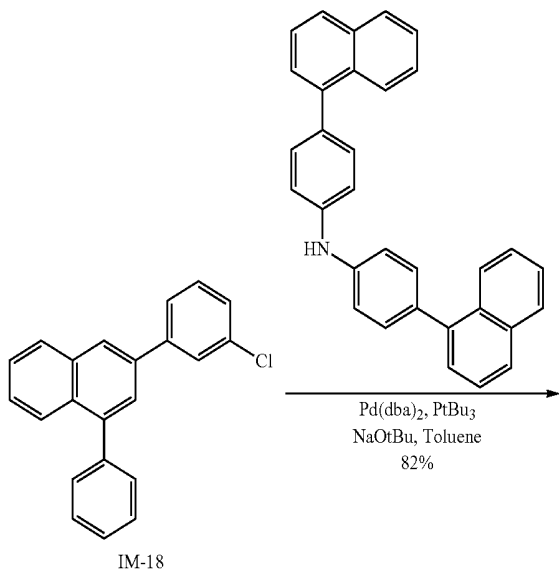
[0191] Compound E32, a monoamine compound according to an example embodiment may be synthesized, for example, as follows.

[0192] (Synthesis of Intermediate IM-18)



[0193] Under an Ar atmosphere, IM-15 (13.00 g, 45.9 mmol), 3-chlorophenylboronic acid (7.90 g, 1.1 equiv., 50.5 mmol), K₂CO₃ (19.04 g, 3.0 equiv., 60.7 mmol), Pd(PPh₃)₄ (2.65 g, 0.05 eq., 2.3 mmol), and a mixture solution of toluene/EtOH/H₂O (4/2/1) (321 mL) were added in order to an 1 L three-neck flask, and the mixture was stirred and heated at about 80° C. After cooling in air to room temperature, the reaction solution was extracted with toluene. After removing aqueous layer, organic layer was washed with saturated brine, and then dried over MgSO₄. MgSO₄ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Intermediate IM-18 (11.42 g, yield 79%).

[0194] Intermediate IM-18 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass m/z=314.

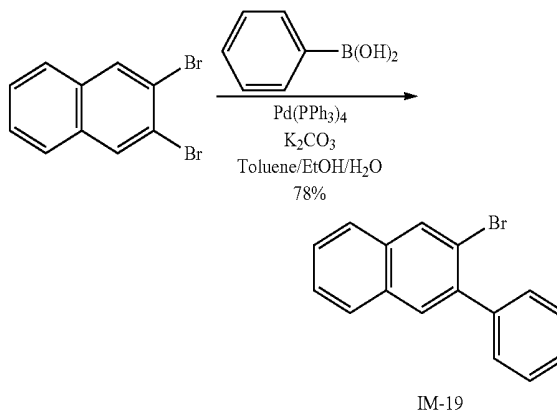
[0195] (Synthesis of Compound E32)

[0196] Under an Ar atmosphere, IM-18 (10.00 g, 31.8 mmol), Pd(dba)₂ (0.55 g, 0.03 equiv., 1.0 mmol), NaOtBu (6.11 g, 2.0 equiv., 63.5 mmol), toluene (158 mL), bis(4-(naphthalen-1-yl)phenyl)amine (14.73 g, 1.1 equiv., 34.9 mmol) and tBu₃P (0.64 g, 0.1 equiv., 3.2 mmol) were added in order to a 300 mL three-neck flask, and the mixture was stirred and heated to reflux. After cooling in air to room temperature, water was added to the reaction solvent and an organic layer was separated and taken. Toluene was added to the remaining aqueous layer, followed by extraction of the aqueous layer to obtain another organic layer. Organic layers were combined and washed with brine, and then dried over MgSO₄. MgSO₄ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Compound E32 (18.23 g, yield 82%).

[0197] Compound E32 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass $m/z=699$.

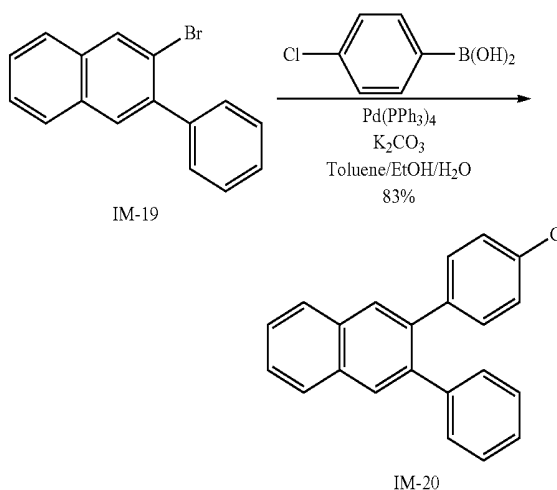
[0198] 12. Synthesis of Compound F46

[0199] Compound F46, a monoamine compound according to an example embodiment may be synthesized, for example, as follows.

[0200] (Synthesis of Intermediate IM-19)

[0201] Under an Ar atmosphere, 2,3-dibromonaphthalene (25.00 g, 87.4 mmol), phenylboronic acid (11.73 g, 1.1 equiv., 96.2 mmol), K₂CO₃ (36.2 g, 3.0 equiv., 262.3 mmol), Pd(PPh₃)₄ (5.05 g, 0.05 eq., 3.4 mmol), and a mixture solution of toluene/EtOH/H₂O (4/2/1) (612 mL) were added in order to an 1 L three-neck flask, and the mixture was stirred and heated at about 80° C. After cooling in air to room temperature, the reaction solution was extracted with toluene. After removing aqueous layer, organic layer was washed with saturated brine, and then dried over MgSO₄. MgSO₄ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Intermediate IM-19 (19.31 g, yield 78%).

[0202] Intermediate IM-19 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass $m/z=283$.

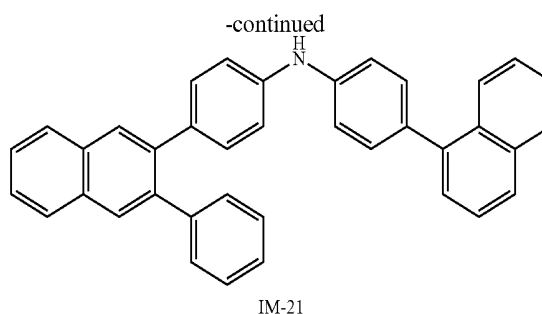
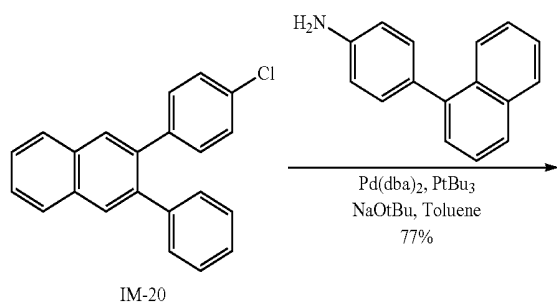
[0203] (Synthesis of Intermediate IM-20)

[0204] Under an Ar atmosphere, IM-19 (13.00 g, 45.9 mmol), 4-chlorophenylboronic acid (7.90 g, 1.1 equiv., 50.5 mmol), K₂CO₃ (19.04 g, 3.0 equiv., 60.7 mmol), Pd(PPh₃)₄

(2.65 g, 0.05 eq., 2.3 mmol), and a mixture solution of toluene/EtOH/H₂O (4/2/1) (321 mL) were added in order to an 1 L three-neck flask, and the mixture was stirred and heated at about 80° C. After cooling in air to room temperature, the reaction solution was extracted with toluene. After removing aqueous layer, organic layer was washed with saturated brine, and then dried over MgSO₄. MgSO₄ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Intermediate IM-20 (12.00 g, yield 83%).

[0205] Intermediate IM-20 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass $m/z=314$.

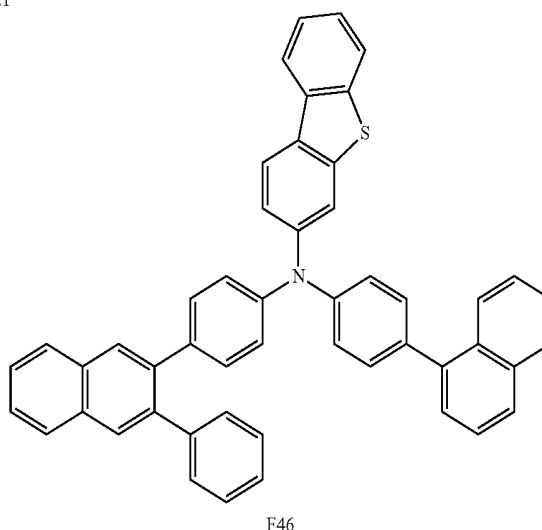
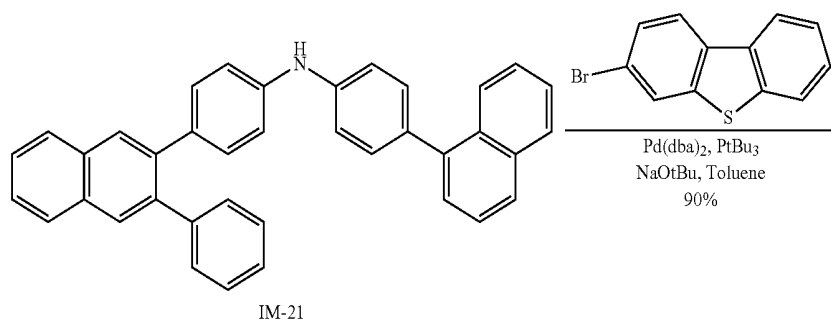
[0206] (Synthesis of Intermediate IM-21)



[0207] Under an Ar atmosphere, IM-20 (10.00 g, 31.8 mmol), Pd(dba)₂ (0.55 g, 0.03 equiv., 1.0 mmol), NaOtBu (3.05 g, 1.0 equiv., 31.8 mmol), toluene (159 mL), 4-(naphthalen-1-yl)aniline (7.66 g, 1.1 equiv., 34.9 mmol) and tBu₃P (0.64 g, 0.1 equiv., 3.2 mmol) were added in order to a 300 mL three-neck flask, and the mixture was stirred and heated to reflux. After cooling in air to room temperature, water was added to the reaction solvent and an organic layer was separated and taken. Toluene was added to the remaining aqueous layer, followed by extraction of the aqueous layer to obtain another organic layer. Organic layers were combined and washed with brine, and then dried over MgSO₄. MgSO₄ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Intermediate IM-21 (10.31 g, yield 77%).

[0208] Intermediate IM-21 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass $m/z=421$.

[0209] (Synthesis of Compound F46)



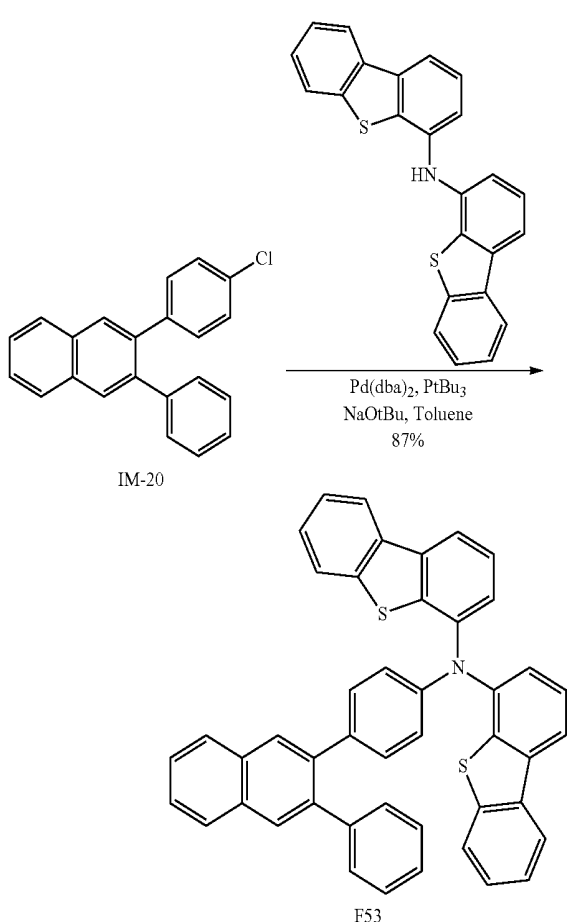
[0210] Under an Ar atmosphere, IM-21 (8.00 g, 19.0 mmol), Pd(dba)₂ (0.33 g, 0.03 equiv., 0.6 mmol), NaOtBu (3.65 g, 2.0 equiv., 38.0 mmol), toluene (95 mL), 3-bromo-dibenzothiophen (5.49 g, 1.1 equiv., 20.9 mmol) and tBu₃P (0.39 g, 0.1 equiv., 1.9 mmol) were added in order to a 300 mL three-neck flask, and the mixture was stirred and heated to reflux. After cooling in air to room temperature, water was added to the reaction solvent and an organic layer was separated and taken. Toluene was added to the remaining aqueous layer, followed by extraction of the aqueous layer to obtain another organic layer. Organic layers were combined and washed with brine, and then dried over MgSO₄. MgSO₄ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Compound F46 (11.61 g, yield 90%).

[0211] Compound F46 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass m/z=679.

[0212] 13. Synthesis of Compound F53

[0213] Compound F53, a monoamine compound according to an example embodiment may be synthesized, for example, as follows.

[0214] (Synthesis of Compound F53)



[0215] Under an Ar atmosphere, IM-20 (8.00 g, 23.4 mmol), Pd(dba)₂ (0.40 g, 0.03 equiv., 0.7 mmol), NaOtBu (4.50 g, 2.0 equiv., 46.8 mmol), toluene (117 mL), bis (dibenzothiophen-4-yl)amine (9.82 g, 1.1 equiv., 25.7

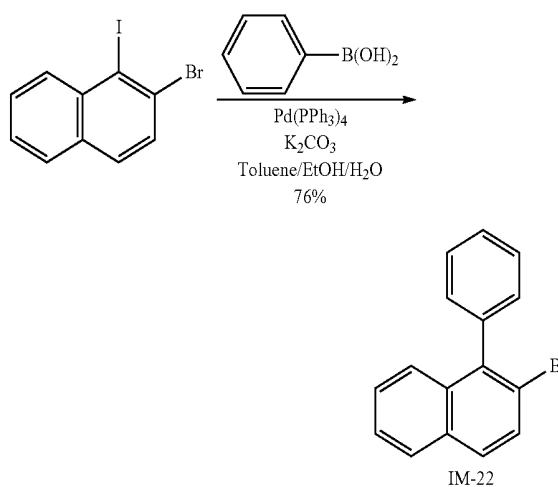
mmol) and tBu₃P (0.47 g, 0.1 equiv., 2.3 mmol) were added in order to a 300 mL three-neck flask, and the mixture was stirred and heated to reflux. After cooling in air to room temperature, water was added to the reaction solvent and an organic layer was separated and taken. Toluene was added to the remaining aqueous layer, followed by extraction of the aqueous layer to obtain another organic layer. Organic layers were combined and washed with brine, and then dried over MgSO₄. MgSO₄ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Compound F53 (13.44 g, yield 87%).

[0216] Compound F53 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass m/z=659.

[0217] 14. Synthesis of Compound G54

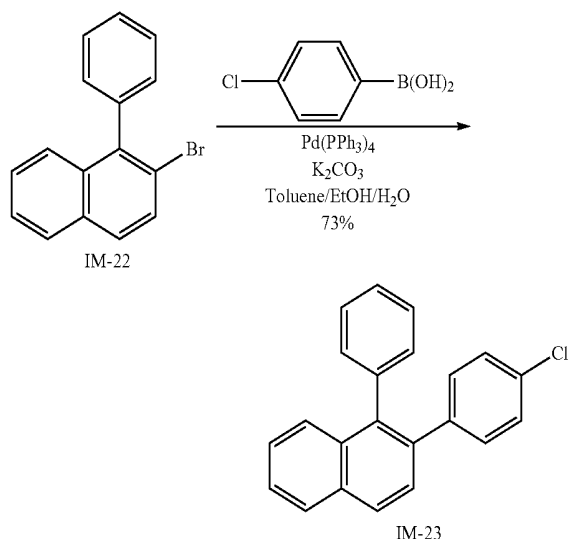
[0218] Compound G54, a monoamine compound according to an example embodiment may be synthesized, for example, as follows.

[0219] (Synthesis of Intermediate IM-22)



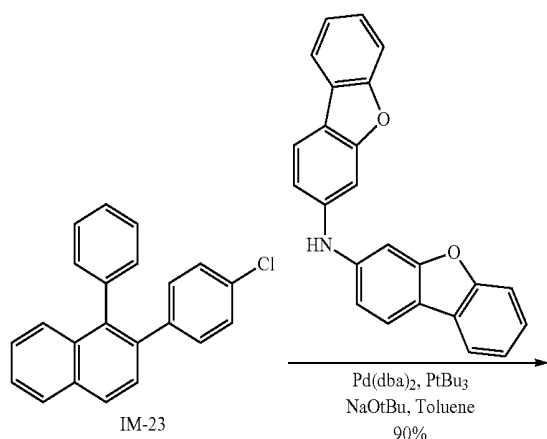
[0220] Under an Ar atmosphere, 2-bromo-1-iodo-naphthalene (25.00 g, 75.1 mmol), phenylboronic acid (10.07 g, 1.1 equiv., 82.6 mmol), K₂CO₃ (31.1 g, 3.0 equiv., 225.2 mmol), Pd(PPh₃)₄ (4.34 g, 0.05 eq., 3.8 mmol), and a mixture solution of toluene/EtOH/H₂O (4/2/1) (525 mL) were added in order to an 1 L three-neck flask, and the mixture was stirred and heated at about 80° C. After cooling in air to room temperature, the reaction solution was extracted with toluene. After removing aqueous layer, organic layer was washed with saturated brine, and then dried over MgSO₄. MgSO₄ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Intermediate IM-22 (16.16 g, yield 76%).

[0221] Intermediate IM-22 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass m/z=283.

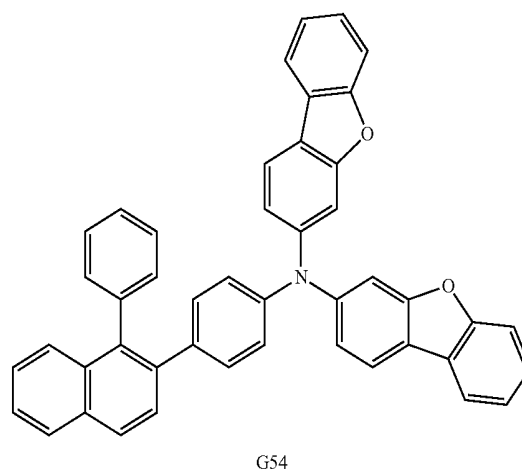
[0222] (Synthesis of Intermediate IM-23)

[0223] Under an Ar atmosphere, IM-22 (13.00 g, 45.9 mmol), 4-chlorophenylboronic acid (7.90 g, 1.1 equiv., 50.5 mmol), K_2CO_3 (19.04 g, 3.0 equiv., 60.7 mmol), $\text{Pd(PPh}_3)_4$ (2.65 g, 0.05 eq., 2.3 mmol), and a mixture solution of toluene/EtOH/ H_2O (4/2/1) (321 mL) were added in order to an 1 L three-neck flask, and the mixture was stirred and heated at about 80° C. After cooling in air to room temperature, the reaction solution was extracted with toluene. After removing aqueous layer, organic layer was washed with saturated brine, and then dried over MgSO_4 . MgSO_4 was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Intermediate IM-23 (10.55 g, yield 73%).

[0224] Intermediate IM-23 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass $m/z=314$.

[0225] (Synthesis of Compound G54)

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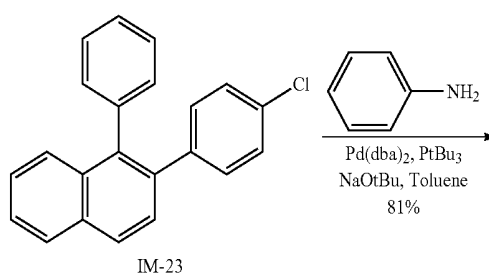


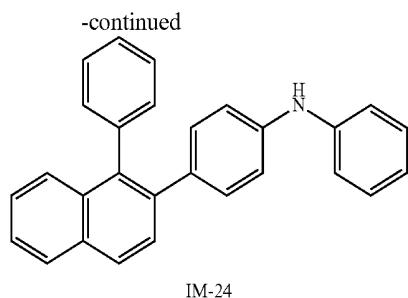
[0226] Under an Ar atmosphere, IM-23 (8.00 g, 25.4 mmol), Pd(dba)_2 (0.44 g, 0.03 equiv., 0.8 mmol), NaOtBu (4.88 g, 2.0 equiv., 50.8 mmol), toluene (127 mL), bis(dibenzofuran-3-yl)amine (9.77 g, 1.1 equiv., 28.0 mmol) and tBu_3P (0.51 g, 0.1 equiv., 2.5 mmol) were added in order to a 300 mL three-neck flask, and the mixture was stirred and heated to reflux. After cooling in air to room temperature, water was added to the reaction solvent and an organic layer was separated and taken. Toluene was added to the remaining aqueous layer, followed by extraction of the aqueous layer to obtain another organic layer. Organic layers were combined and washed with brine, and then dried over MgSO_4 . MgSO_4 was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Compound G54 (14.4 g, yield 90%).

[0227] Compound G54 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass $m/z=627$.

[0228] 15. Synthesis of Compound G58

[0229] Compound G58, a monoamine compound according to an example embodiment may be synthesized, for example, as follows.

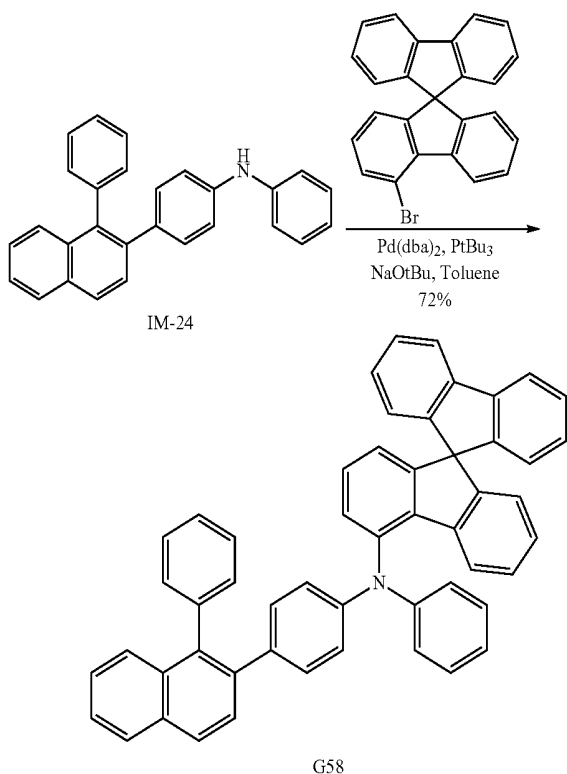
[0230] (Synthesis of Intermediate IM-24)



[0231] Under an Ar atmosphere, IM-23 (10.00 g, 31.8 mmol), Pd(dba)₂ (0.55 g, 0.03 equiv., 1.0 mmol), NaOtBu (3.05 g, 1.0 equiv., 31.8 mmol), toluene (159 mL), aniline (3.25 g, 1.1 equiv., 34.9 mmol) and tBu₃P (0.64 g, 0.1 equiv., 3.2 mmol) were added in order to a 300 mL three-neck flask, and the mixture was stirred and heated to reflux. After cooling in air to room temperature, water was added to the reaction solvent and an organic layer was separated and taken. Toluene was added to the remaining aqueous layer, followed by extraction of the aqueous layer to obtain another organic layer. Organic layers were combined and washed with brine, and then dried over MgSO₄. MgSO₄ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Intermediate IM-24 (9.56 g, yield 81%).

[0232] Intermediate IM-24 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass m/z=371.

[0233] (Synthesis of Compound G58)



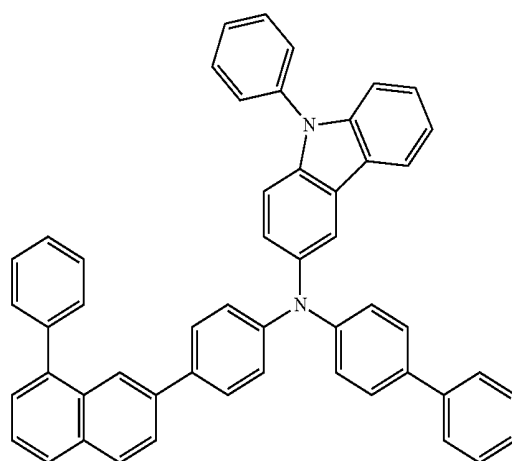
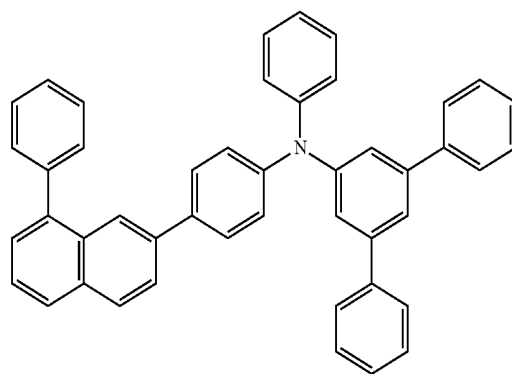
[0234] Under an Ar atmosphere, IM-24 (8.00 g, 21.5 mmol), Pd(dba)₂ (0.37 g, 0.03 equiv., 0.6 mmol), NaOtBu (4.14 g, 2.0 equiv., 43.1 mmol), toluene (108 mL), 4-bromo-9,9'-spirobifluorene (9.36 g, 1.1 equiv., 23.7 mmol) and tBu₃P (0.44 g, 0.1 equiv., 2.2 mmol) were added in order to a 300 mL three-neck flask, and the mixture was stirred and heated to reflux. After cooling in air to room temperature, water was added to the reaction solvent and an organic layer was separated and taken. Toluene was added to the remaining aqueous layer, followed by extraction of the aqueous layer to obtain another organic layer. Organic layers were combined and washed with brine, and then dried over MgSO₄. MgSO₄ was filtered out and organic layer was concentrated. The crude product thus obtained was purified by silica gel column chromatography (using a mixture of hexane and toluene as developing solvent) to obtain Compound G58 (10.63 g, yield 72%).

[0235] Compound G58 was identified by measuring FAB-MS in which a molecular ion peak was observed at mass m/z=685.

[0236] (Device Manufacturing Example)

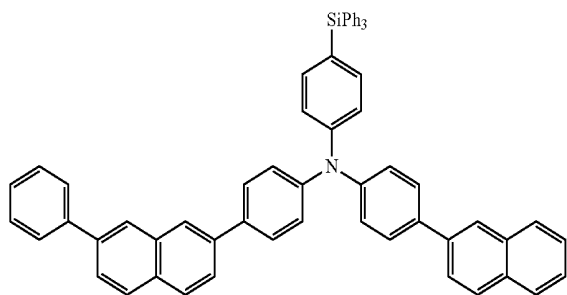
[0237] Organic electroluminescence devices of Examples 1 to 15 were manufactured by using the above Compounds A4, A17, B13, B20, B40, C25, C51, D12, D22, E3, E32, F46, F53, G54, and G58 as an electron blocking material.

[0238] [Example Compounds]

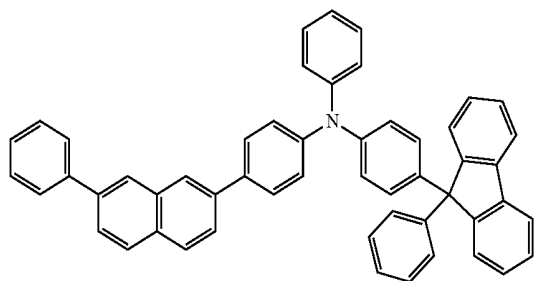


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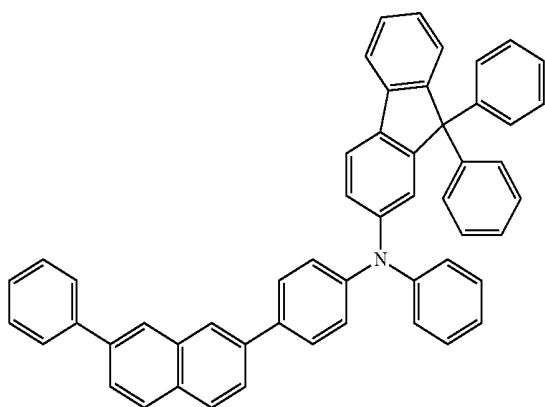
B13



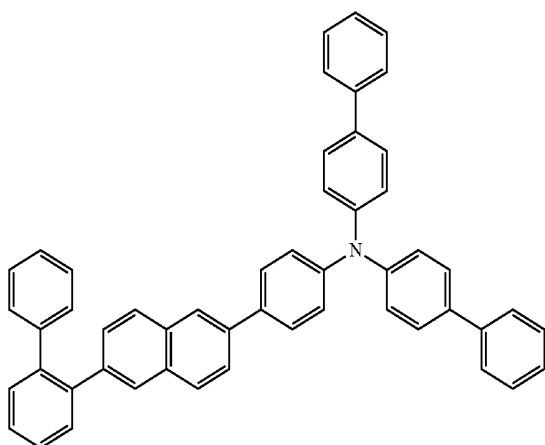
B20



B40

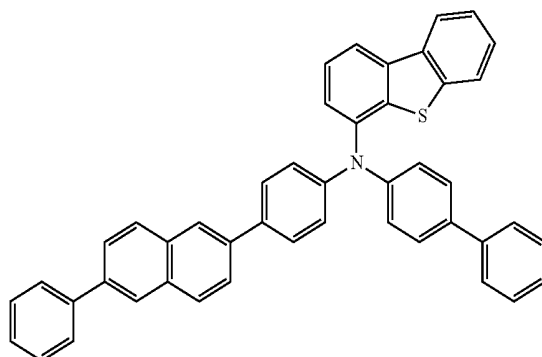


C25

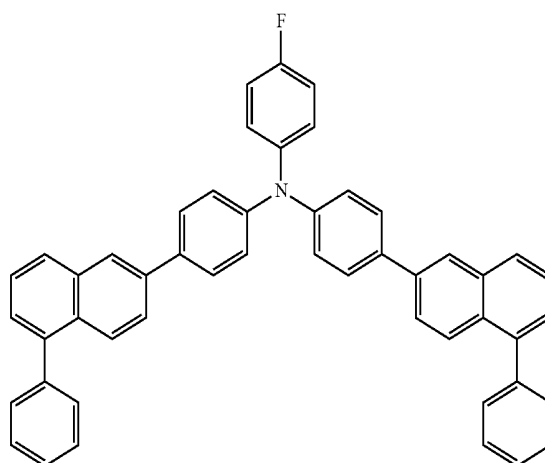


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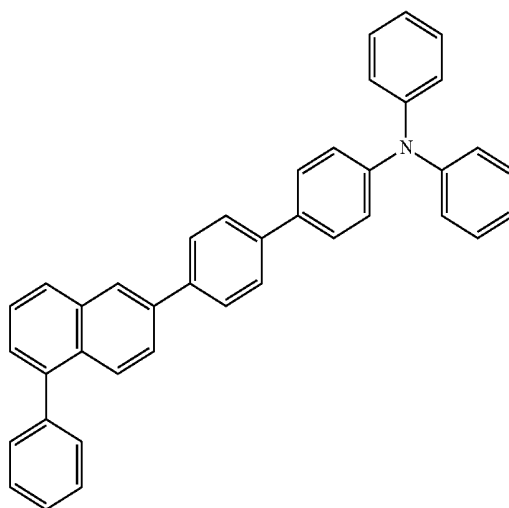
C51



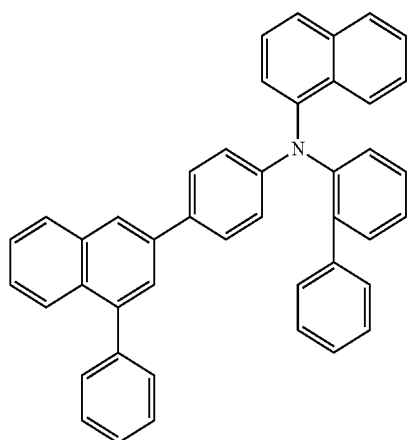
D12



D22

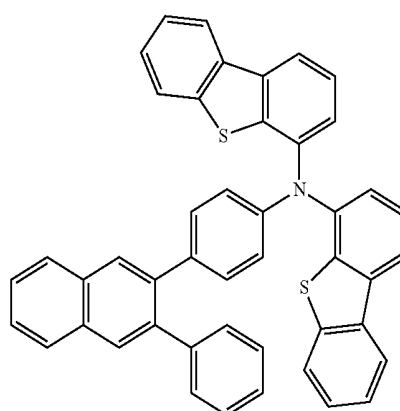


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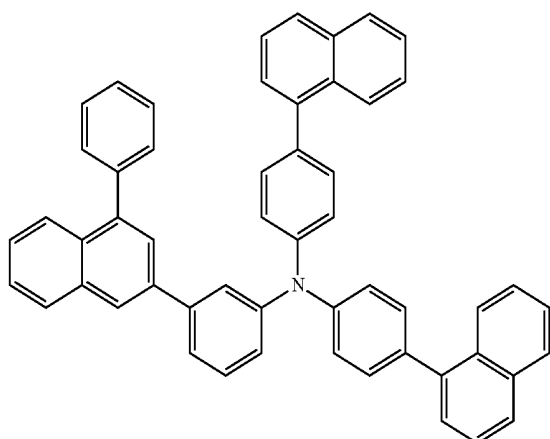
E3

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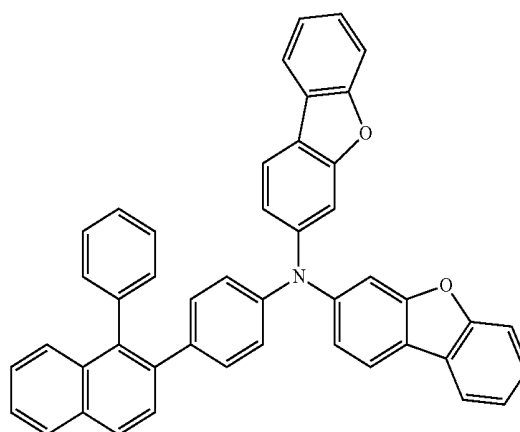


F53

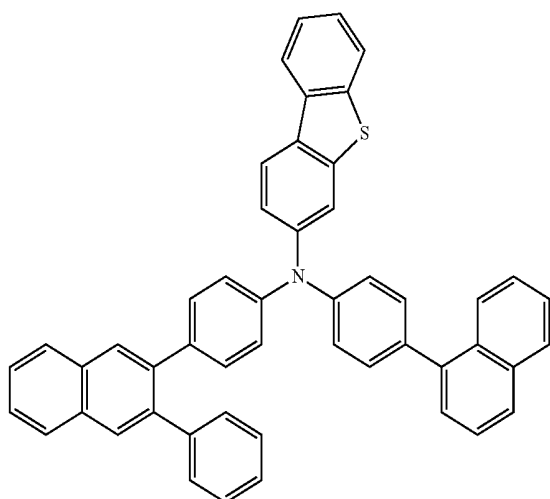
E32



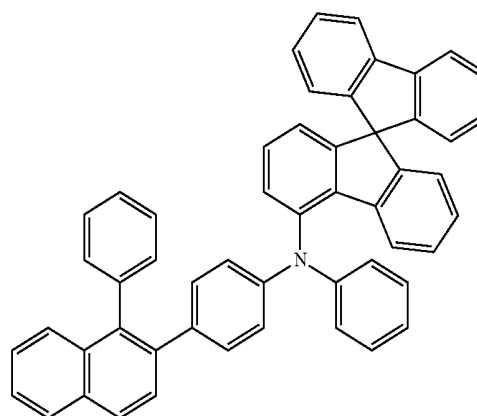
G54



F46



G58



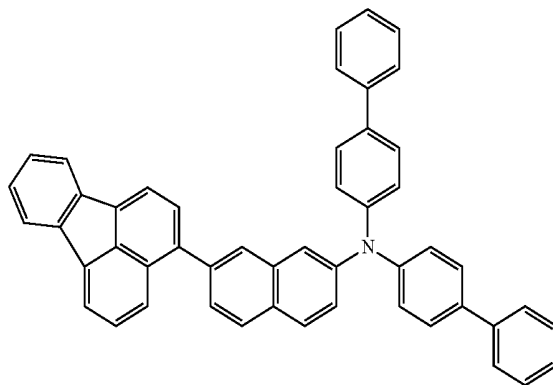
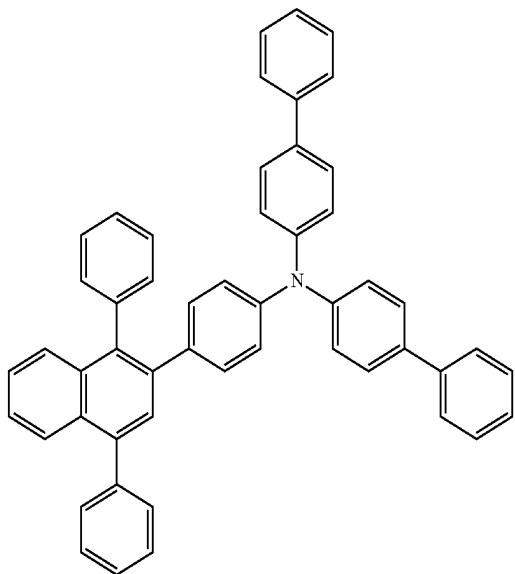
[0239] Organic electroluminescent devices of Comparative Examples 1 to 8 were manufactured by using the following Comparative Compounds R-1 to R-8.

[0240] [Comparative Compounds]

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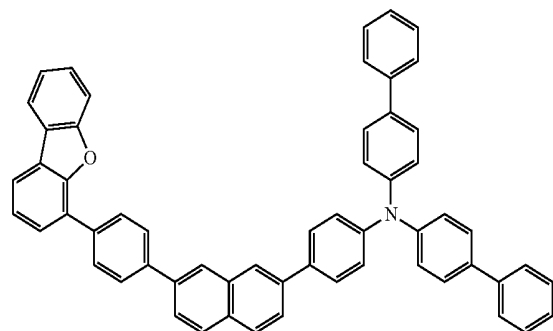
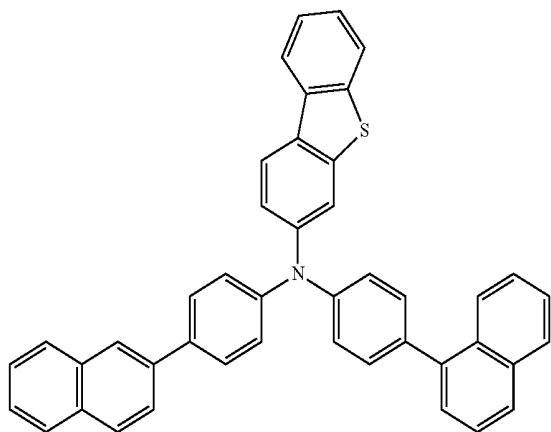
R4

R1



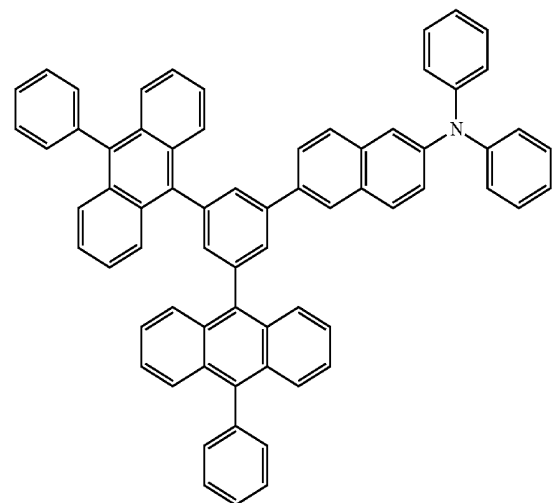
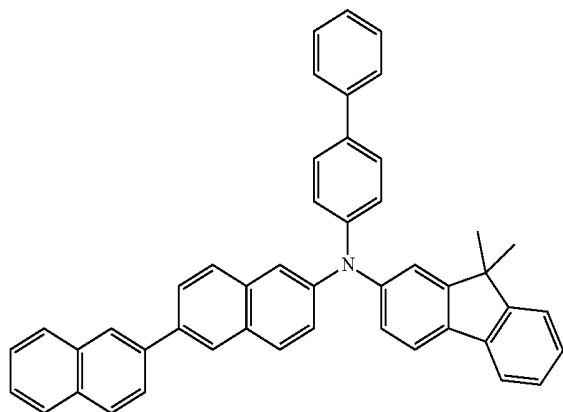
R5

R2



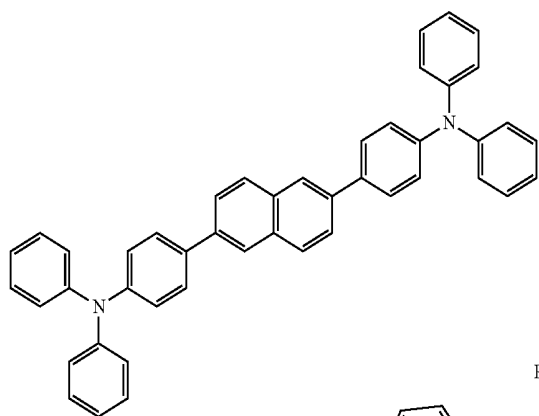
R6

R3

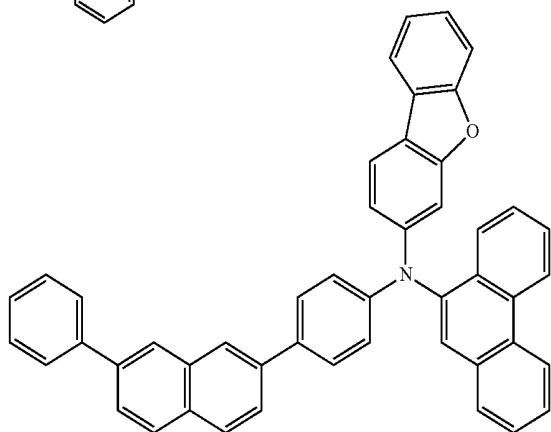


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R7

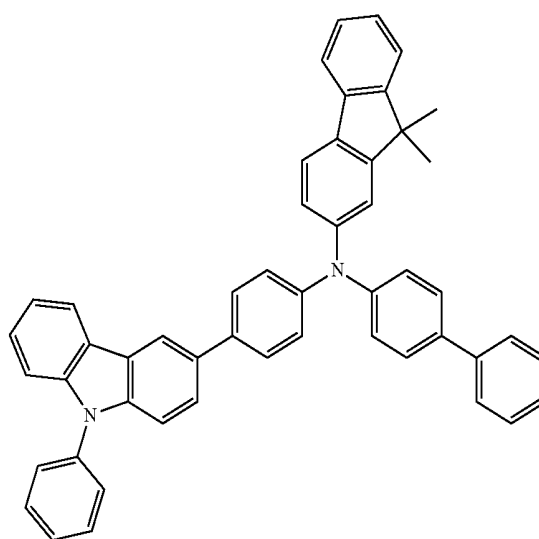


R8

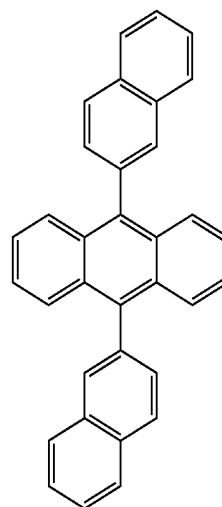


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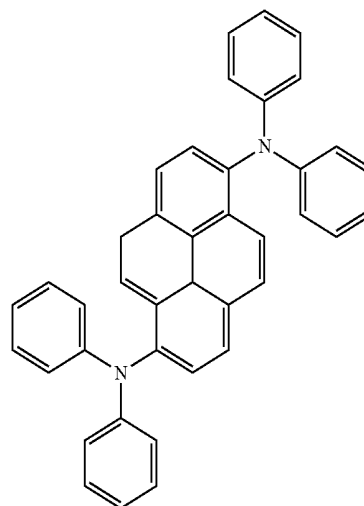
HT1



BH

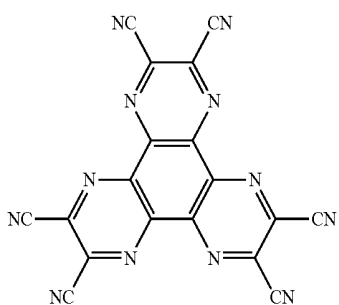


BD

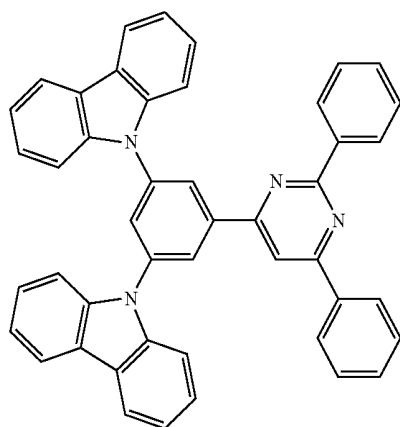


[0241] The organic electroluminescence devices according to Examples 1 to 15 and Comparative Examples 1 to 8 were manufactured by forming a first electrode using ITO to a thickness of about 150 nm, a hole injection layer using HT1 doped with 2% HIL-M to a thickness of about 10 nm, a hole transport layer using HT1 to a thickness of about 120 nm, an electron blocking layer using the example compounds or the comparative compounds to a thickness of about 10 nm, an emission layer using BH doped with 2% BD to a thickness of about 30 nm, a hole blocking layer using ET1 to a thickness of about 10 nm, an electron transport layer using ET2 to a thickness of about 20 nm, an electron injection layer using LiF to a thickness of about 1 nm, and a second electrode using a Mg/Ag alloy co-deposited at a volumetric ratio of 9:1 to a thickness of about 120 nm. Each layer was formed by a vacuum deposition method.

HIL-M

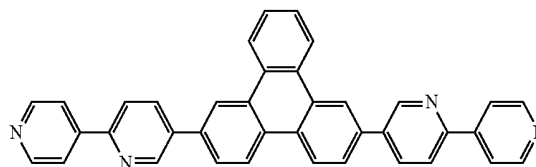


-continued



ET1

-continued



ET2

[0242] The voltage, half-life, emission efficiency, and color coordinate of the organic electroluminescence devices manufactured in Examples 1 to 15 and Comparative Examples 1 to 8 are shown in Table 1 below.

TABLE 1

	Electron blocking layer	Voltage (V)	Life LT50 (h)	Emission efficiency (cd/A)	Color coordinate CIE (x, y)
Example 1	Example Compound A4	4.8	5.5	189	0.141, 0.051
Example 2	Example Compound A17	4.6	5.5	190	0.142, 0.051
Example 3	Example Compound B13	4.7	5.6	196	0.141, 0.051
Example 4	Example Compound B20	4.6	5.5	195	0.141, 0.052
Example 5	Example Compound B40	4.6	5.4	197	0.142, 0.052
Example 6	Example Compound C22	4.6	5.4	199	0.142, 0.051
Example 7	Example Compound C51	4.8	5.4	196	0.141, 0.051
Example 8	Example Compound D12	4.8	5.5	188	0.142, 0.052
Example 9	Example Compound D22	4.7	5.4	190	0.142, 0.051
Example 10	Example Compound E3	4.8	5.6	184	0.141, 0.052
Example 11	Example Compound E32	4.8	5.6	189	0.141, 0.052
Example 12	Example Compound F46	4.7	5.3	193	0.141, 0.051
Example 13	Example Compound F53	4.8	5.5	192	0.141, 0.051
Example 14	Example Compound G54	4.8	5.6	197	0.141, 0.052
Example 15	Example Compound G58	4.8	5.6	185	0.142, 0.052
Comparative Example 1	Comparative Compound R1	5.0	4.9	167	0.140, 0.052
Comparative Example 2	Comparative Compound R2	5.2	3.8	165	0.141, 0.053
Comparative Example 3	Comparative Compound R3	5.1	4.0	167	0.142, 0.051
Comparative Example 4	Comparative Compound R4	5.3	4.2	163	0.139, 0.049
Comparative Example 5	Comparative Compound R5	5.1	5.0	168	0.140, 0.050
Comparative Example 6	Comparative Compound R6	5.5	3.5	155	0.137, 0.047
Comparative Example 7	Comparative Compound R7	4.9	5.0	157	0.143, 0.053
Comparative Example 8	Comparative Compound R8	4.9	4.9	169	0.142, 0.052

[0243] In the above table, the emission efficiency was a measured value at a current density of about 10 mA/cm², and the half-life was a value at about 1.0 mA/cm².

[0244] Referring to the results in Table 1, it may be found that the organic electroluminescence devices of Examples 1 to 15 had decreased driving voltage, extended life and enhanced efficiency when compared with those of Comparative Examples 1 to 8.

[0245] A monoamine compound according to an example embodiment may include a substituted β -phenylnaphthyl group, which may help provide decreased driving voltage, extended life, and enhanced efficiency of the device. Furthermore, the monoamine compound may achieve an extended device life by the introduction of a naphthyl group having a high thermal resistance and electric charge resistance, with the maintenance of the property of amine group. Furthermore, the monoamine compound may have a bulky naphthyl group substituted with a phenyl group, which may decrease symmetry of molecule and inhibit crystallization, to thereby enhance quality of layers and attain high efficiency of the device.

[0246] The organic electroluminescence devices of Examples 1, 2, 8 to 11, 14 and 15 had significantly enhanced efficiency. Without being bound by theory, it is believed that Example Compounds A4, A17, D12, D22, E3, E32, G54 and G58, including a substituent at a position of the naphthyl group, may have a steric electron repulsion between the substituent of a position and the hydrogen atom of other α' position, and distortion of the naphthyl structure and phenyl group substituted therein may lead to decreased planarity of the whole molecule and inhibit crystallization, thereby improving hole transport property and enhancing the chance of recombining holes and electrons in an emission layer.

[0247] Furthermore, the organic electroluminescence devices of Examples 3 to 7, 12 and 13 had significantly extended device life. Without being bound by theory, it is believed that Example Compounds B13, B20, B40, C25, C51, F46 and F53, including a substituent at β position of the naphthyl group, may have a steric conformation close to plane for the naphthyl group and the substituent at β position, which may result in a stabilized radical state due to the delocalized conjugation around amine, thereby enhancing device life.

[0248] The organic electroluminescence device of Comparative Example 1 showed decreased device life when compared with those of Examples. Comparative Compound R1 has an amine group substituted at β position of naphthyl group via a linker similar to Example Compounds, but has two phenyl groups substituted in naphthyl group, which may result in largely distributed HOMO in naphthyl group and decreased electron density in amine group, thereby making it difficult to maintain the property of amine to extend device life.

[0249] The organic electroluminescence device of Comparative Example 2 uses an amine compound including a naphthyl group but not a phenylnaphthyl group, which results in low electric charge resistance, thereby decreasing device life and emission efficiency due to the insufficient quality of layers.

[0250] The organic electroluminescence devices of Comparative Examples 3 and 4 use Comparative Compounds R3 and R4 having an amine group substituted at β position of naphthyl group via a linker similar to Example Compounds, but having polycyclic aromatic groups connected to naph-

thyl group, contrary to Example Compounds having a phenyl group connected to naphthyl group, which may cause a strong molecular stacking and increased deposition temperature due to the polycyclic aromatic group, thereby resulting in easy thermal decomposition and decreased efficiency and device life, when compared with those of Examples.

[0251] The organic electroluminescence device of Comparative Example 6 uses Comparative Compound R6 having an amine group substituted at β position of naphthyl group via a linker similar to Example Compounds, but having a phenyl group with two substituents, which may cause a strong molecular stacking and increased deposition temperature, thereby resulting in easy thermal decomposition and decreased efficiency and device life, when compared with those of Examples.

[0252] The organic electroluminescence devices of Comparative Examples 5 and 7 showed especially decreased emission efficiency when compared with those of Examples. Comparative Compound R5 has a naphthyl group substituted with phenyl group that is substituted with dibenzofuran heterocycle, and Comparative Compound R7 is a diamine compound, both of which may disturb carrier balance.

[0253] The organic electroluminescence device of Comparative Example 8 showed decreased emission efficiency and device life when compared with those of Examples. Comparative Compound R8 has a nitrogen atom substituted with both of 3-dibenzofuranyl and 9-phenanthryl, which may result in easy thermal decomposition. Comparative Compound R8 has a nitrogen atom substituted with 9-phenanthryl, which may increase molecular stacking, and is further substituted with 3-dibenzofuranyl, which may increase planarity of the whole molecule, thereby causing a strong molecular stacking and increased deposition temperature, which seems to result in easy thermal decomposition and decreased efficiency and device life.

[0254] By way of summation and review, in an application of an organic electroluminescence device to a display, decrease of a driving voltage, increase of emission efficiency and extension of life for the organic electroluminescence device are desired, and development of a material which may stably implement these requirements in the organic electroluminescence device is also desired.

[0255] Embodiments may provide an organic electroluminescence device and a monoamine compound for an organic electroluminescence device. Embodiments may provide an organic electroluminescence device with high efficiency and a monoamine compound included in a hole transport region of an organic electroluminescence device.

[0256] A monoamine compound according to an example embodiment may be used as a material for a hole transport region of an organic electroluminescence device, which may contribute to a decrease of a driving voltage, increase of emission efficiency, and extension of life for the organic electroluminescence device.

[0257] The organic electroluminescence device according to an example embodiment may have high efficiency.

[0258] Example embodiments have been disclosed herein, and although specific terms are employed, they are used and are to be interpreted in a generic and descriptive sense only and not for purpose of limitation. In some instances, as would be apparent to one of ordinary skill in the art as of the filing of the present application, features, characteristics, and/or elements described in connection with a particular embodiment may be used singly or in combination with

features, characteristics, and/or elements described in connection with other embodiments unless otherwise specifically indicated. Accordingly, it will be understood by those of skill in the art that various changes in form and details may be made without departing from the spirit and scope of the present invention as set forth in the following claims.

What is claimed is:

1. An organic electroluminescence device, comprising:

a first electrode;

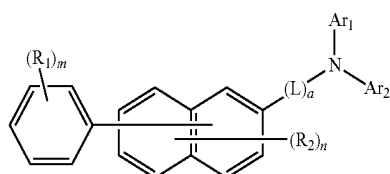
a hole transport region on the first electrode;

an emission layer on the hole transport region;

an electron transport region on the emission layer; and

a second electrode on the electron transport region,

wherein the hole transport region includes a monoamine compound represented by the following Formula 1:



[Formula 1]

wherein in Formula 1,

Ar₁ and Ar₂ are each independently a substituted or unsubstituted alkyl group having 1 to 10 carbon atoms, a substituted or unsubstituted cycloalkyl group having 3 to 20 ring carbon atoms, a substituted or unsubstituted aryl group having 6 to 30 ring carbon atoms, or a substituted or unsubstituted heteroaryl group having 2 to 30 ring carbon atoms, provided that when any one of Ar₁ and Ar₂ is 3-dibenzofuranyl, the other one of Ar₁ and Ar₂ is not 9-phenanthryl,

L is a substituted or unsubstituted arylene group having 6 to 30 ring carbon atoms, or a substituted or unsubstituted heteroarylene group having 2 to 30 ring carbon atoms,

R₁ is a hydrogen atom, a deuterium atom, a halogen atom, a substituted or unsubstituted alkyl group having 1 to 20 carbon atoms, a substituted or unsubstituted cycloalkyl group having 3 to 20 ring carbon atoms, or a substituted or unsubstituted aryl group having 6 to 30 ring carbon atoms,

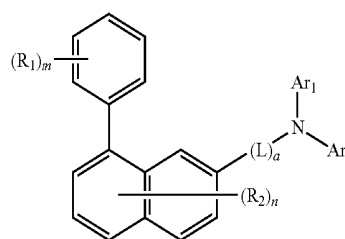
R₂ is a hydrogen atom, a deuterium atom, a halogen atom, a substituted or unsubstituted alkyl group having 1 to 20 carbon atoms, or a substituted or unsubstituted cycloalkyl group having 3 to 20 ring carbon atoms,

a is an integer of 0 to 3,

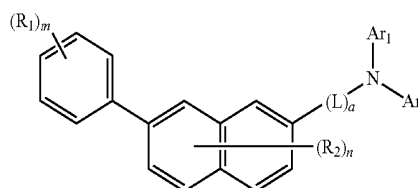
m is an integer of 0 to 1, and

n is an integer of 0 to 6.

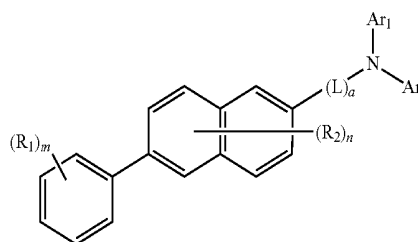
2. The organic electroluminescence device as claimed in claim 1, wherein Formula 1 is represented by any one of the following Formulae 2 to 8:



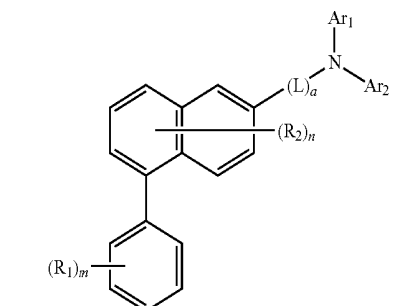
[Formula 2]



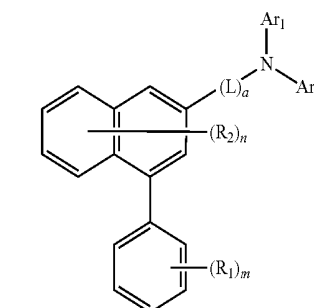
[Formula 3]



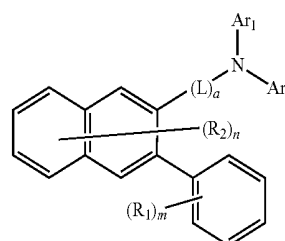
[Formula 4]



[Formula 5]



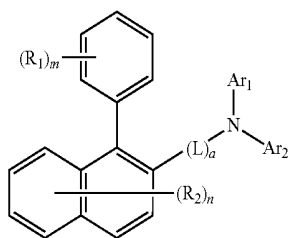
[Formula 6]



[Formula 7]

-continued

[Formula 8]



wherein in Formula 2 to 8,

Ar_1 , Ar_2 , L , R_1 , R_2 , a , m , and n are the same as defined in Formula 1.

3. The organic electroluminescence device as claimed in claim 1, wherein L is a substituted or unsubstituted arylene group having 6 to 12 ring carbon atoms.

4. The organic electroluminescence device as claimed in claim 3, wherein L is a substituted or unsubstituted phenylene group.

5. The organic electroluminescence device as claimed in claim 1, wherein Ar_1 and Ar_2 are each independently a substituted or unsubstituted aryl group having 6 to 12 ring carbon atoms.

6. The organic electroluminescence device as claimed in claim 5, wherein Ar_1 and Ar_2 are each independently a substituted or unsubstituted phenyl group, a substituted or unsubstituted biphenyl group, a substituted or unsubstituted naphthyl group, or a substituted or unsubstituted fluorenyl group.

7. The organic electroluminescence device as claimed in claim 1, wherein Ar_1 and Ar_2 are each independently a substituted or unsubstituted heteroaryl group having 5 to 12 ring carbon atoms.

8. The organic electroluminescence device as claimed in claim 7, wherein Ar_1 and Ar_2 are each independently a substituted or unsubstituted dibenzofuran group, a substituted or unsubstituted dibenzothiophene group, or a substituted or unsubstituted carbazole group.

9. The organic electroluminescence device as claimed in claim 1, wherein R_2 is a hydrogen atom or a deuterium atom.

10. The organic electroluminescence device as claimed in claim 1, wherein the hole transport region has a plurality of layers, and a layer of the plurality of layers contacting the emission layer includes the monoamine compound represented by Formula 1.

11. The organic electroluminescence device as claimed in claim 1, wherein the hole transport region includes:

- a hole injection layer on the first electrode;
- a hole transport layer on the hole injection layer; and
- an electron blocking layer on the hole transport layer, the electron blocking layer including the monoamine compound represented by Formula 1.

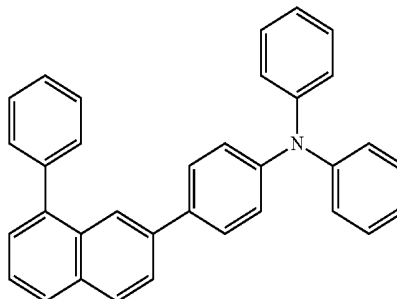
12. The organic electroluminescence device as claimed in claim 1, wherein the electron transport region includes:

- a hole blocking layer on the emission layer;
- an electron transport layer on the hole blocking layer; and
- an electron injection layer on the electron transport layer.

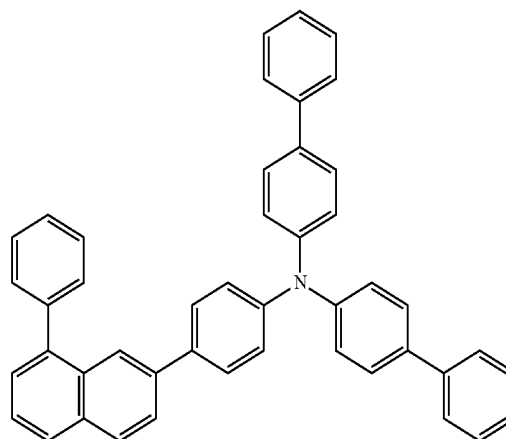
13. The organic electroluminescence device as claimed in claim 1, wherein the monoamine compound represented by Formula 1 is at least one selected from the group of compounds represented in the following Compound Groups 1 to 7:

[Compound Group 1]

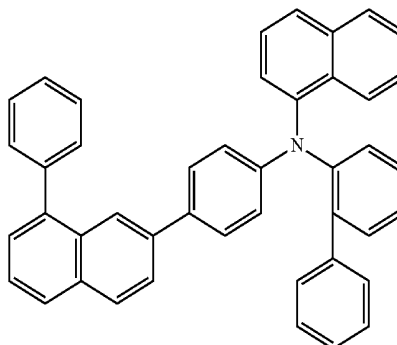
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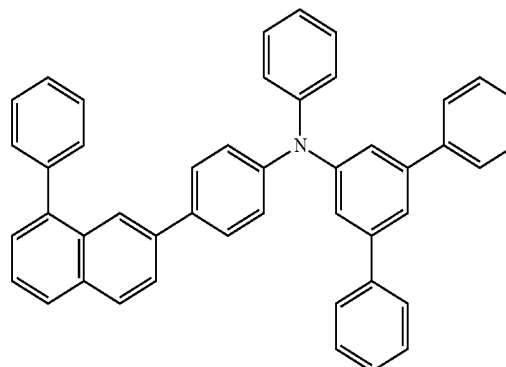
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A3

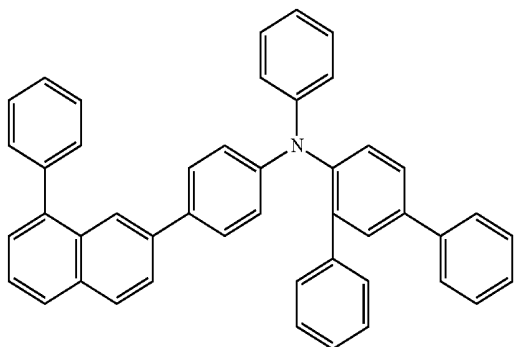


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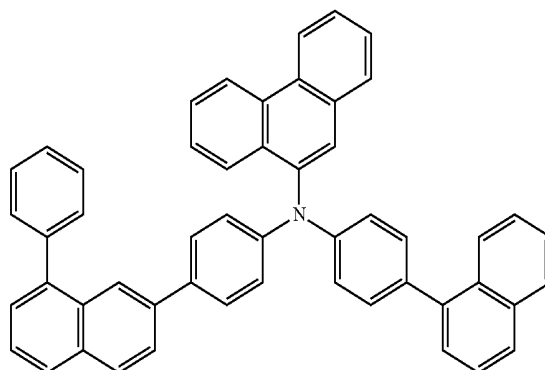
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A5

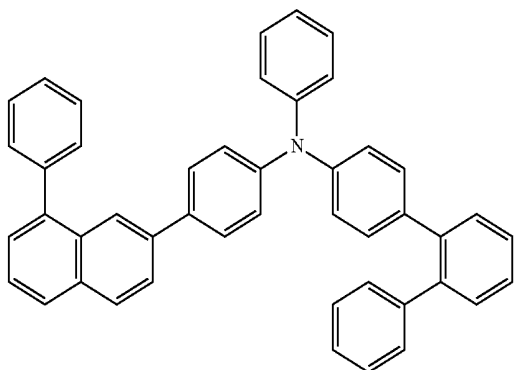


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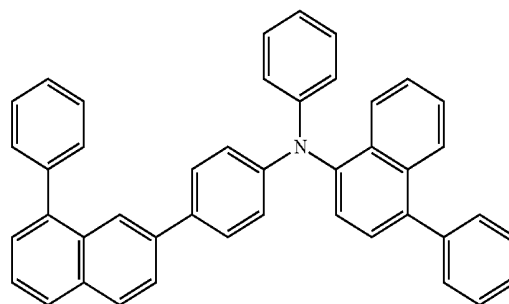
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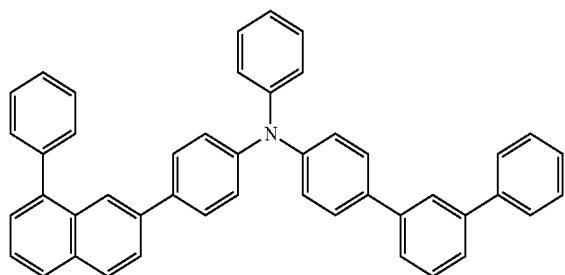
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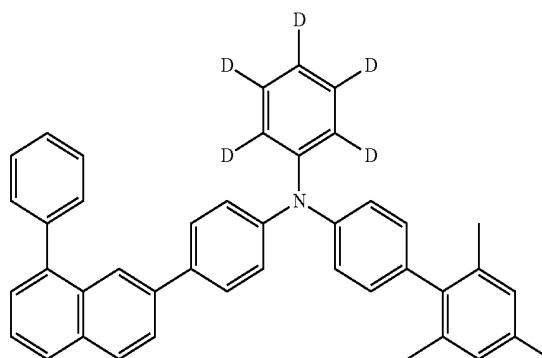
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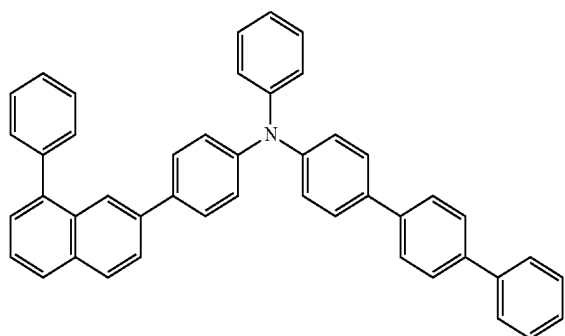
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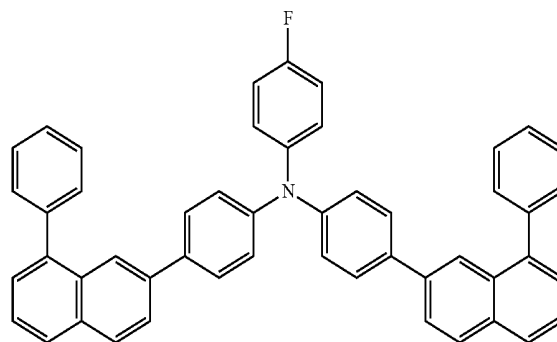
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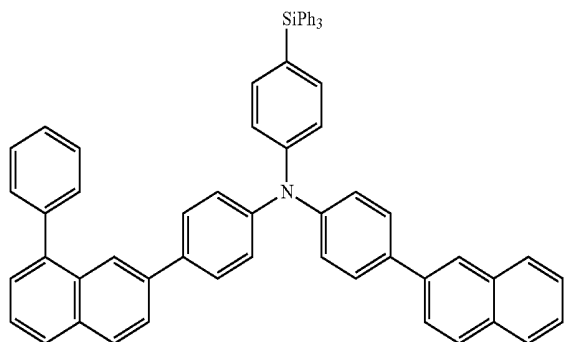


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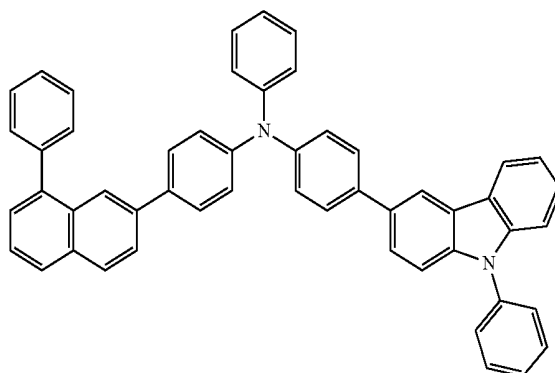
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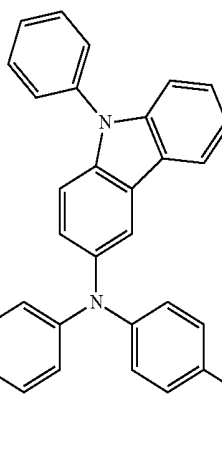
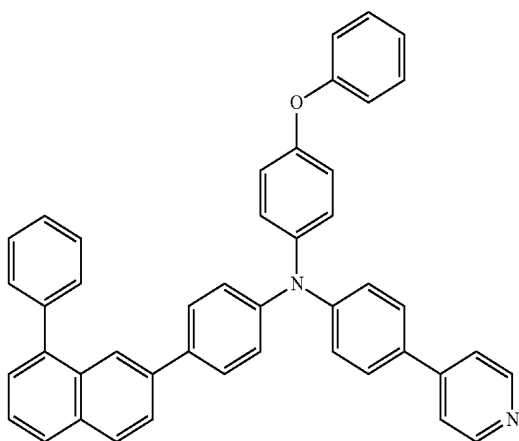
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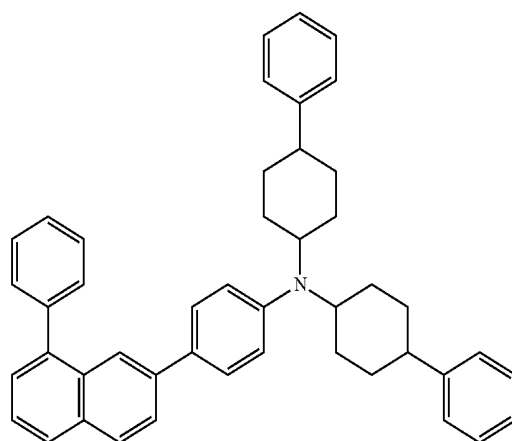
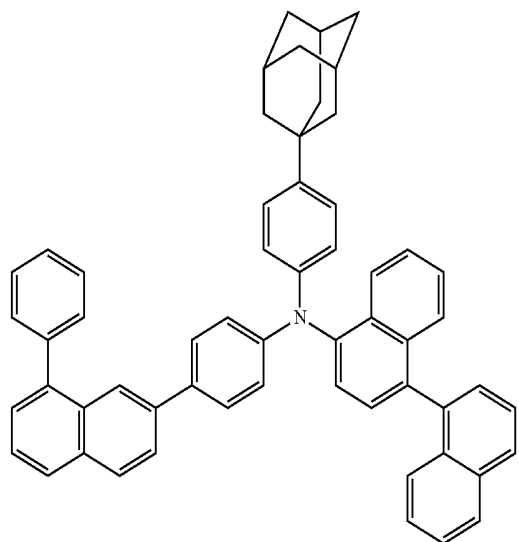
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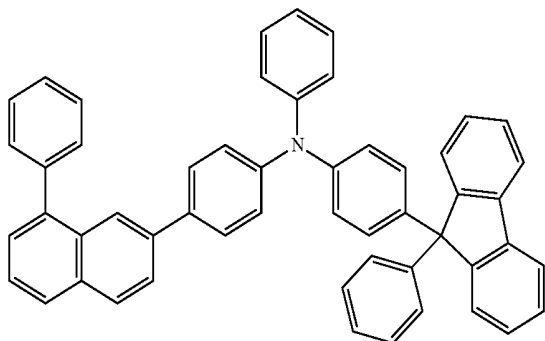
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A19

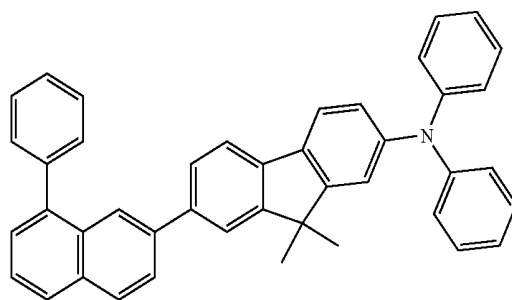
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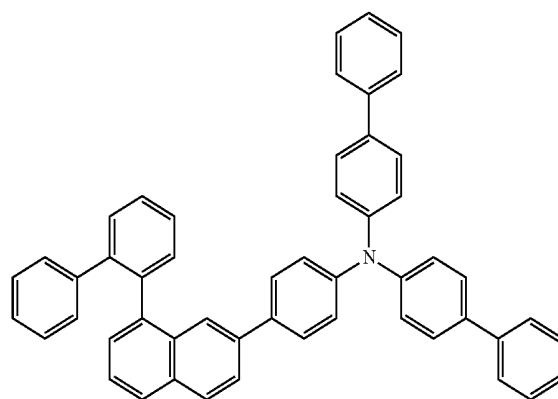
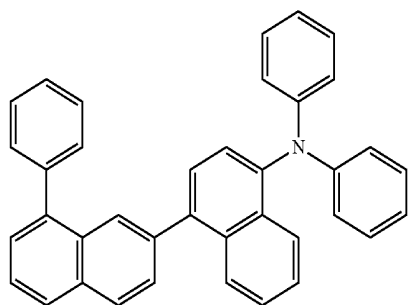
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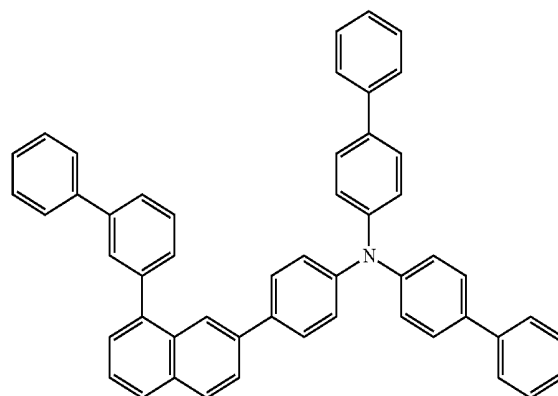
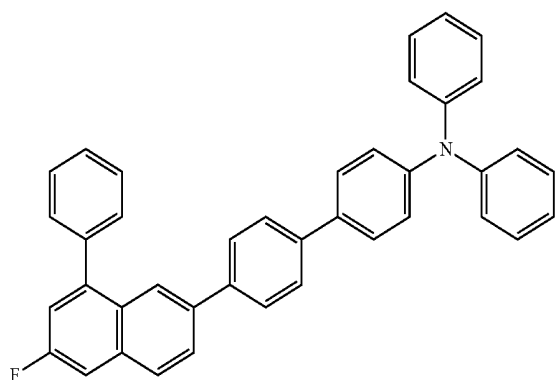
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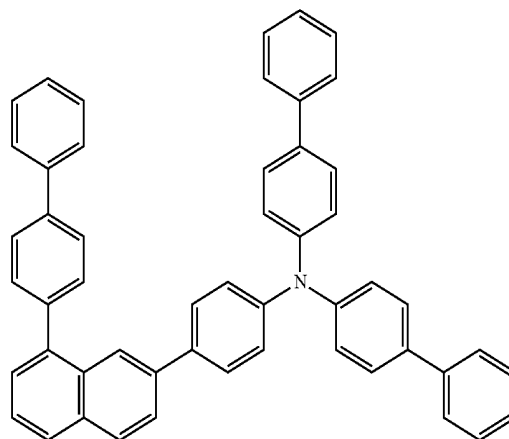
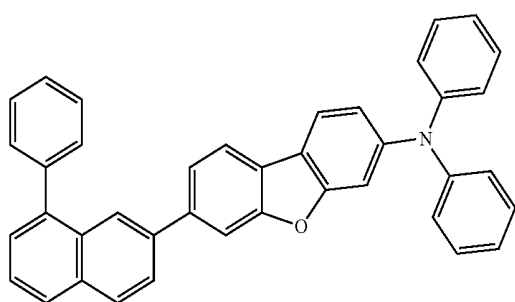
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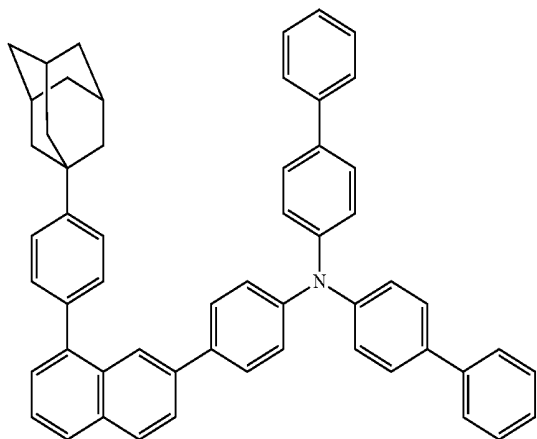
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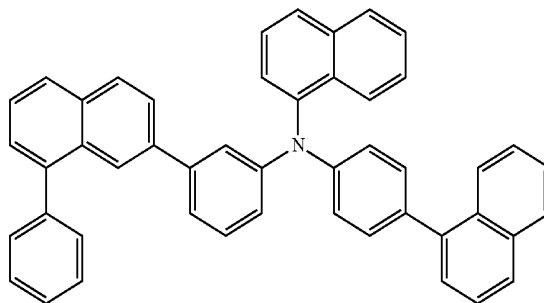
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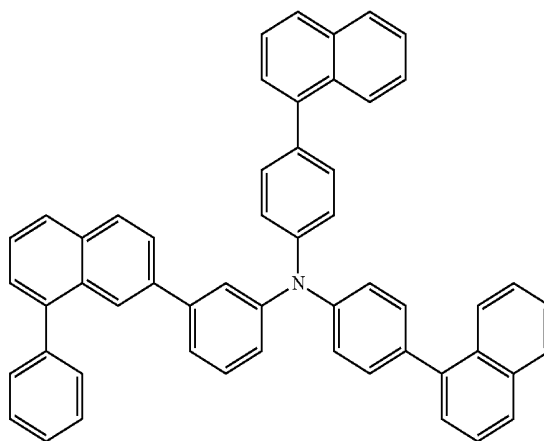
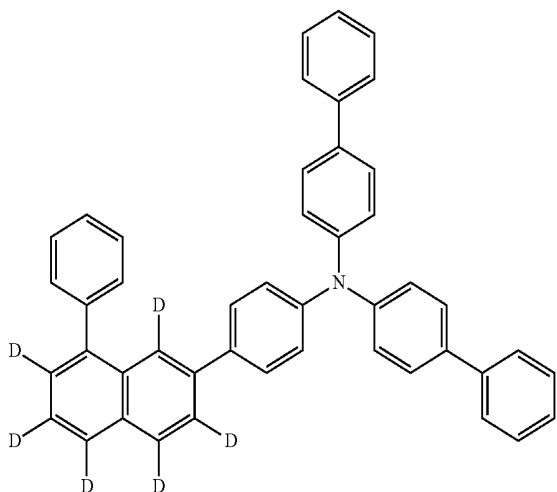
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A31



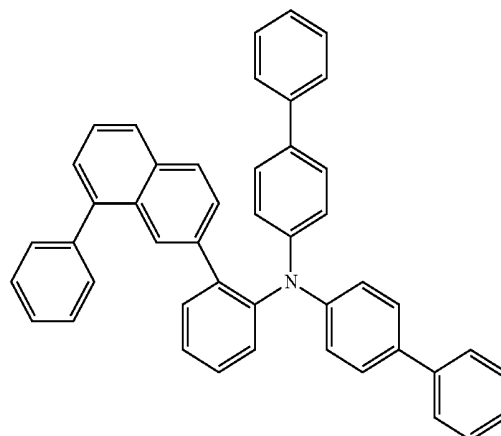
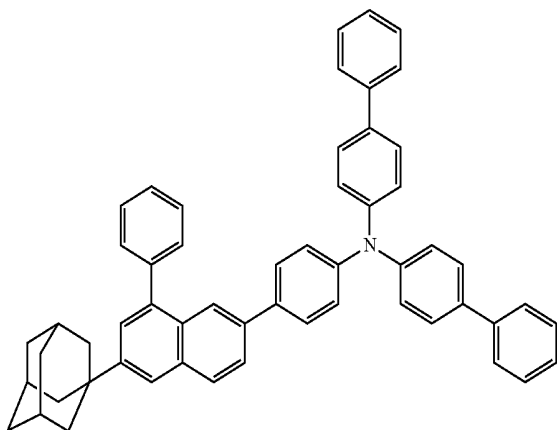
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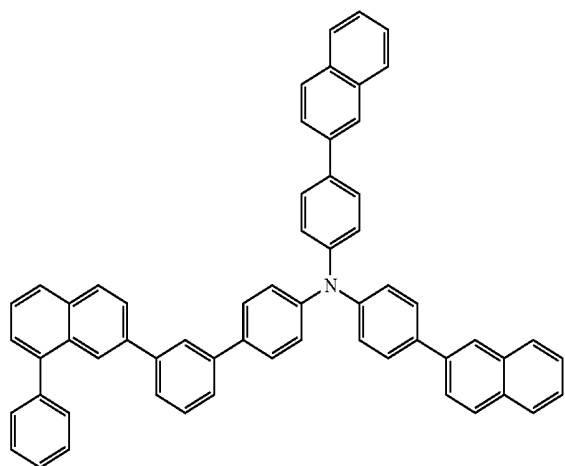
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A30



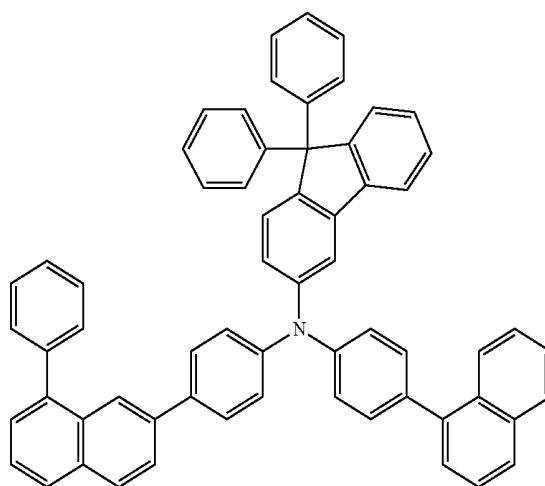
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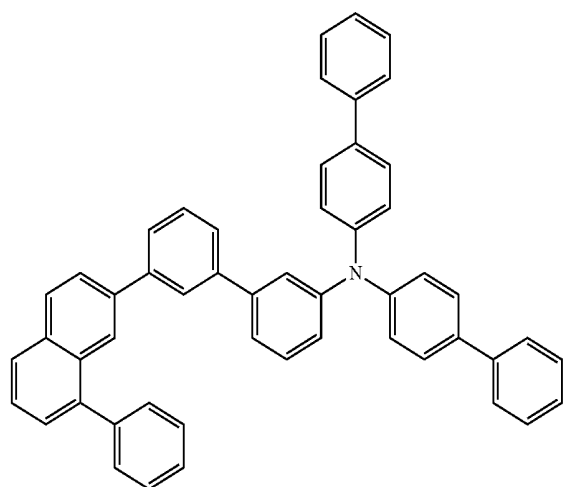


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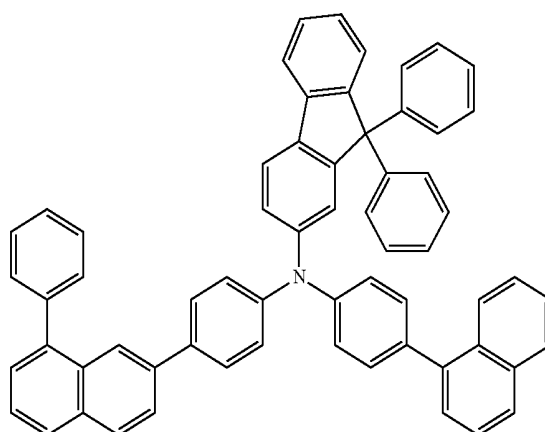
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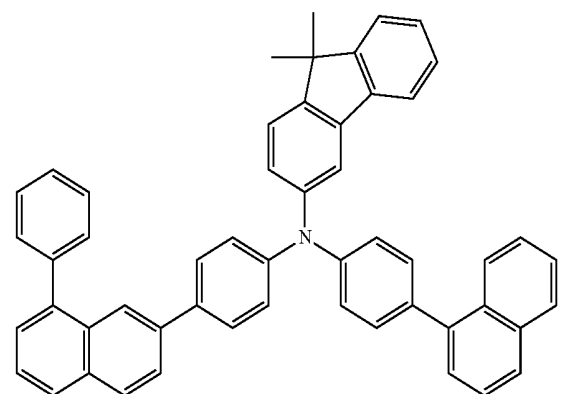
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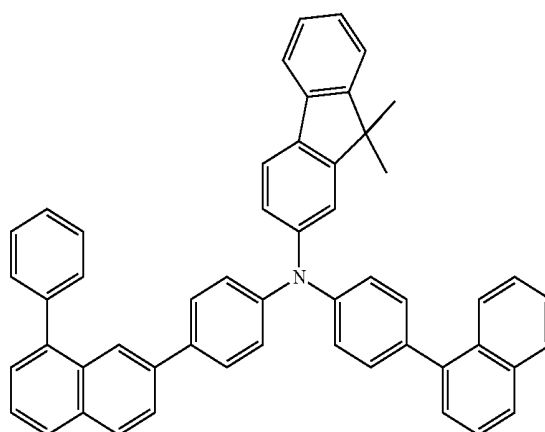
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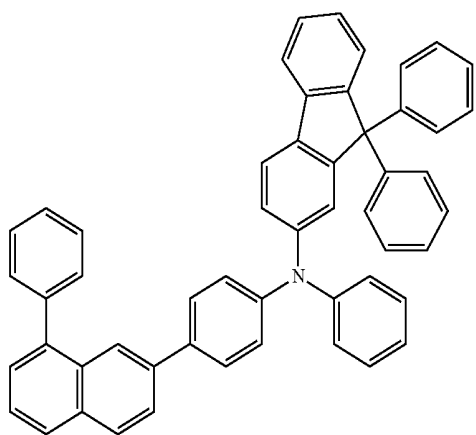
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A39

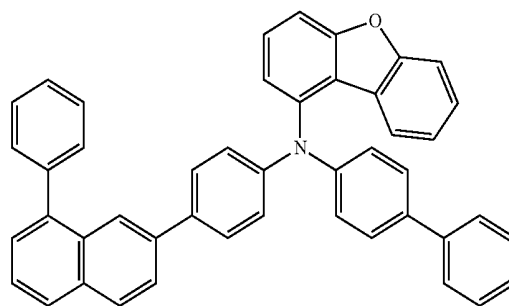


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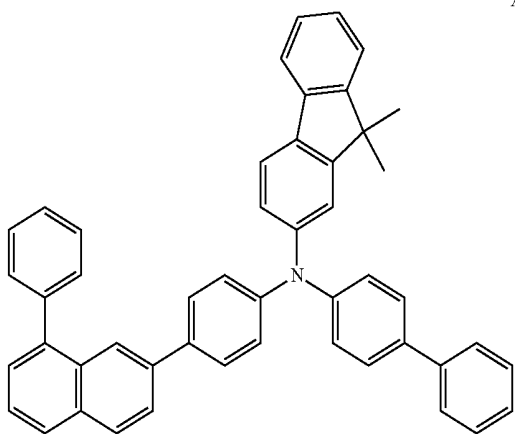


A40

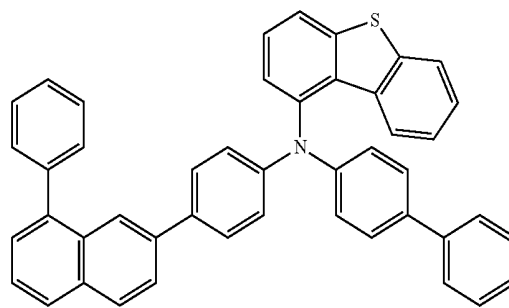
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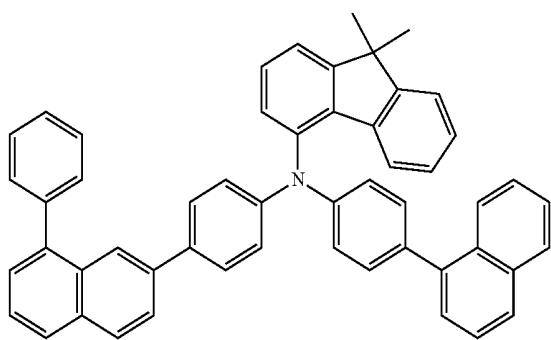
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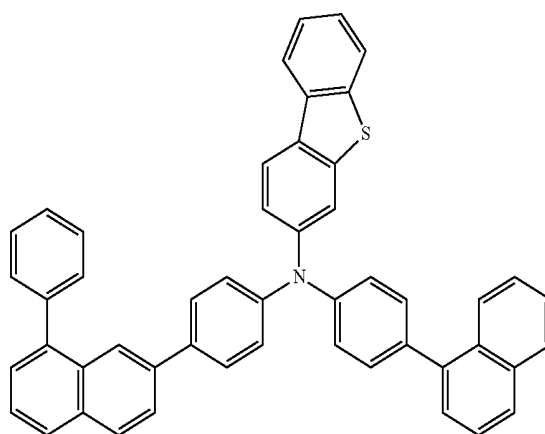
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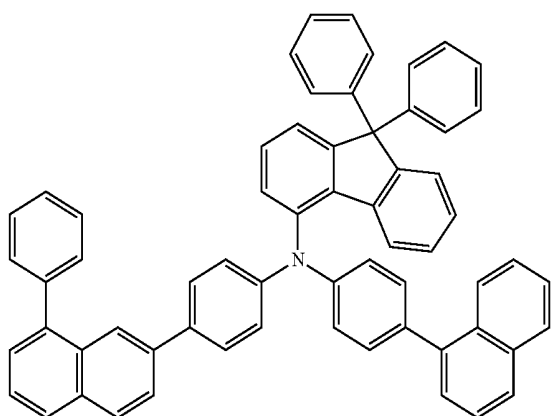
A45



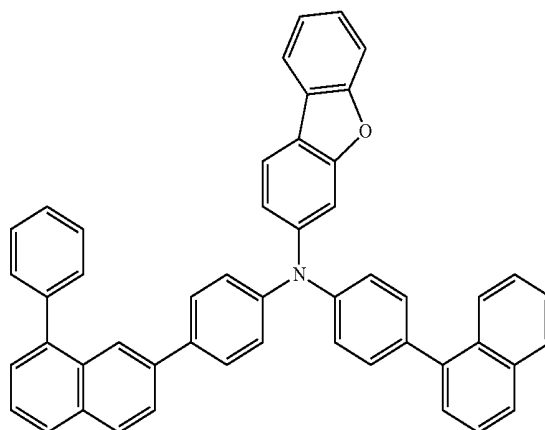
A42



A46



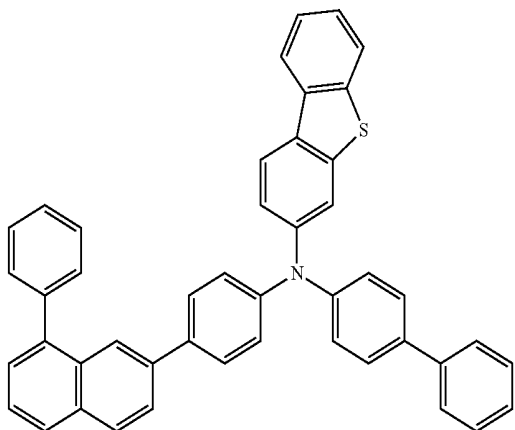
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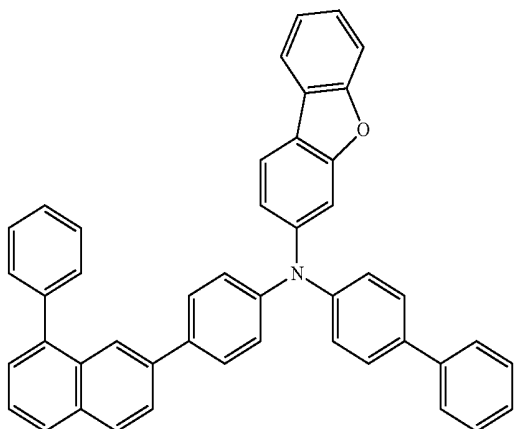
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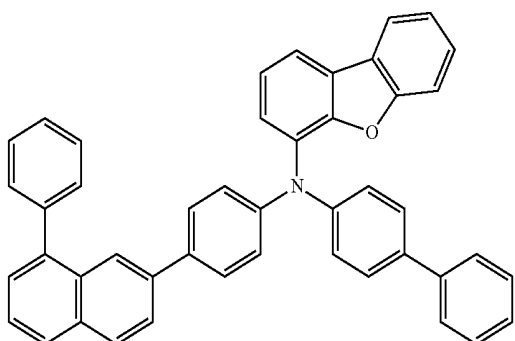
A48



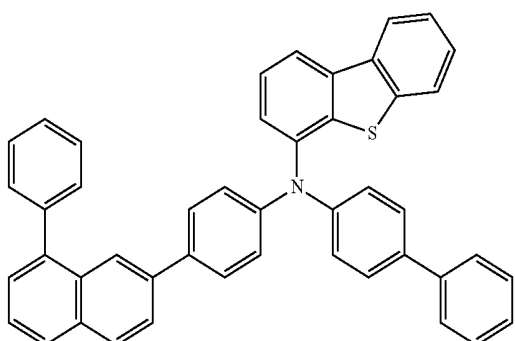
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A50

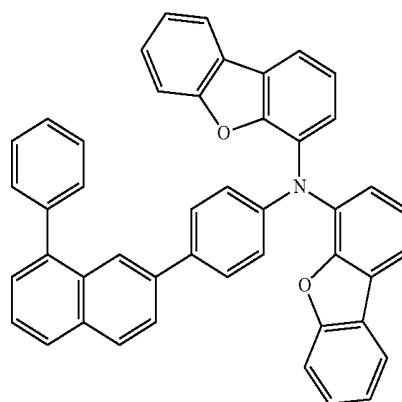


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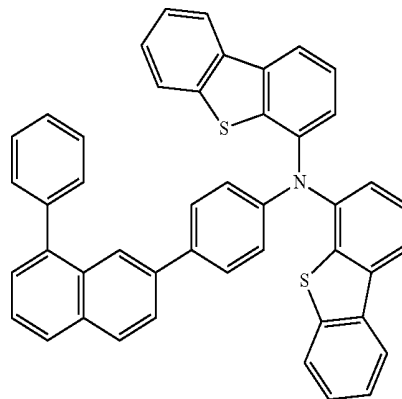


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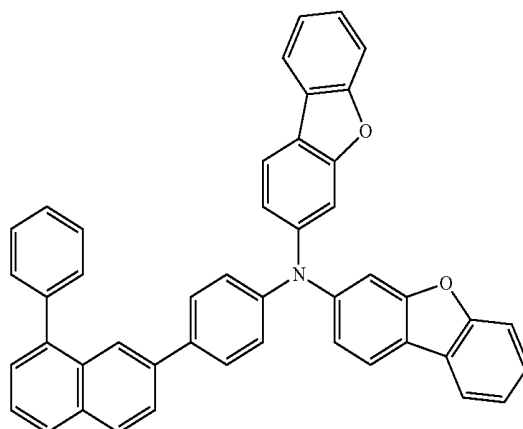
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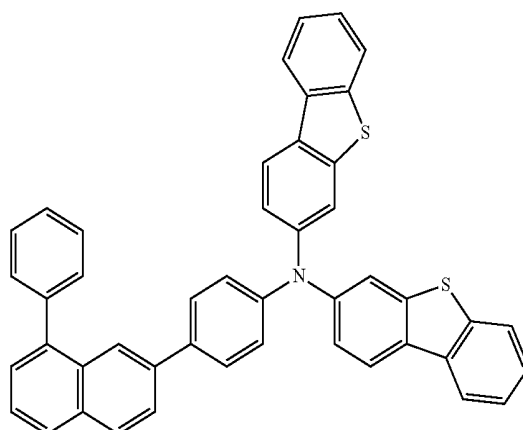
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A54

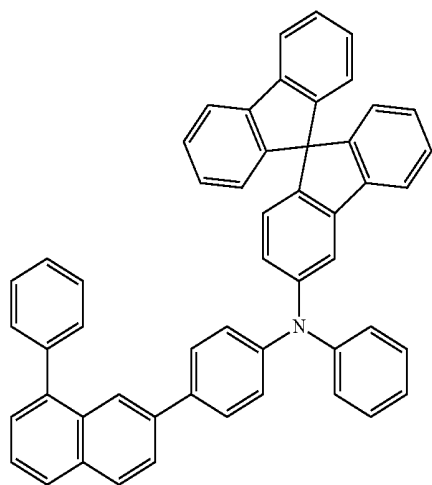


A55



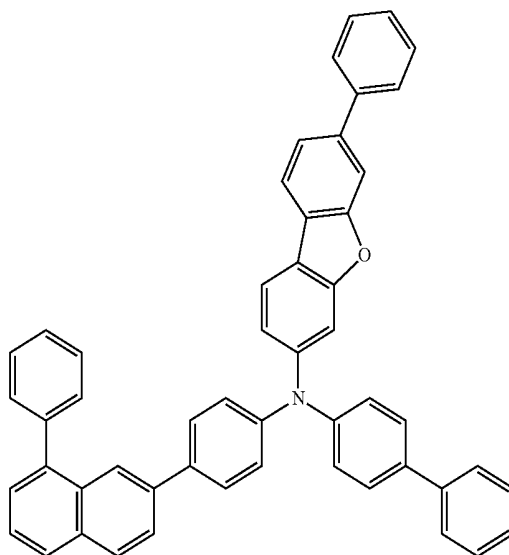
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A56

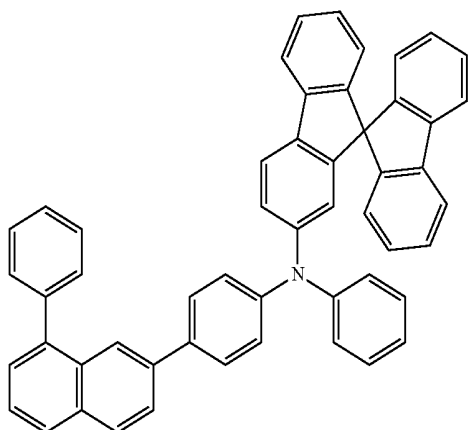


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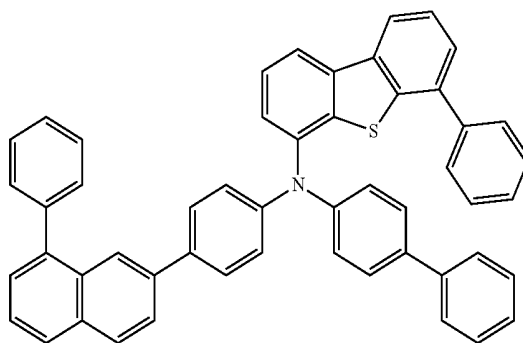
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A57

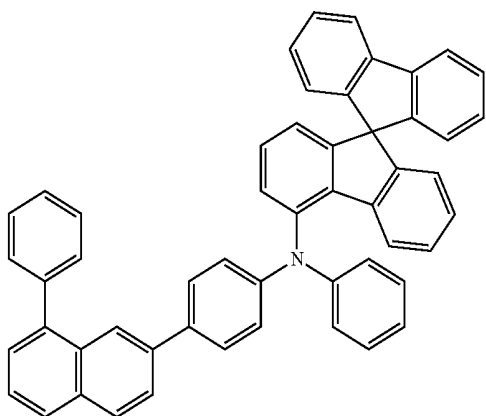


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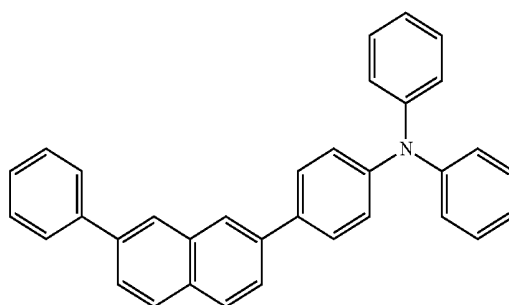


[Compound Group 2]

A58

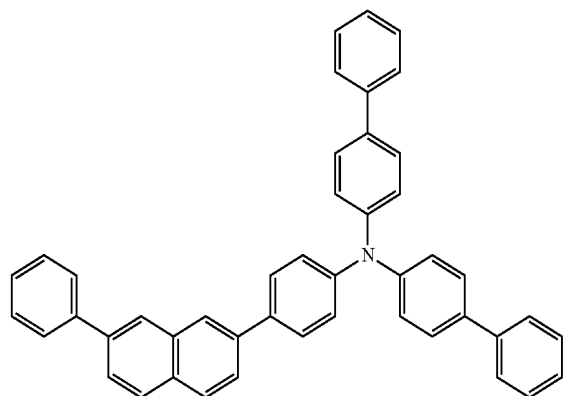


B1



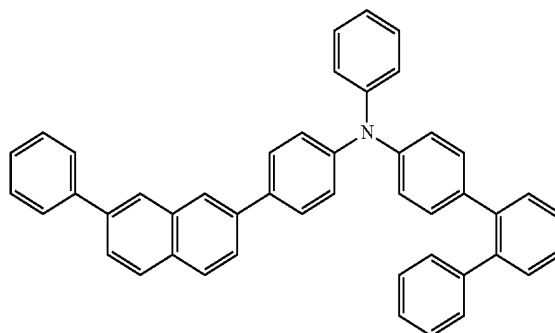
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B2



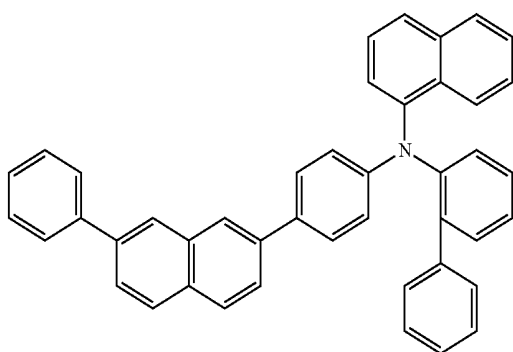
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B6

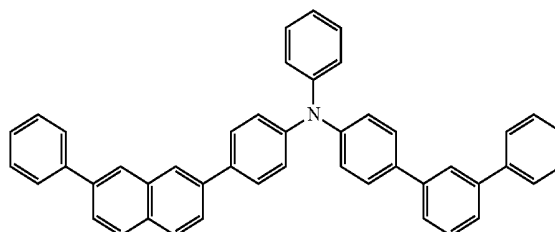


B7

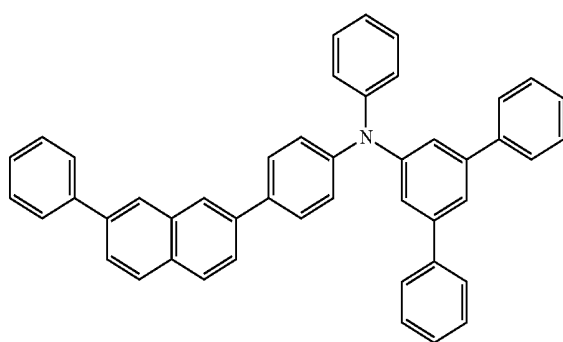
B3



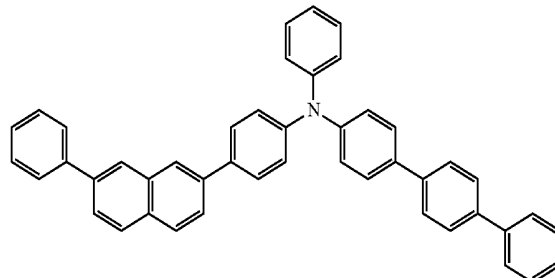
B8



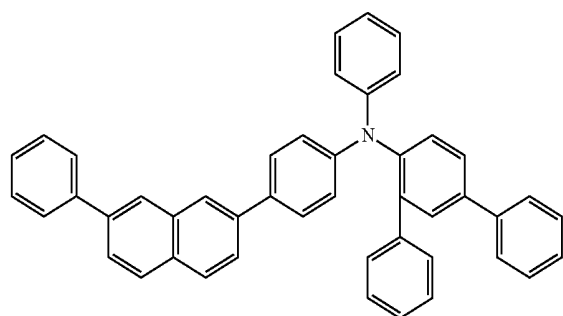
B4



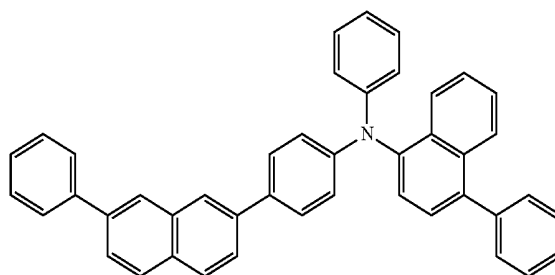
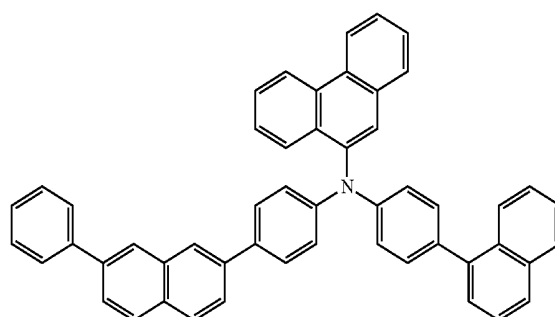
B9



B5

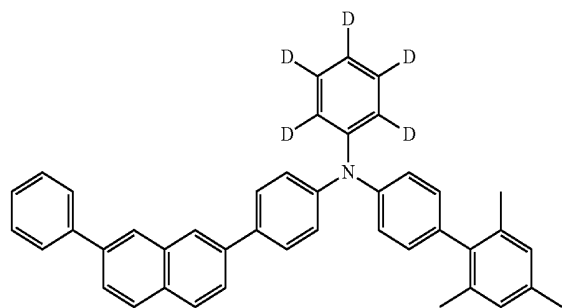


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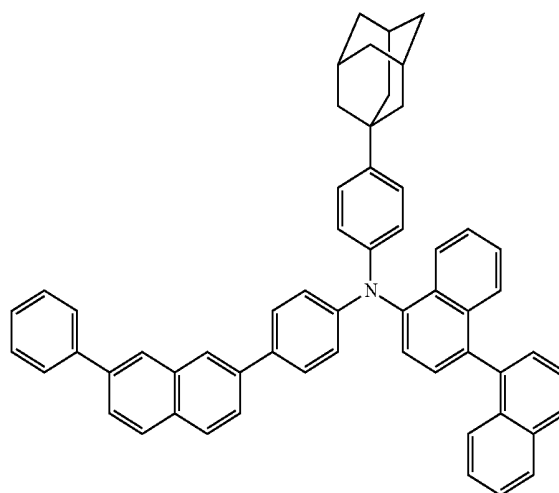
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B11

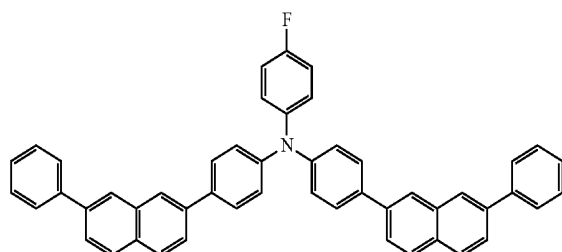


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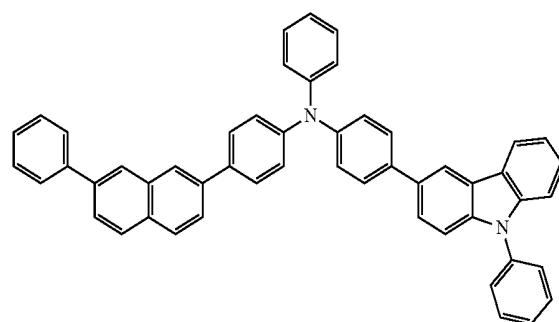
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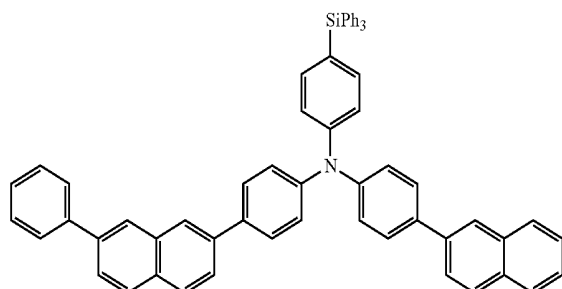
B12



B16

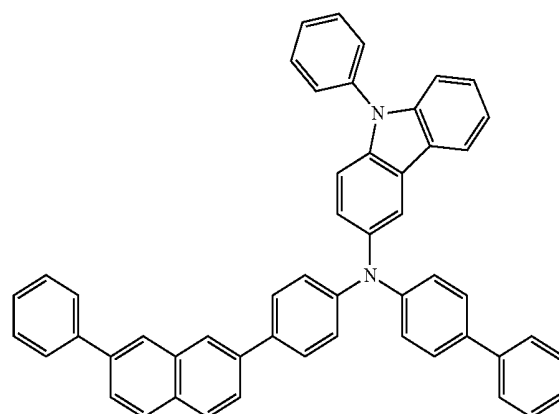
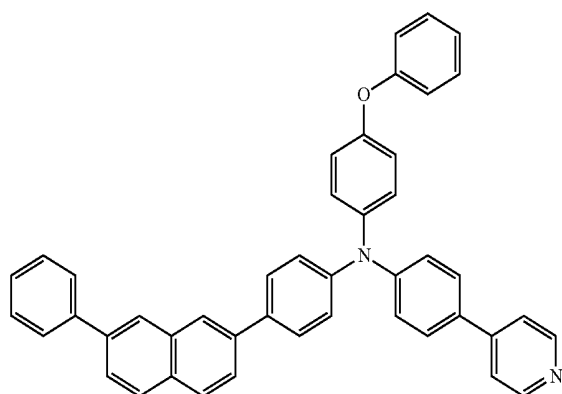


B13



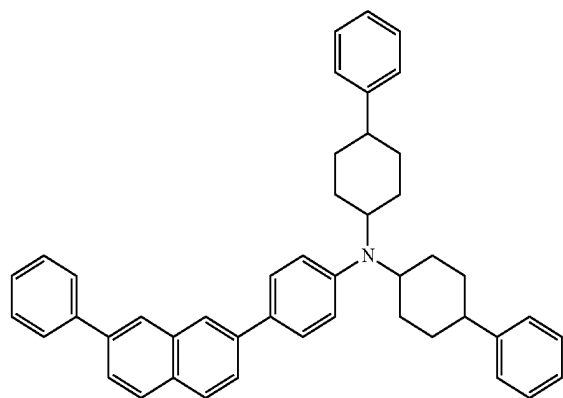
B17

B14



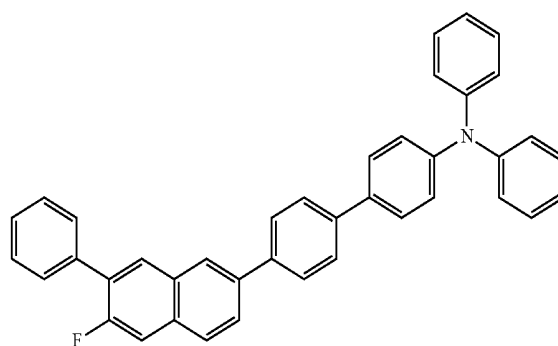
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B18

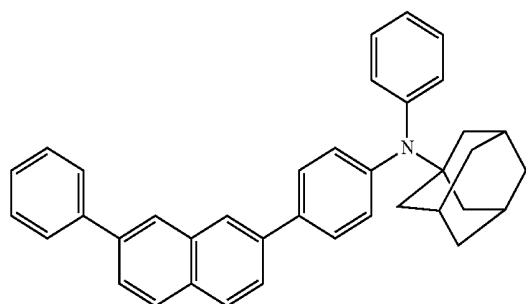


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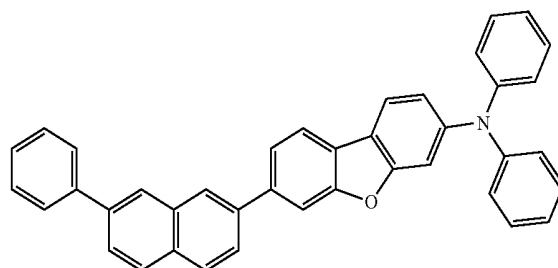
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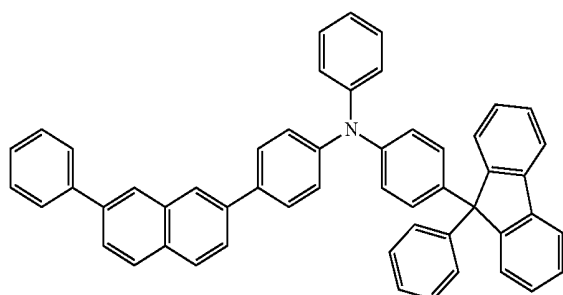
B19



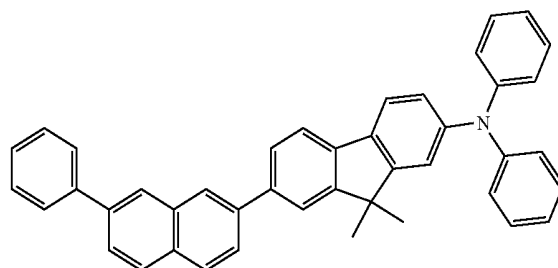
B23



B20

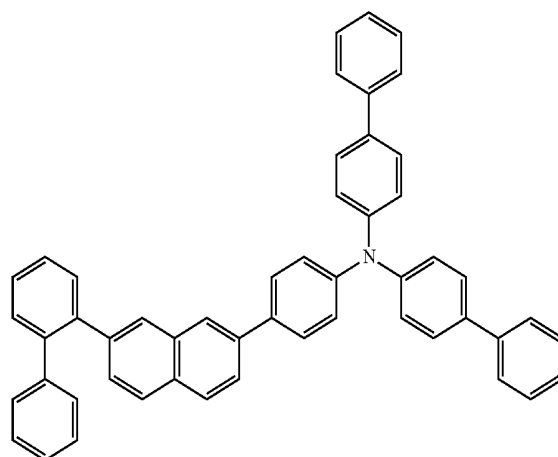
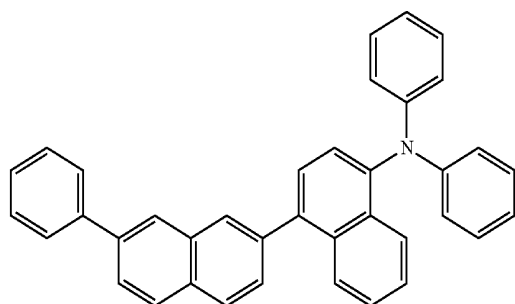


B24



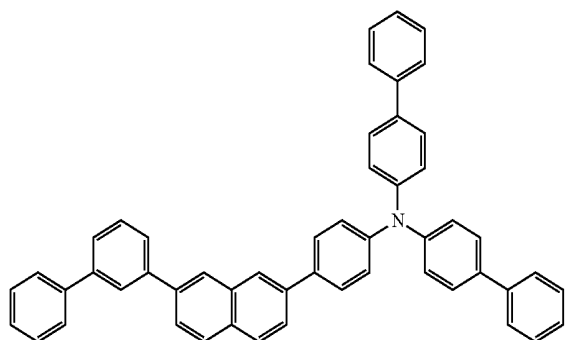
B25

B21

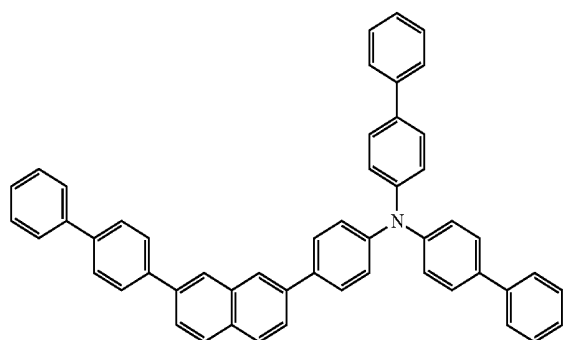


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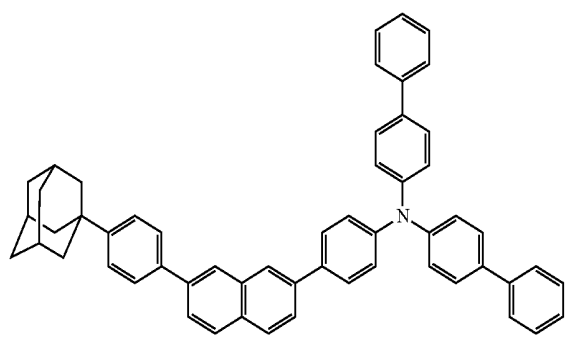
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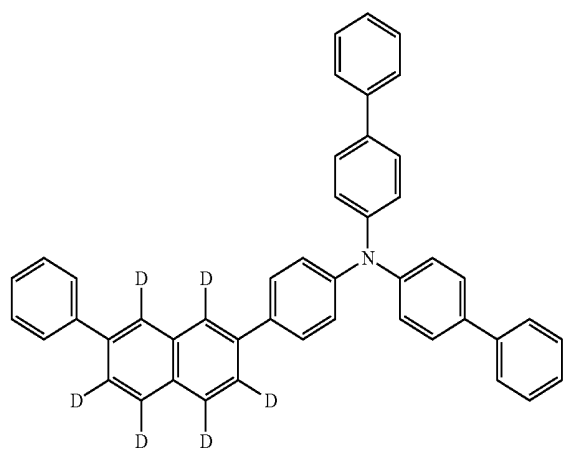
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B28

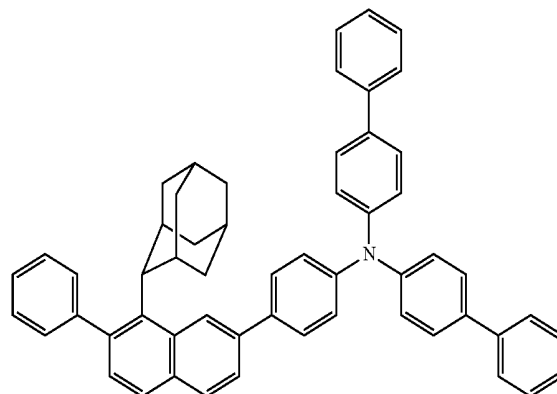


B29

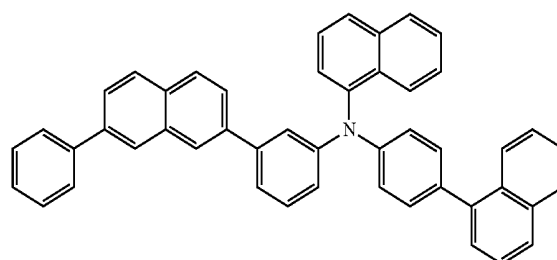


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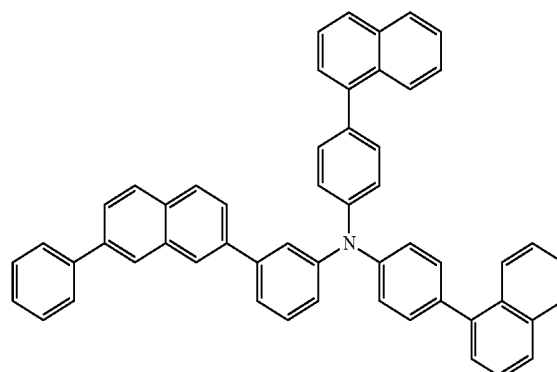
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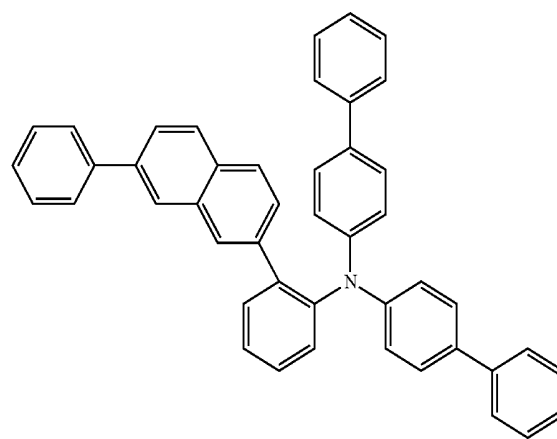
B31



B32

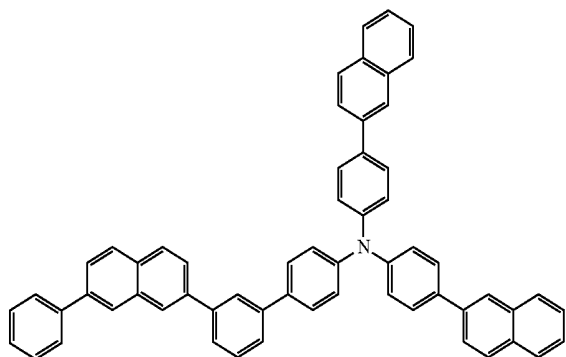


B33



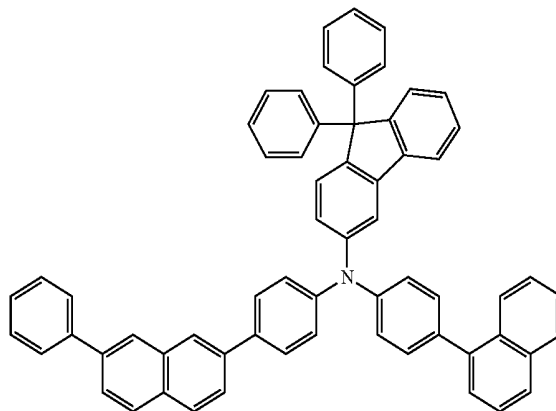
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B34



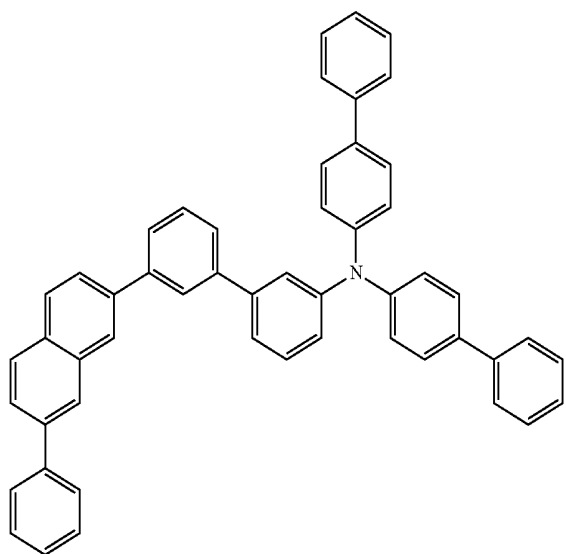
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B37

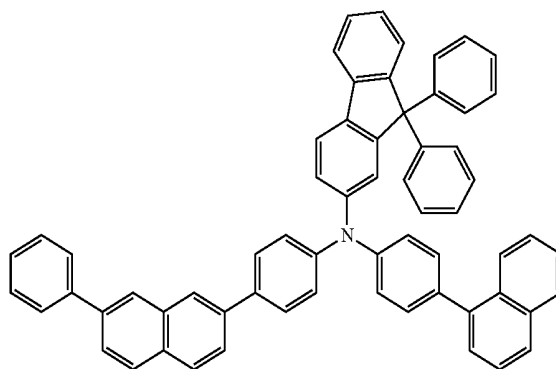


B38

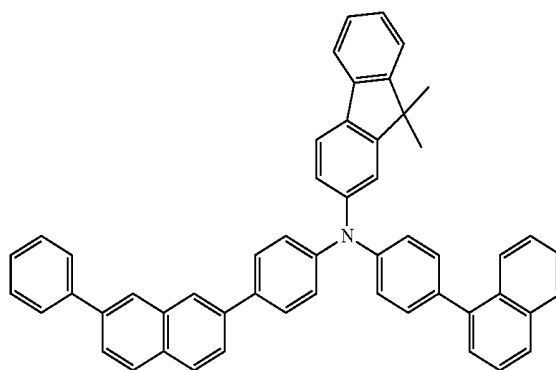
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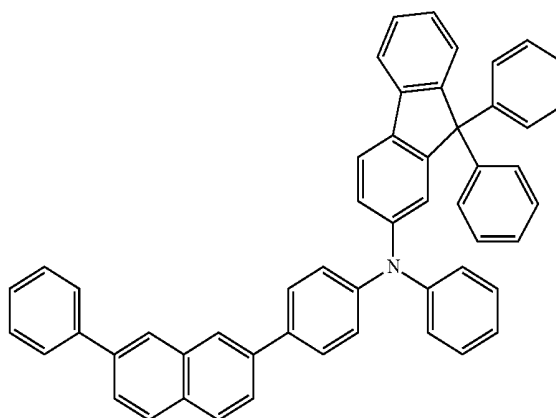
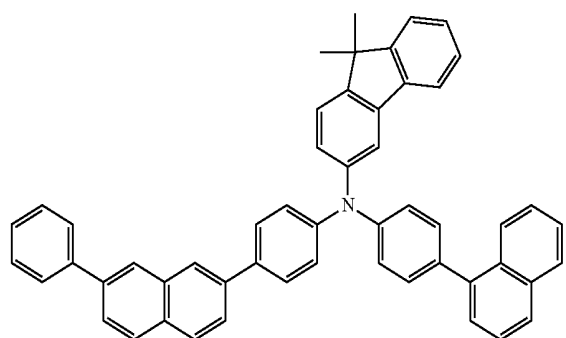
B39



B40

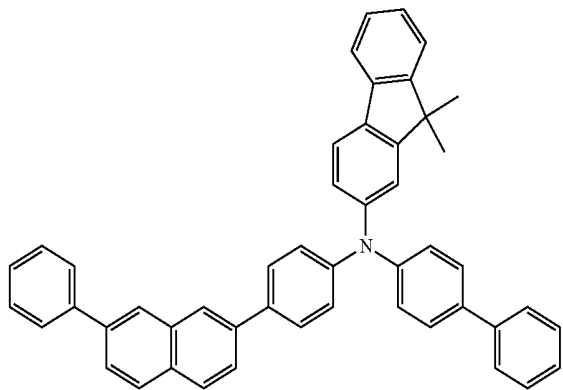


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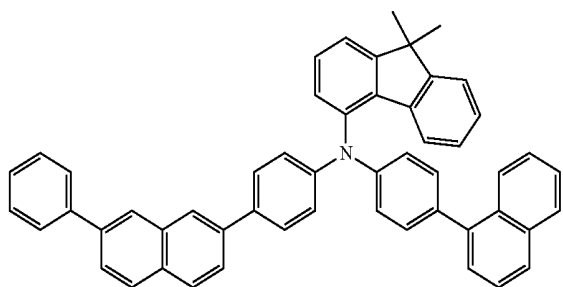


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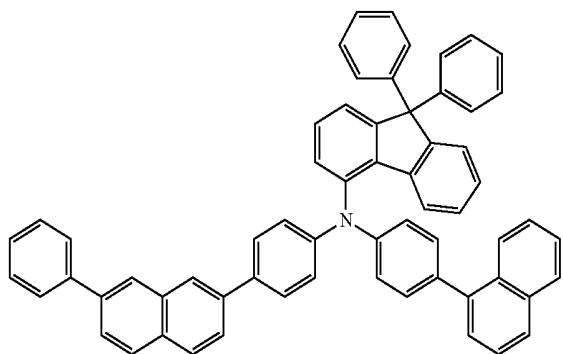
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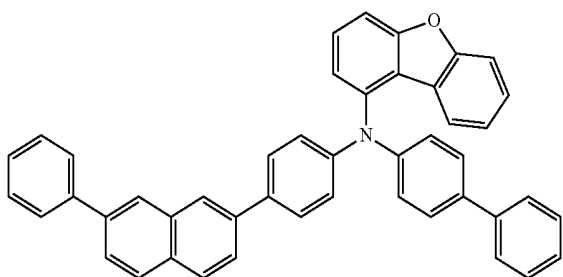
B42



B43

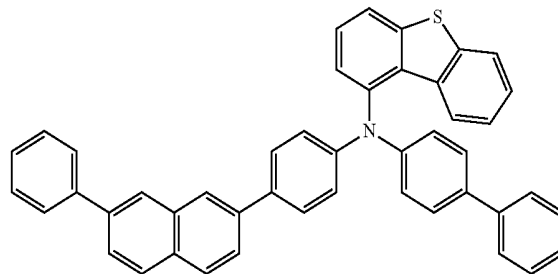


B44

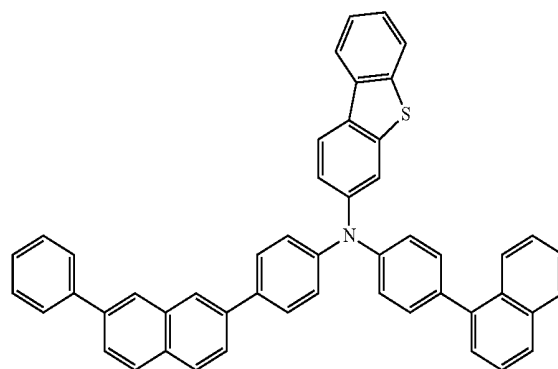


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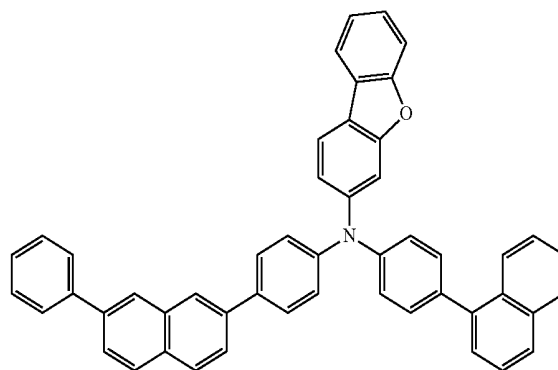
B45



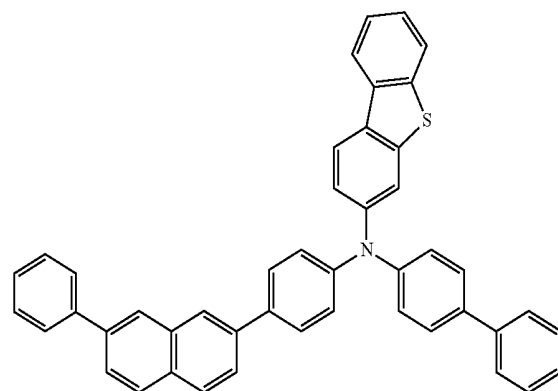
B46



B47

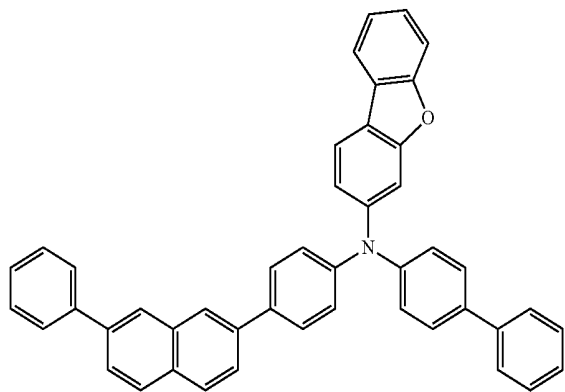


B48

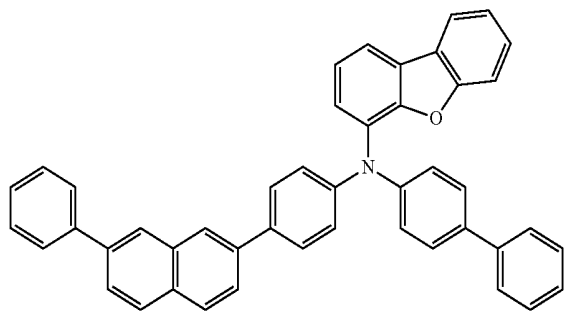


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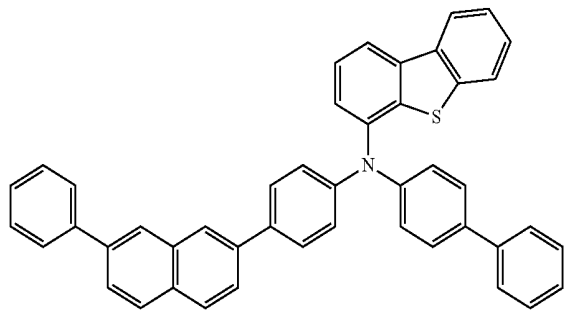
B49



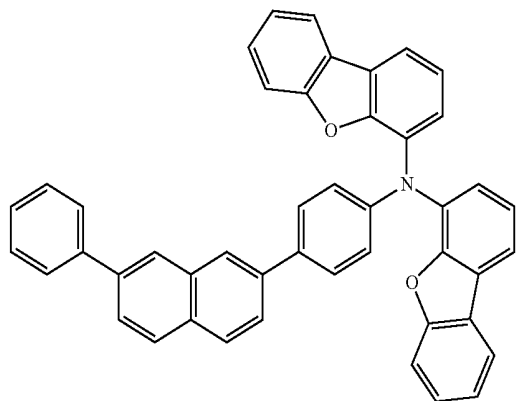
B50



B51

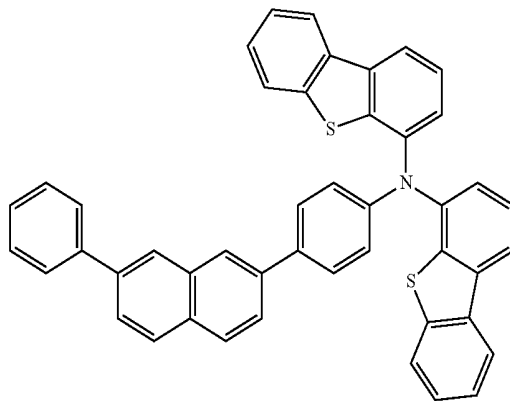


B52

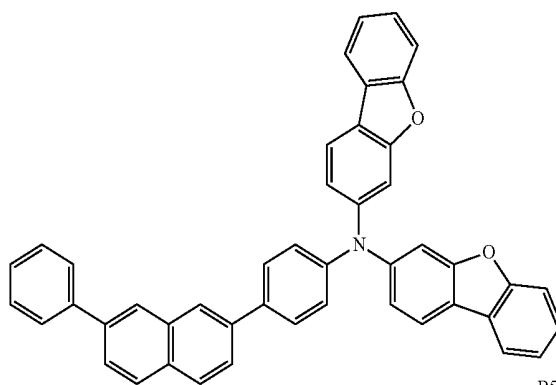


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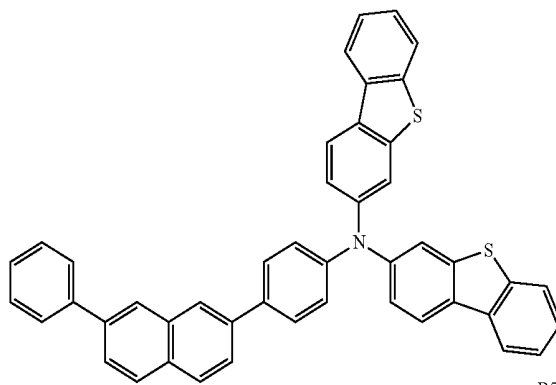
B53



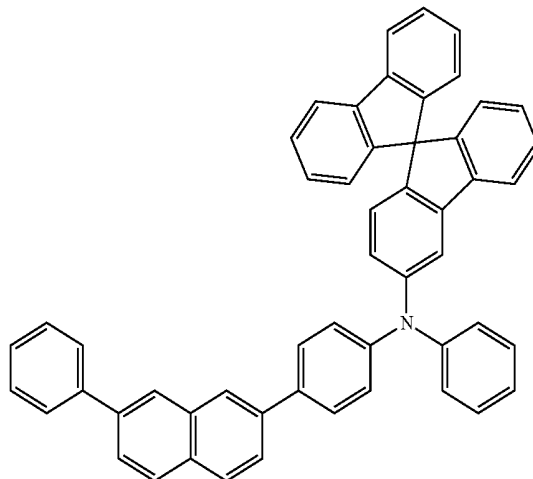
B54



B55

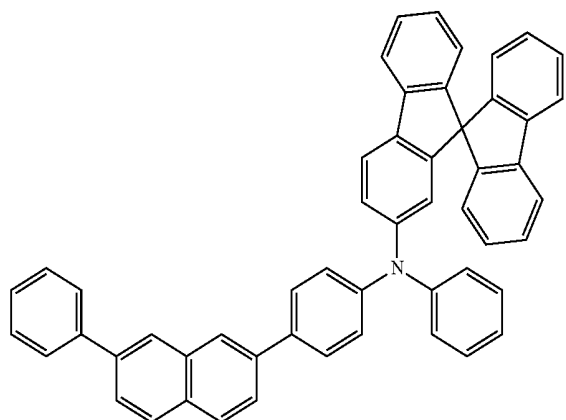


B56



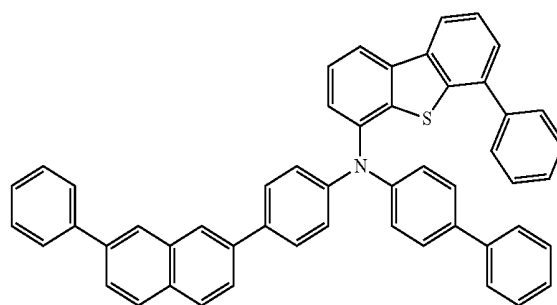
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B57



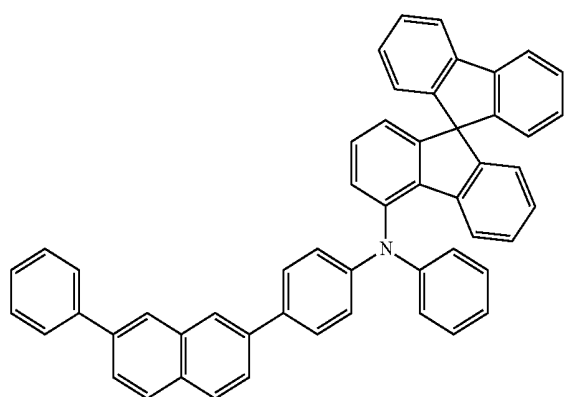
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B60

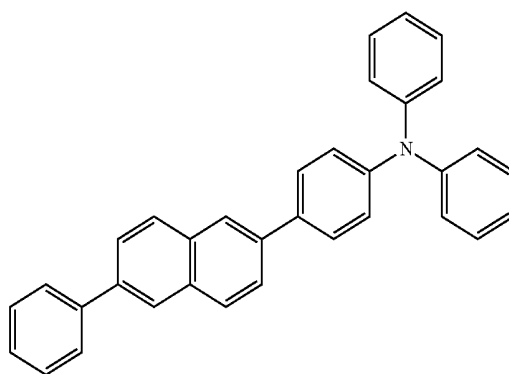


[Compound Group 3]

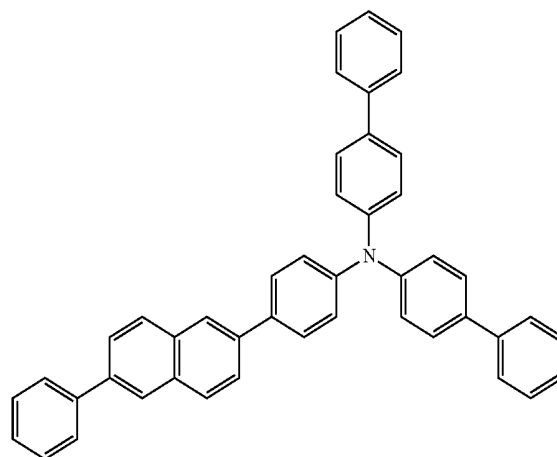
B58



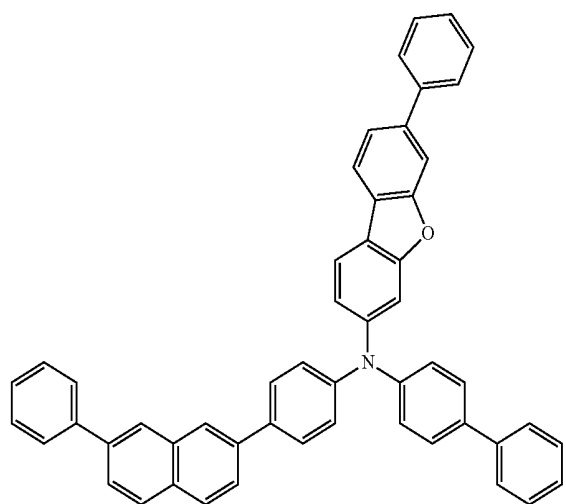
C1



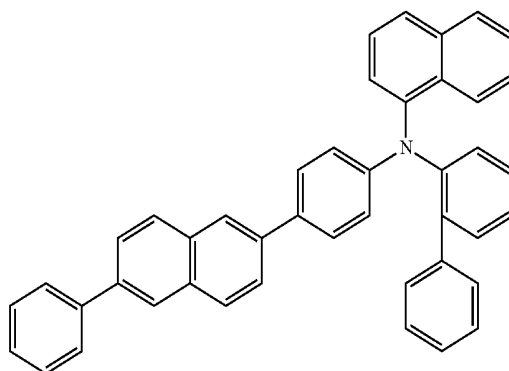
C2



B59

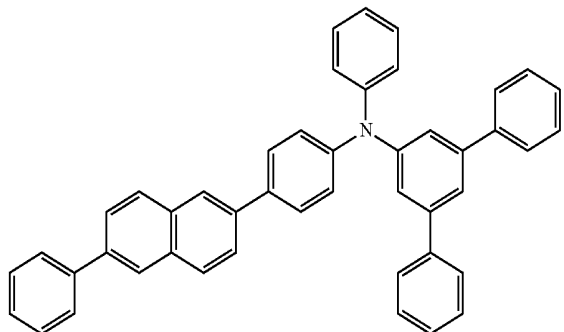


C3



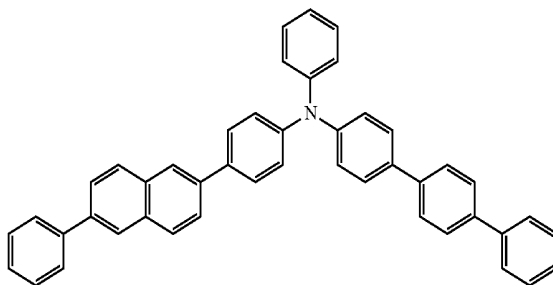
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C4

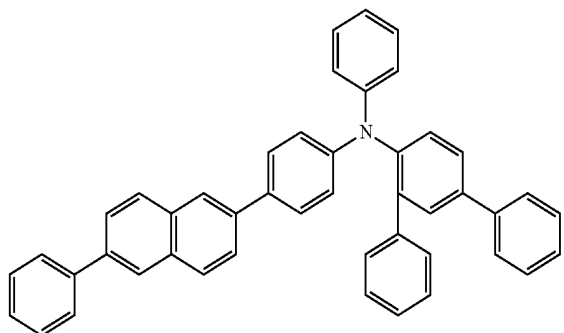


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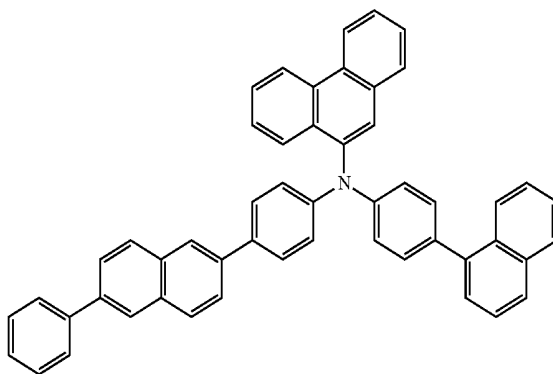
C8



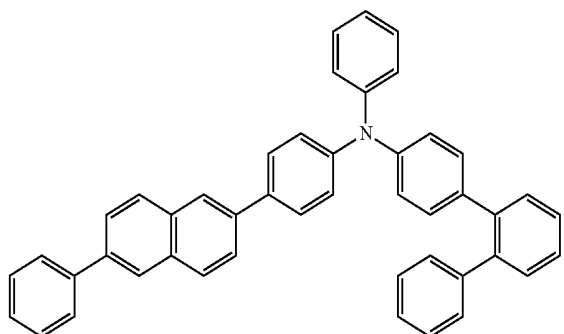
C5



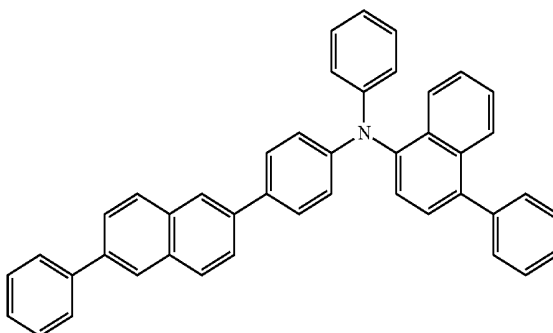
C9



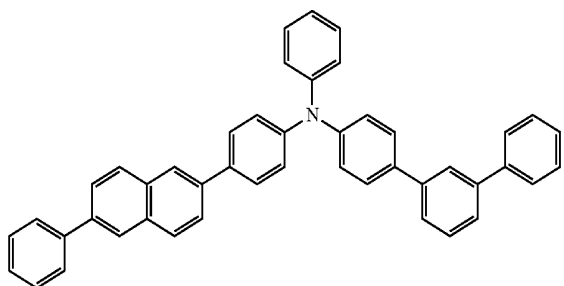
C6



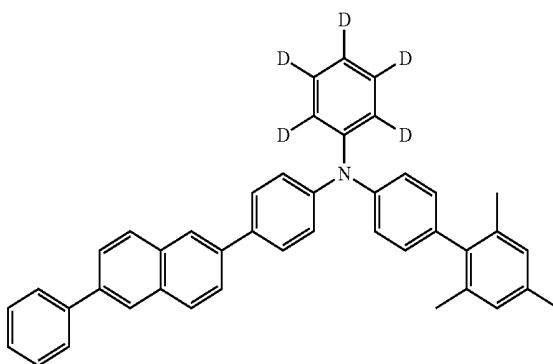
C10



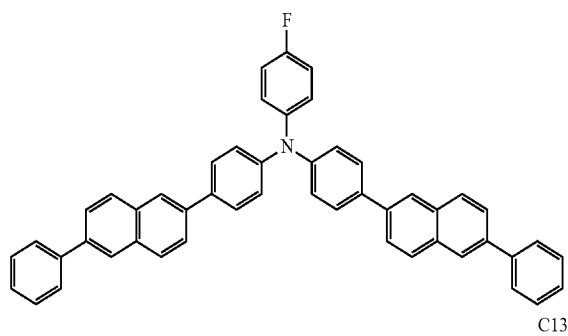
C7



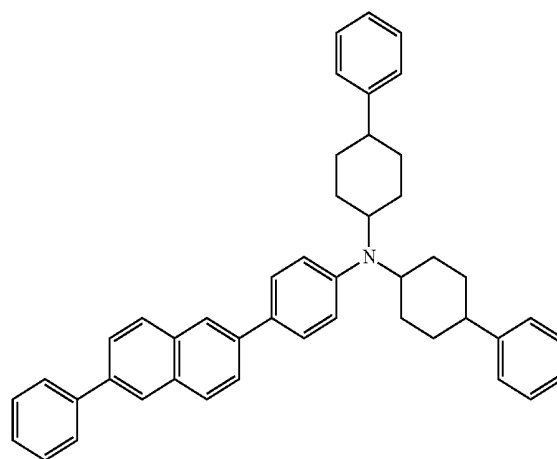
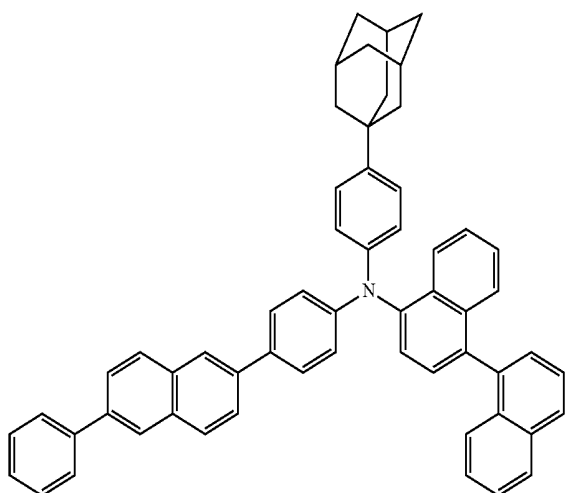
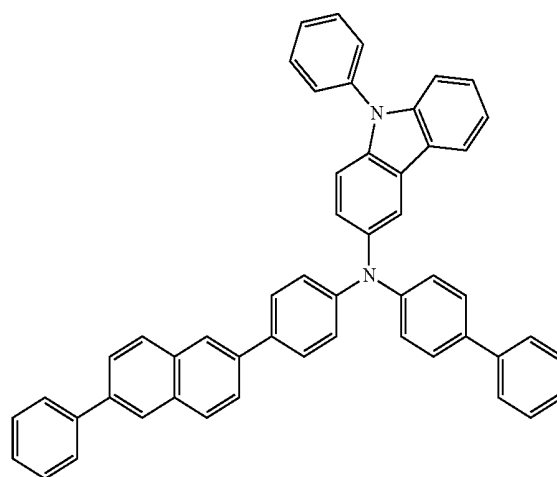
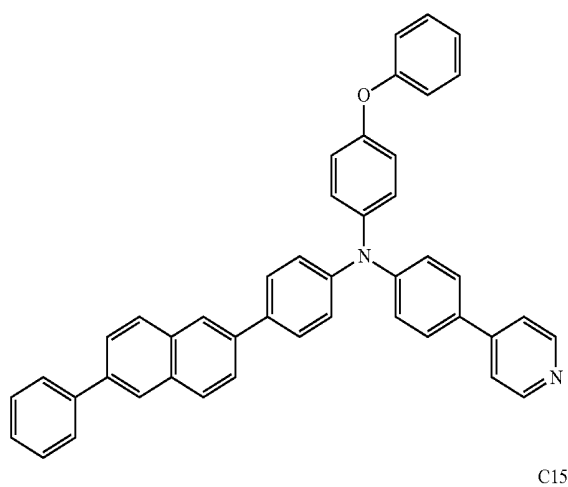
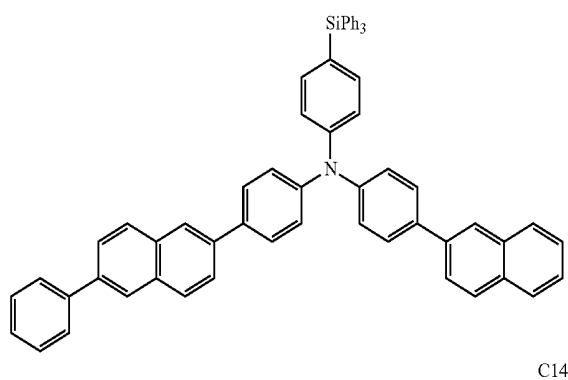
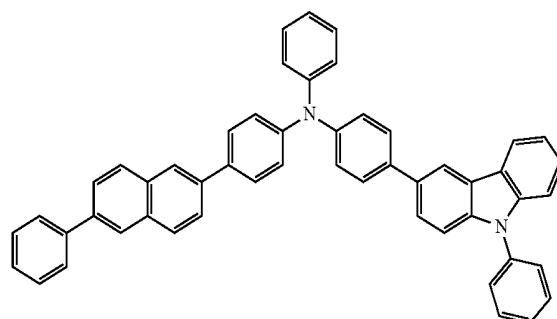
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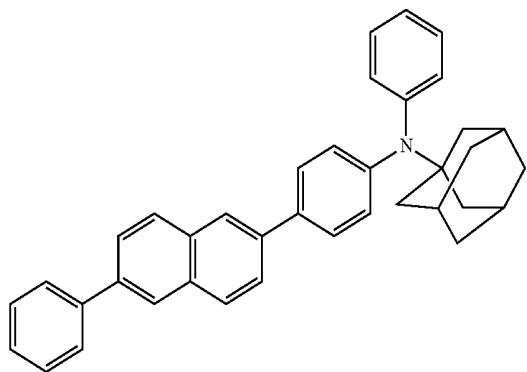


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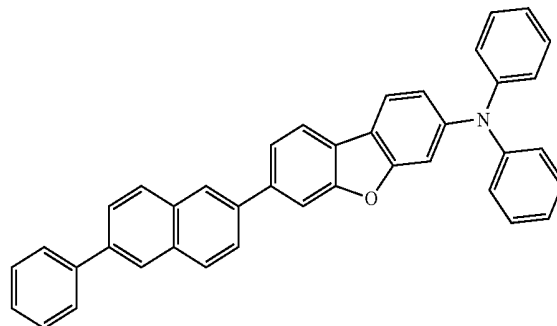
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C19

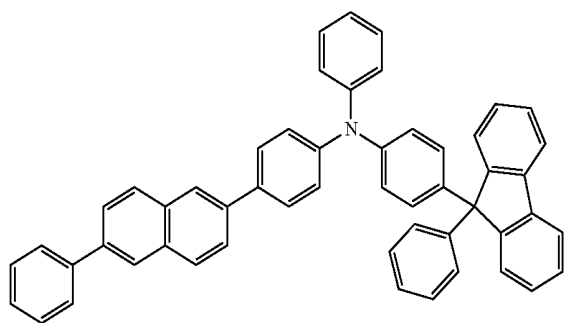


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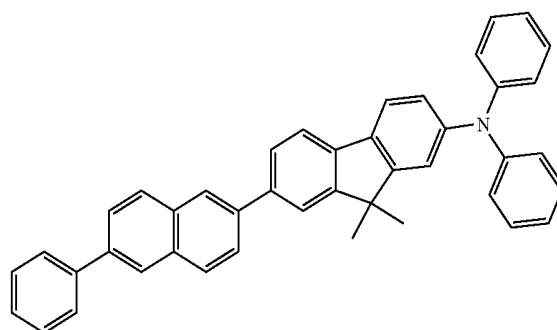
C23



C20

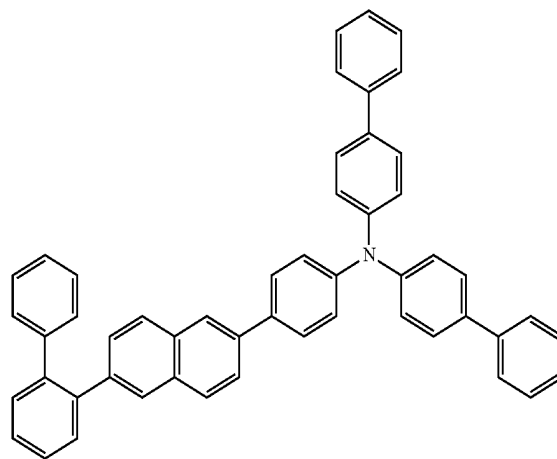
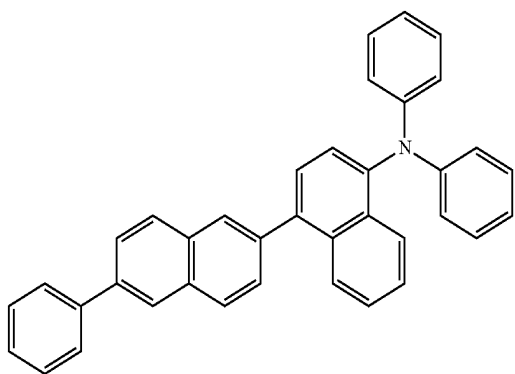


C24

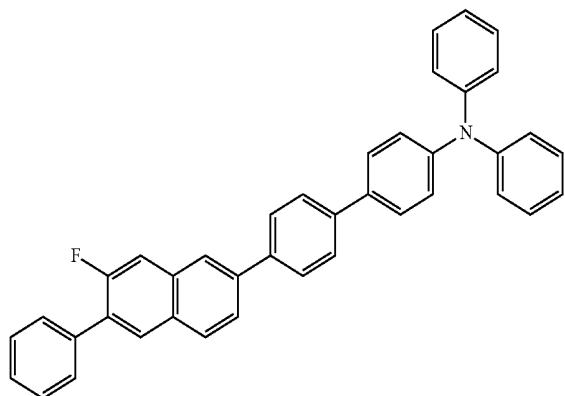


C25

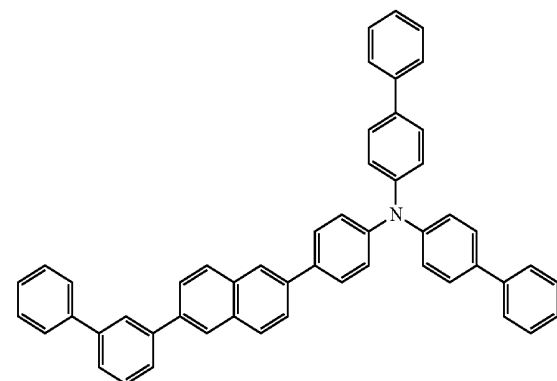
C21



C22

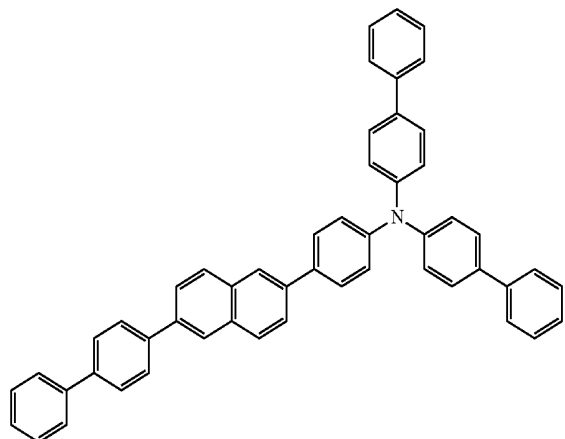


C26



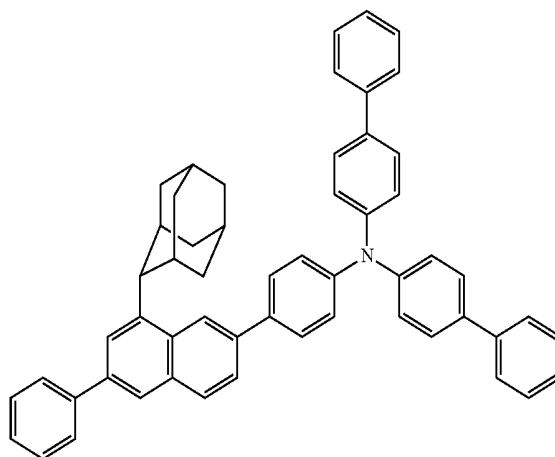
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C27



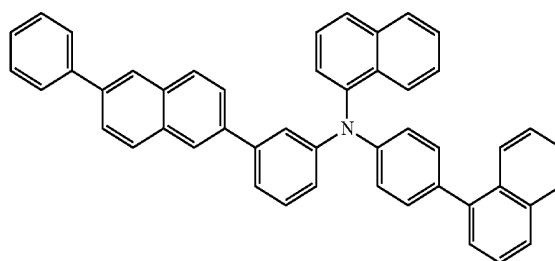
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C30

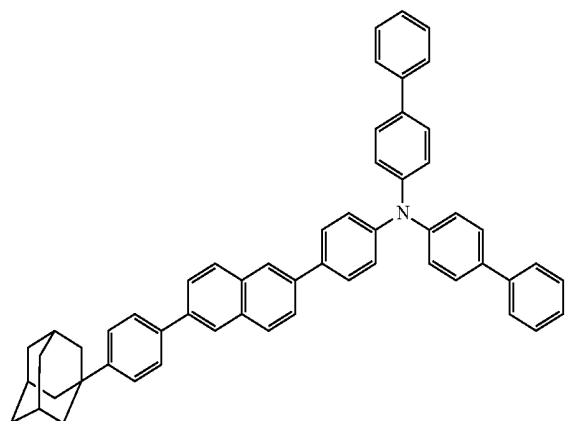


C31

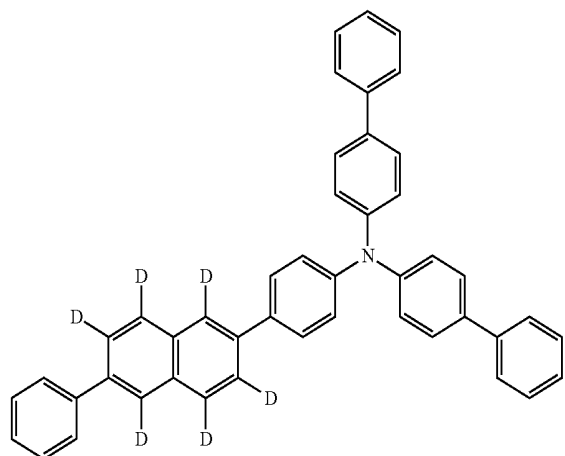
C28



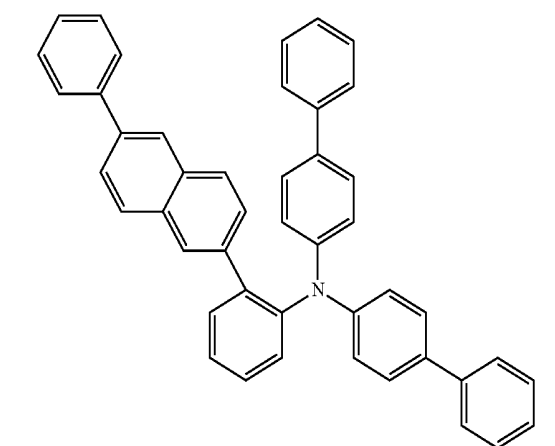
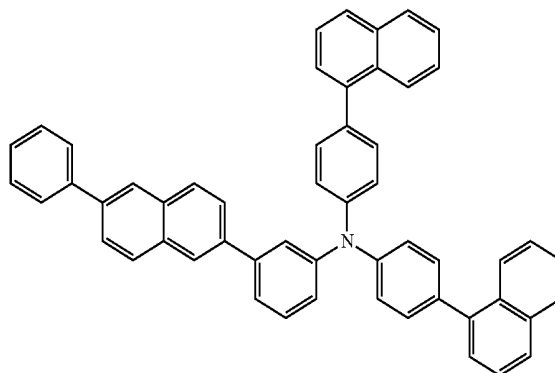
C32



C29

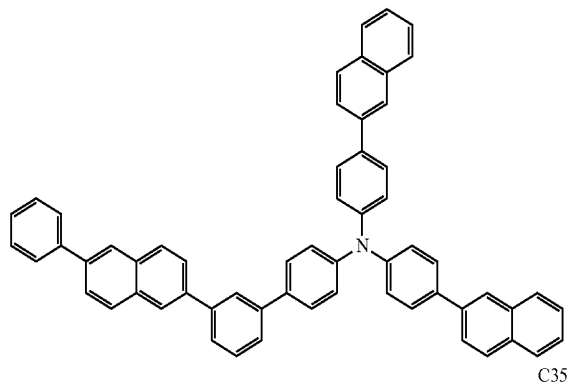


C33



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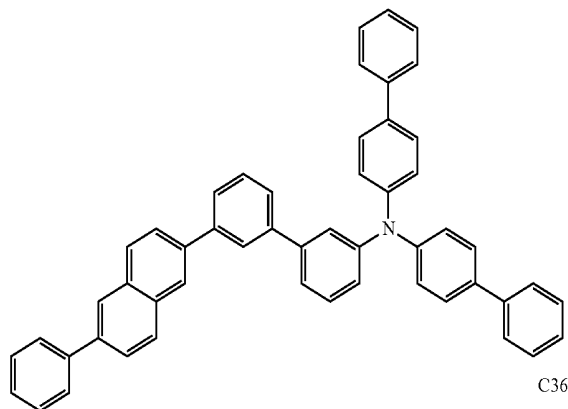
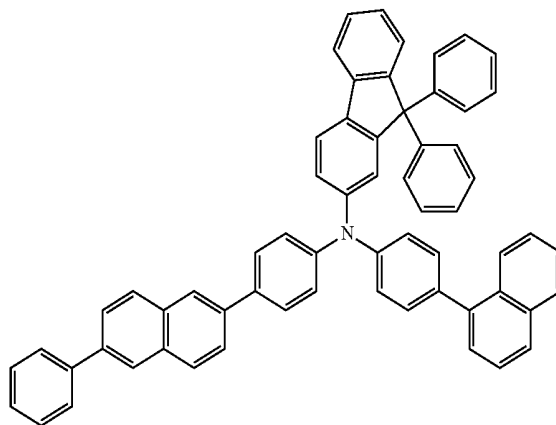
C34



C35

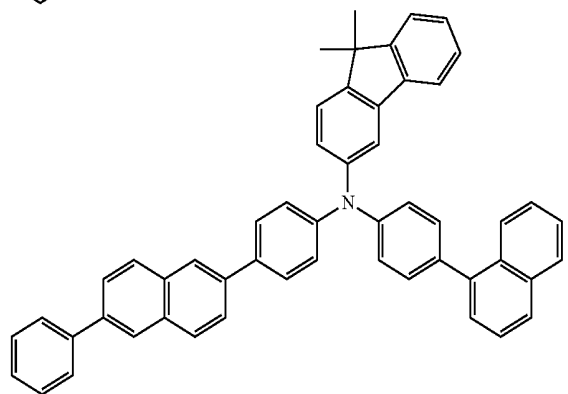
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C38

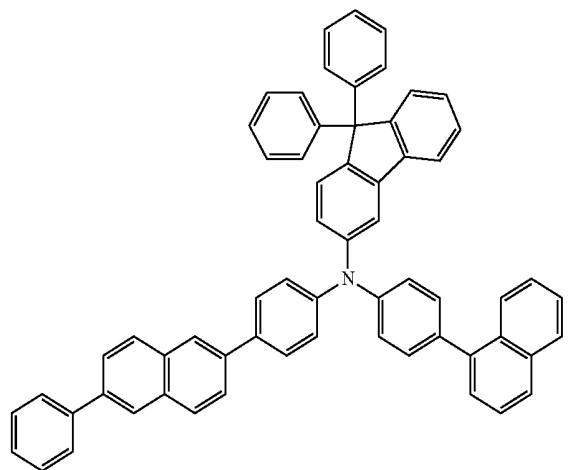
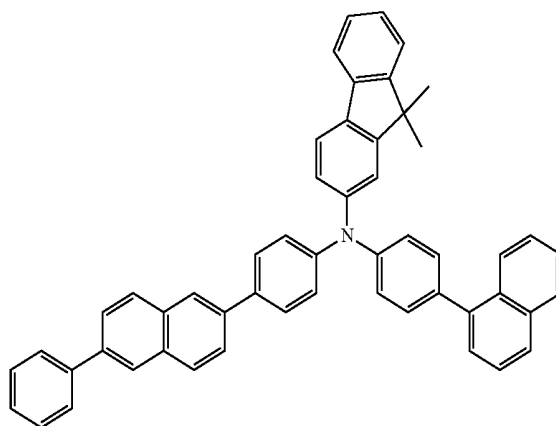


C36

C39

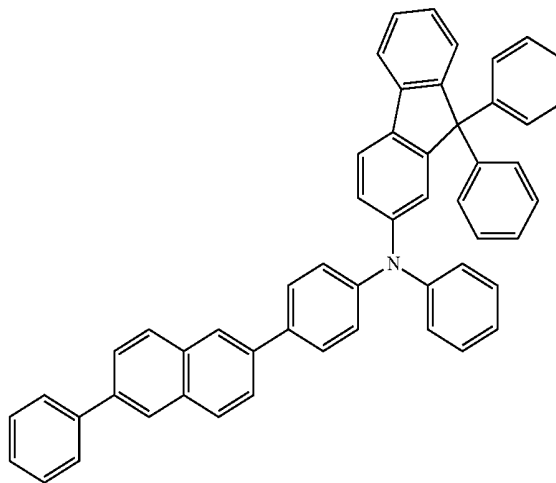


C37



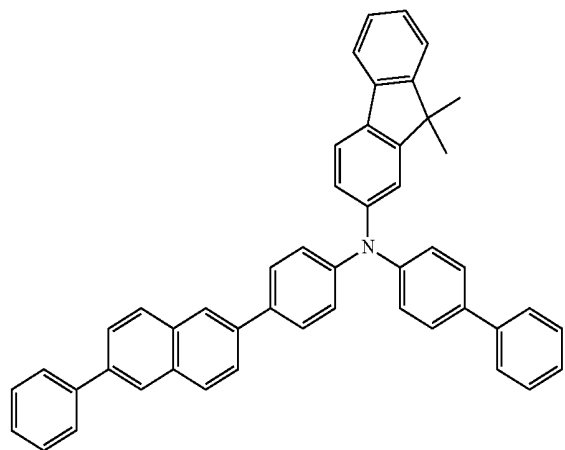
C37

C40

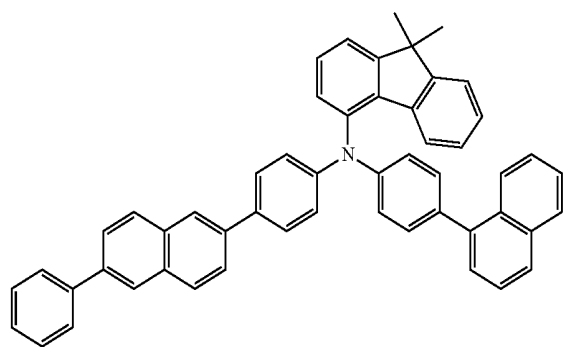


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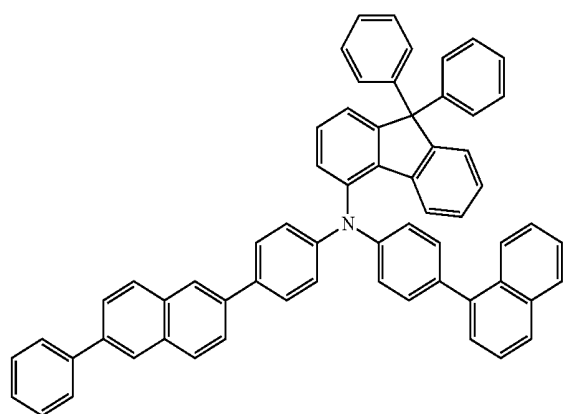
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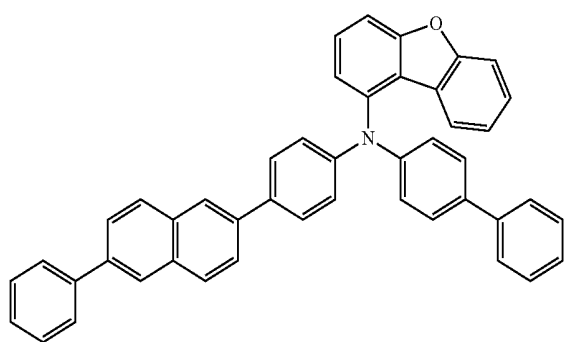
C42



C43

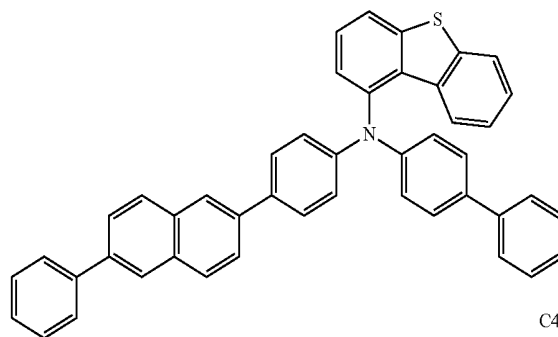


C44

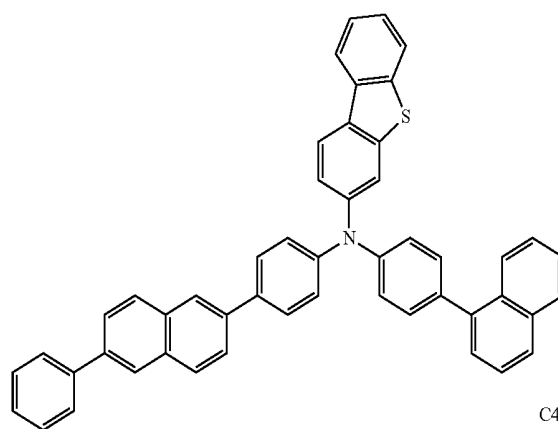


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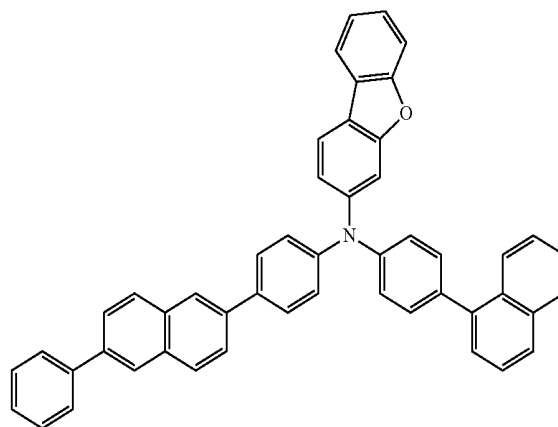
C45



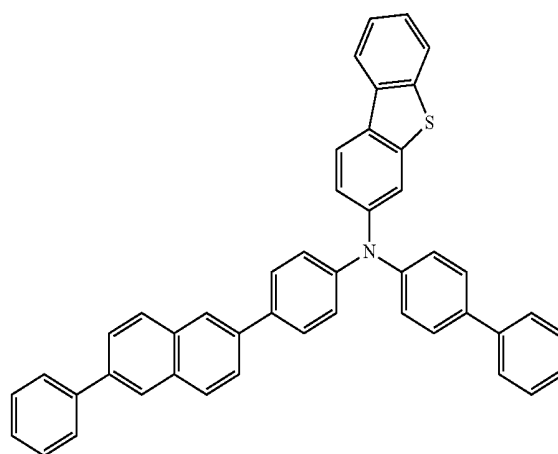
C46



C47

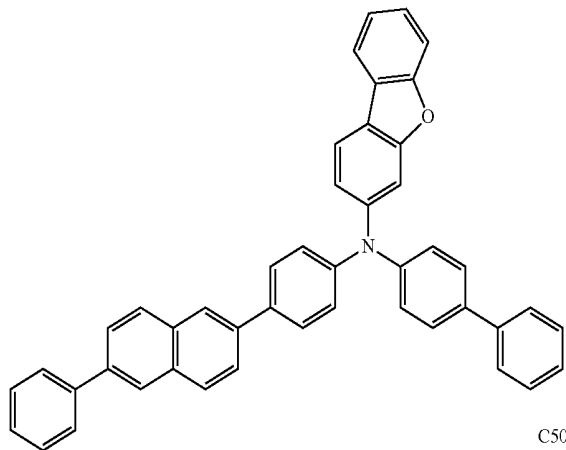


C48

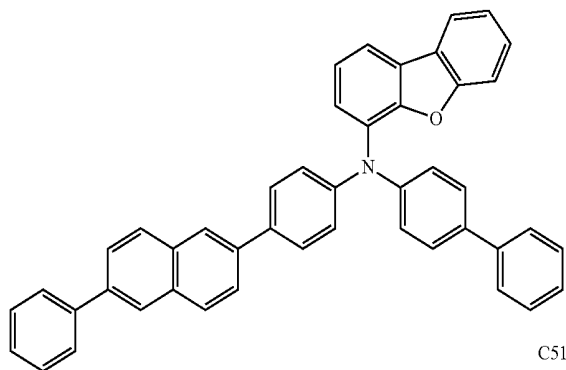


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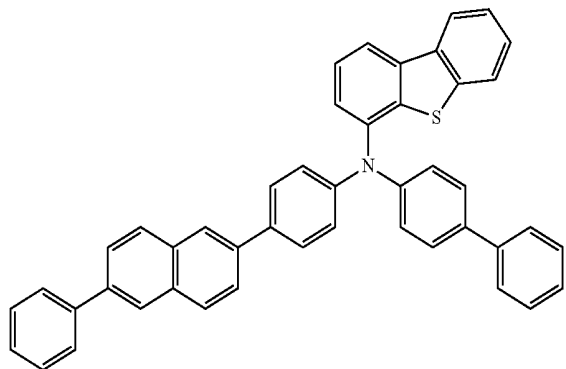
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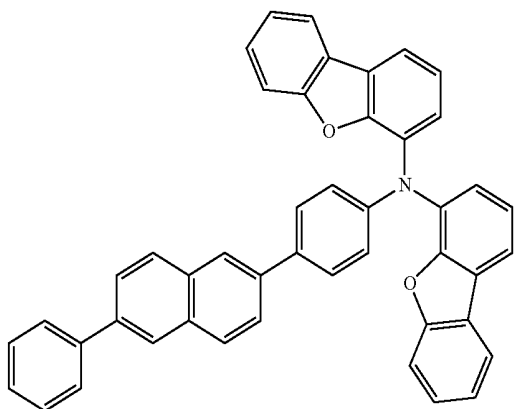
C50



C51



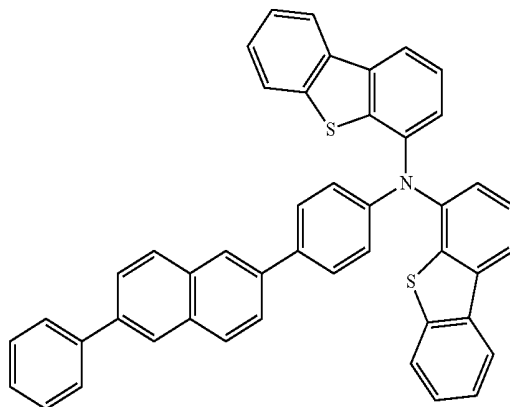
C52



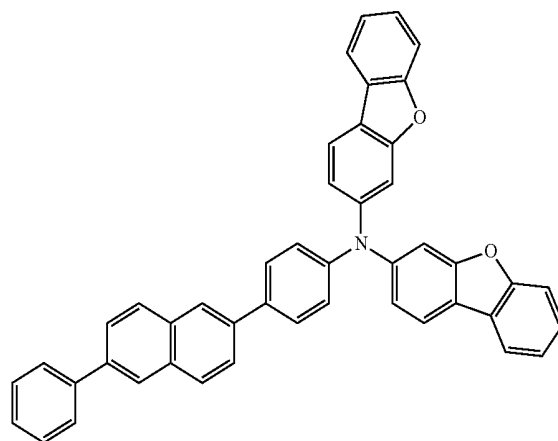
C53

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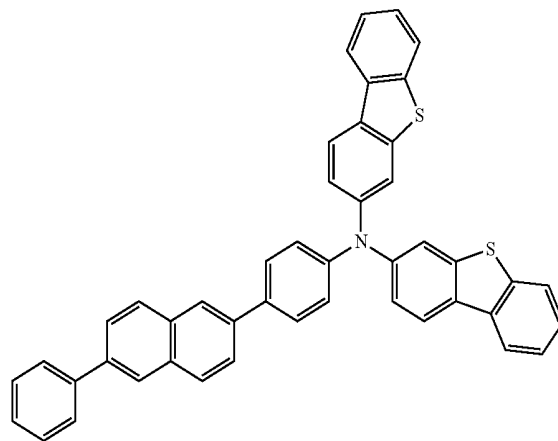
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C54



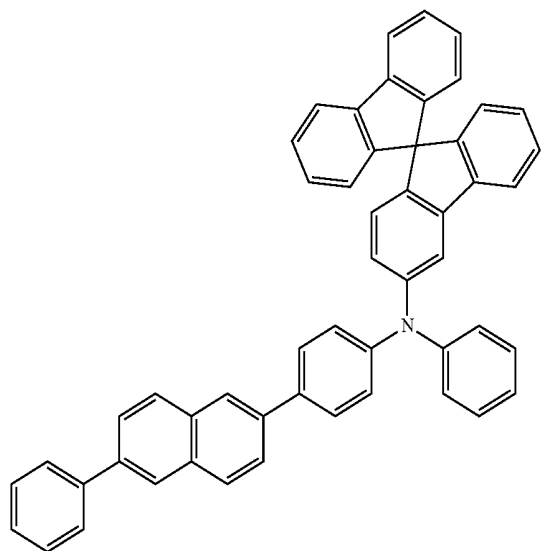
C55



C56

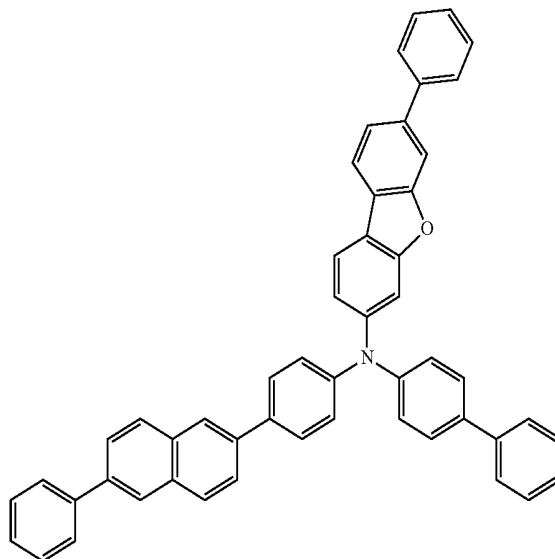
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C56

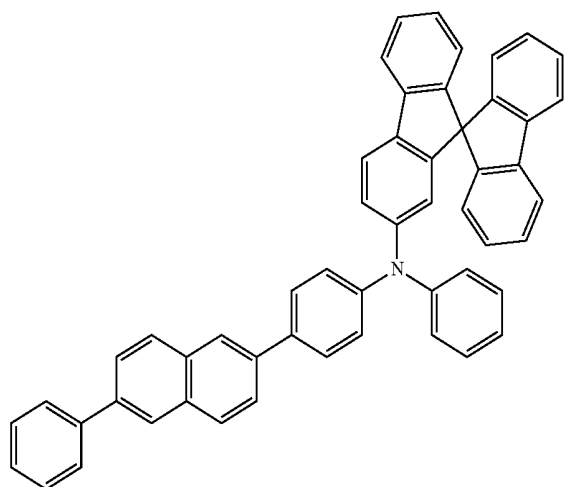


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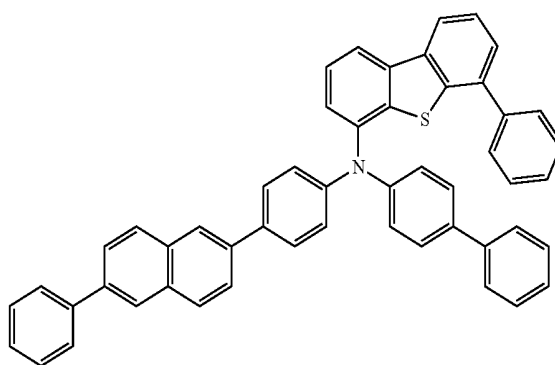
C59



C57

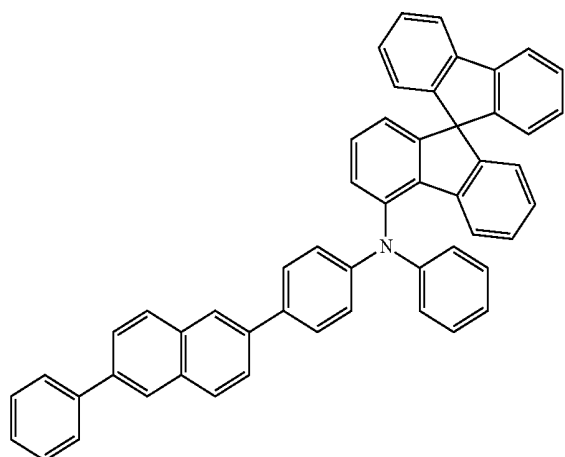


C60

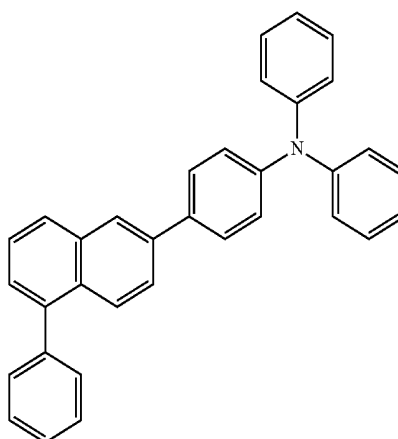


[Compound Group 4]

C58

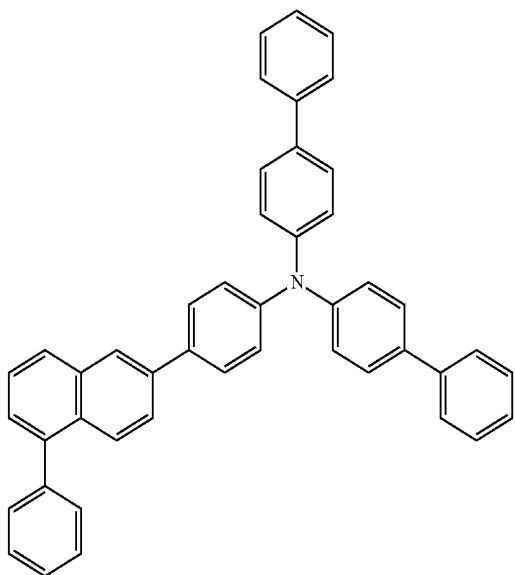


D1



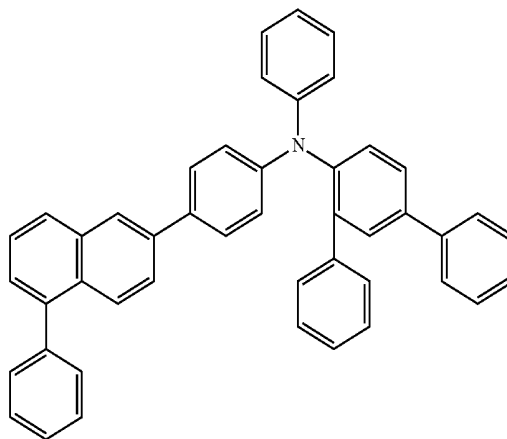
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D2



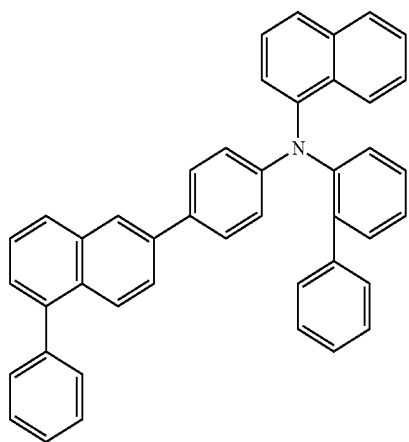
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D5



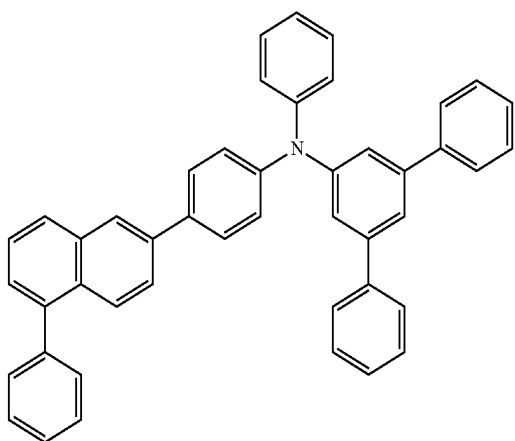
D6

D3

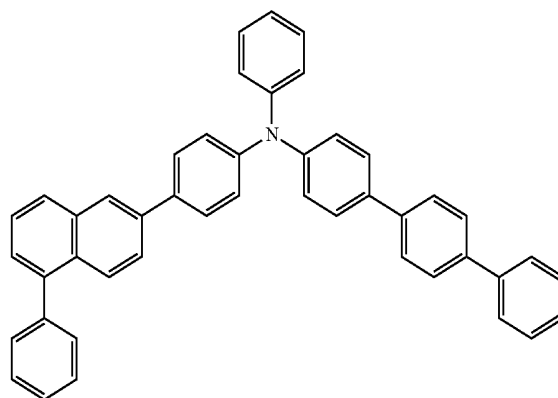


D7

D4

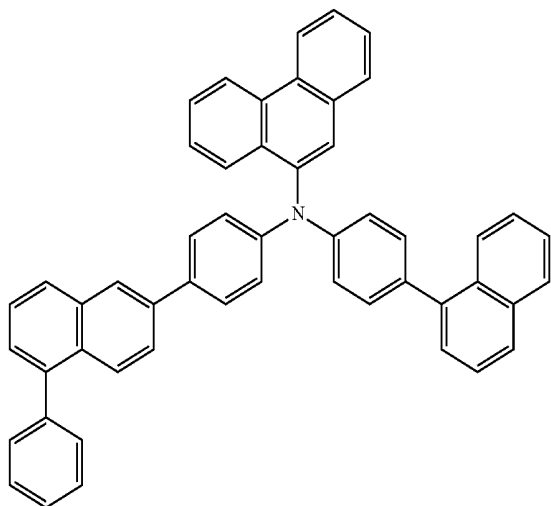


D8



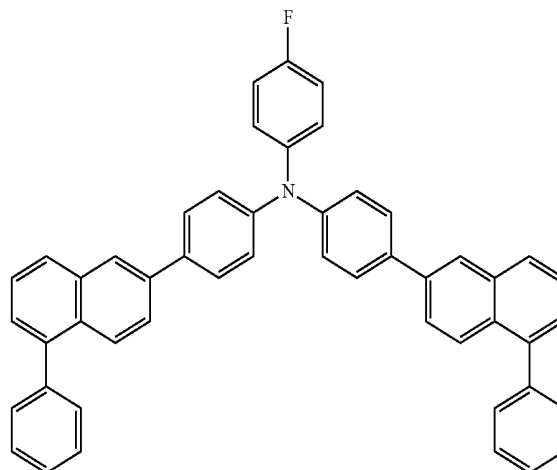
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D9

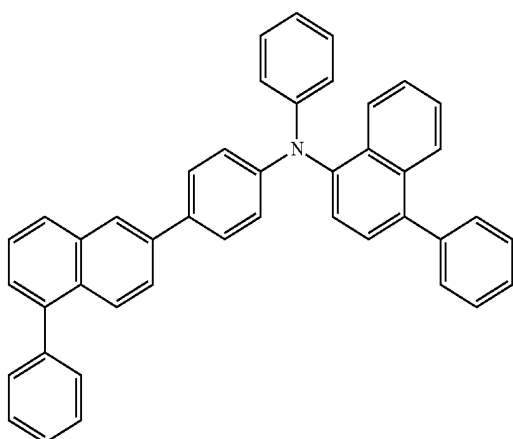


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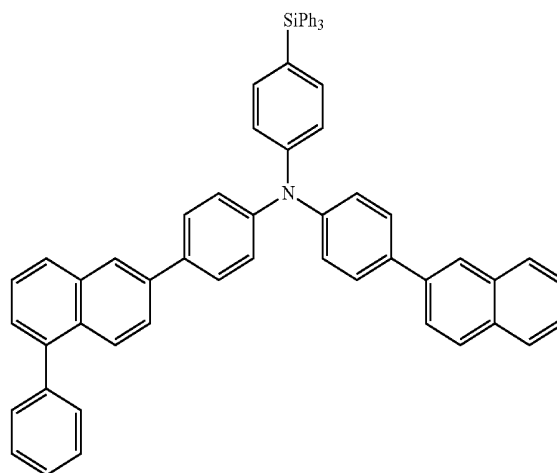
D12



D10

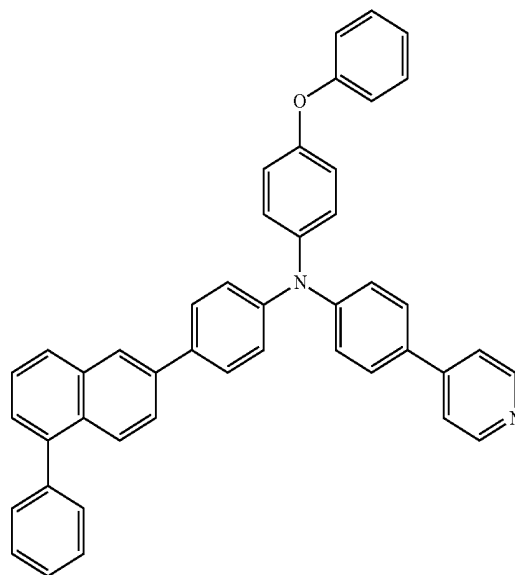
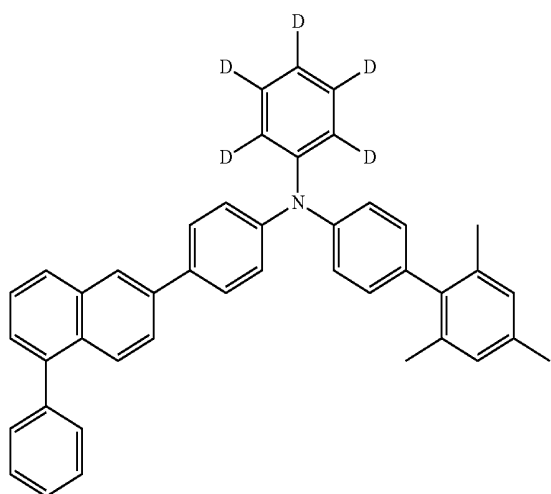


D13



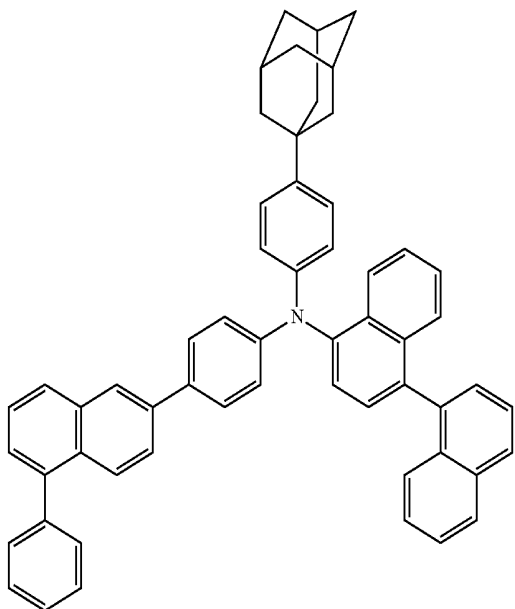
D14

D11



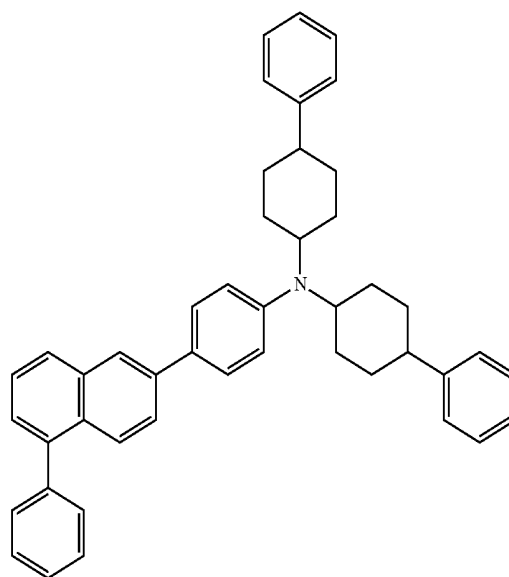
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D15

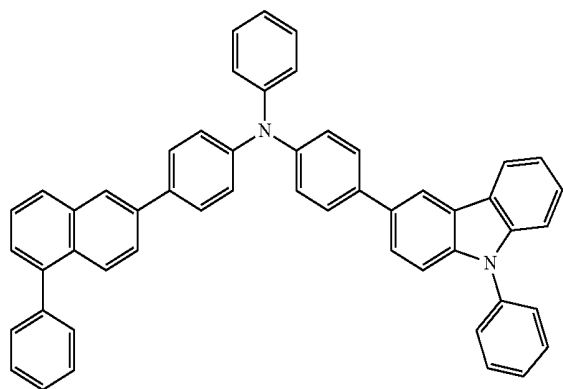


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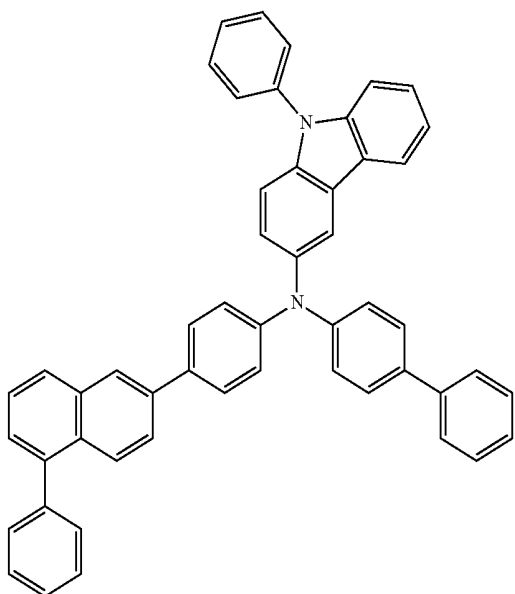
D18



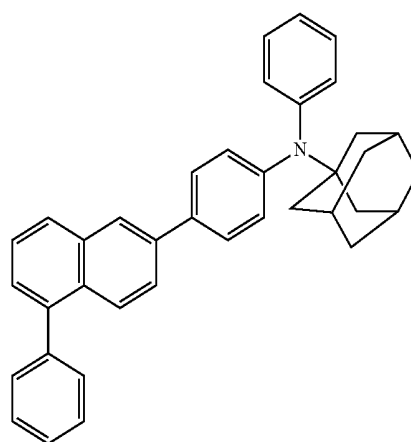
D16



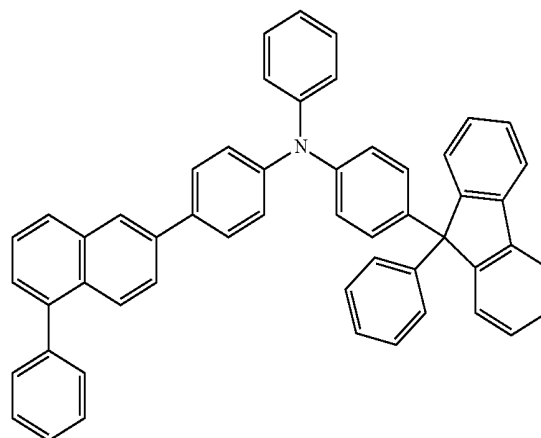
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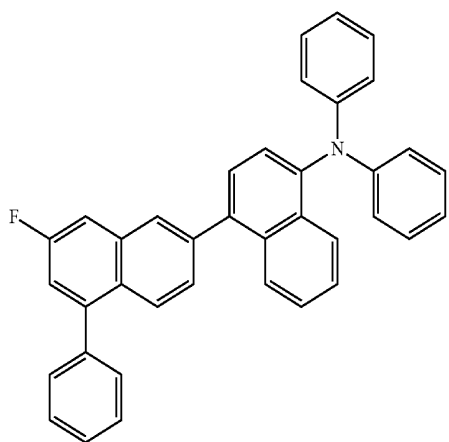
D19



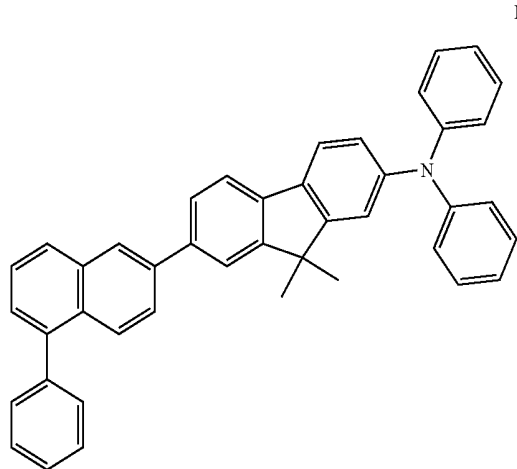
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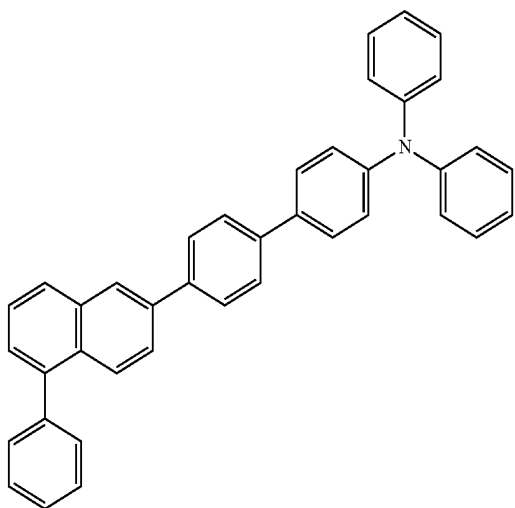
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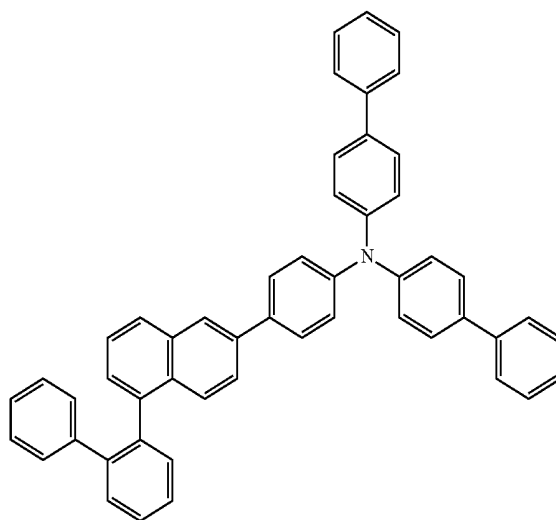
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D22

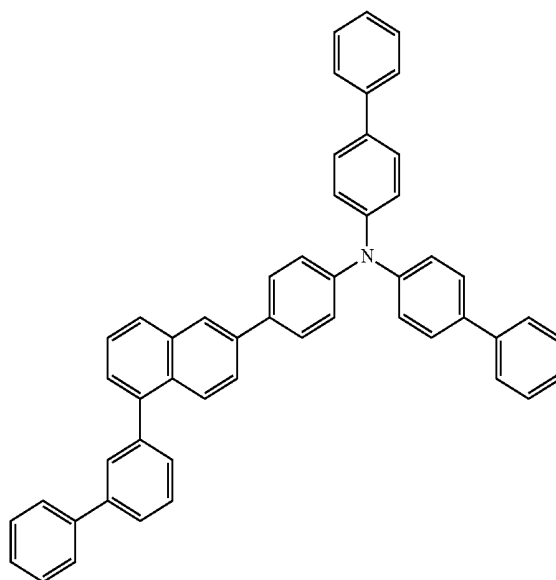
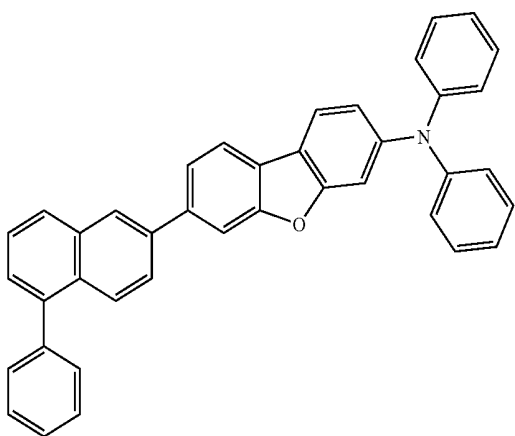


D25



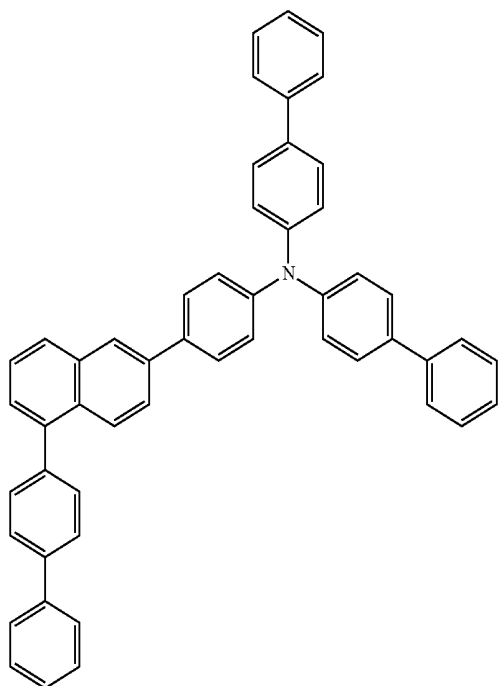
D26

D23



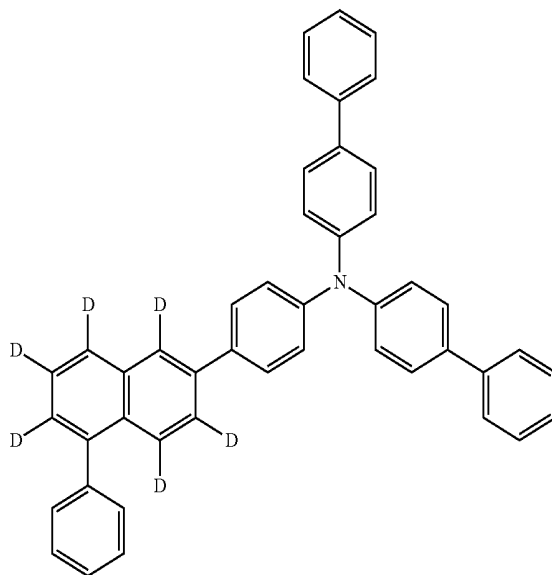
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D27



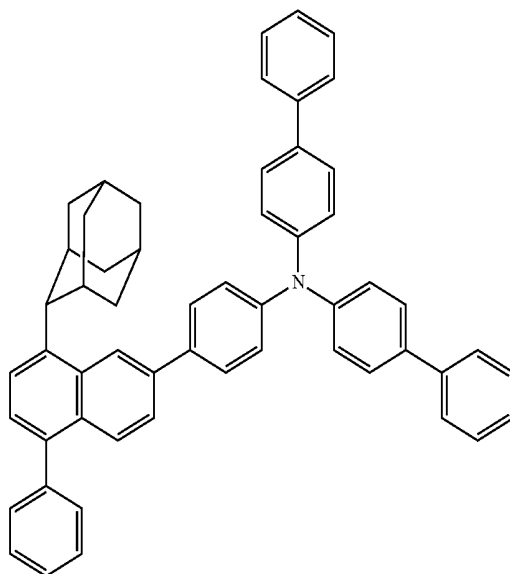
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D29

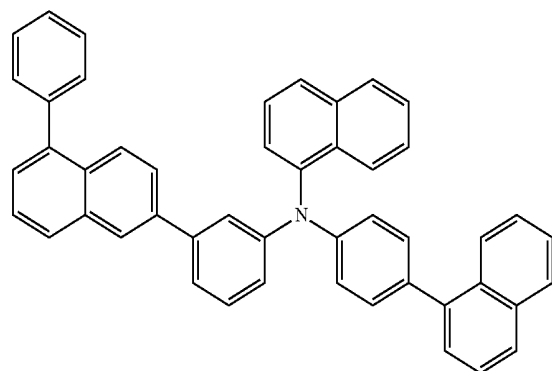
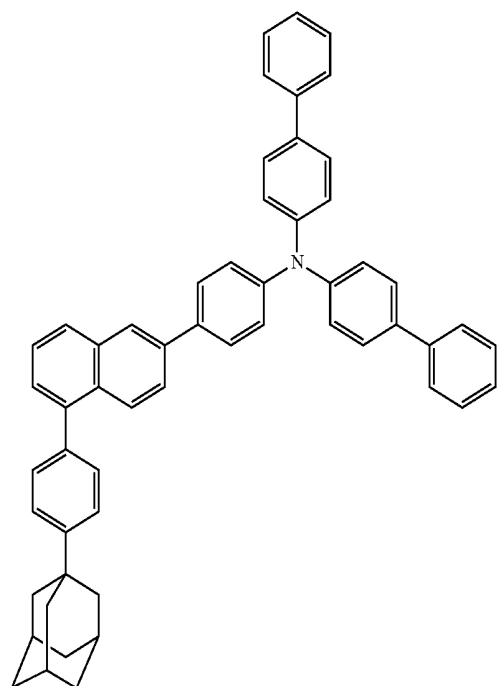


D30

D28

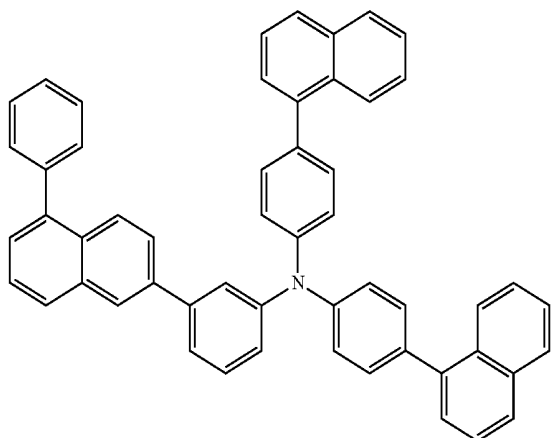


D31



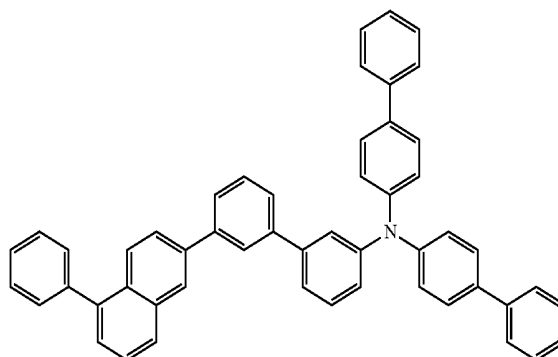
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D32



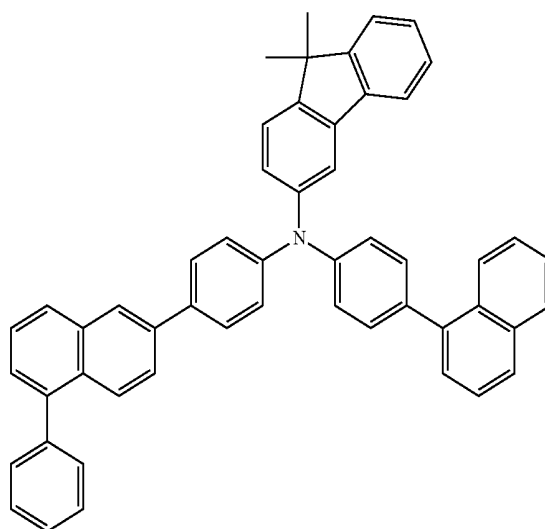
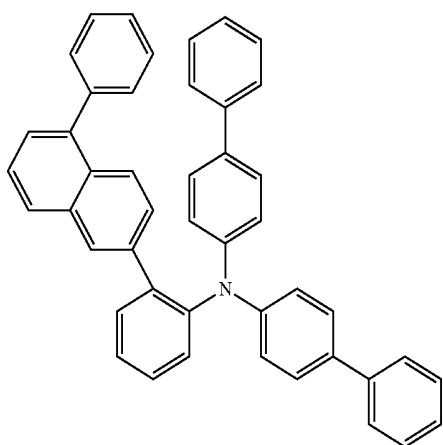
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D35



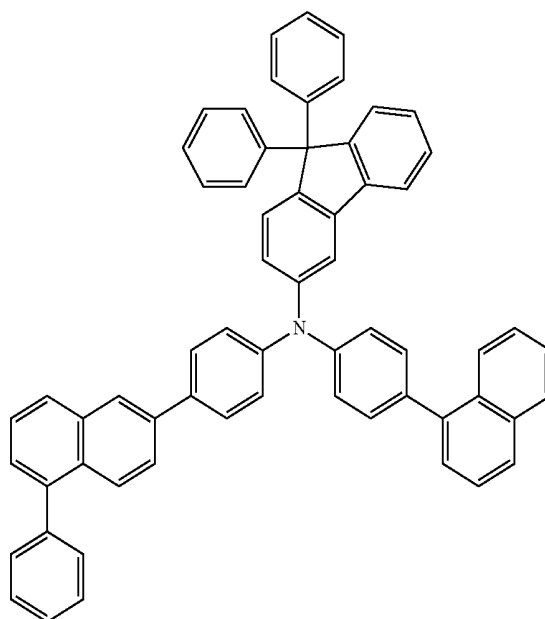
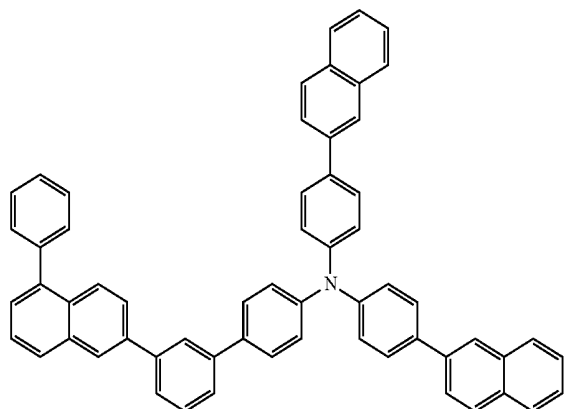
D36

D33



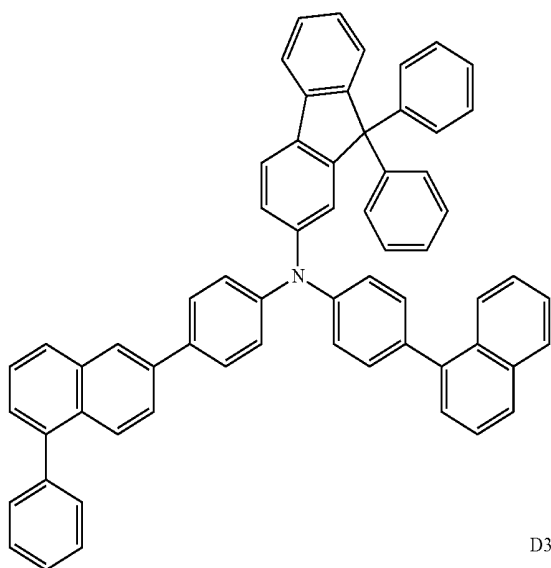
D37

D34

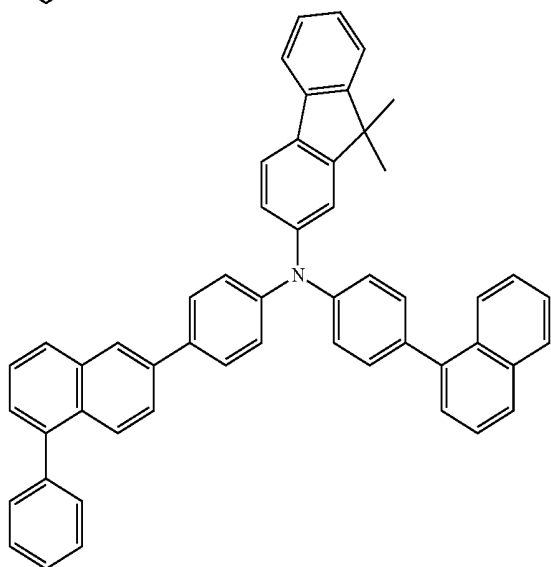


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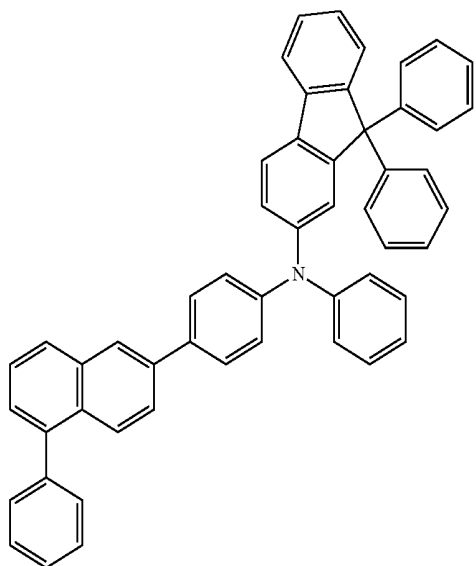
D38



D39

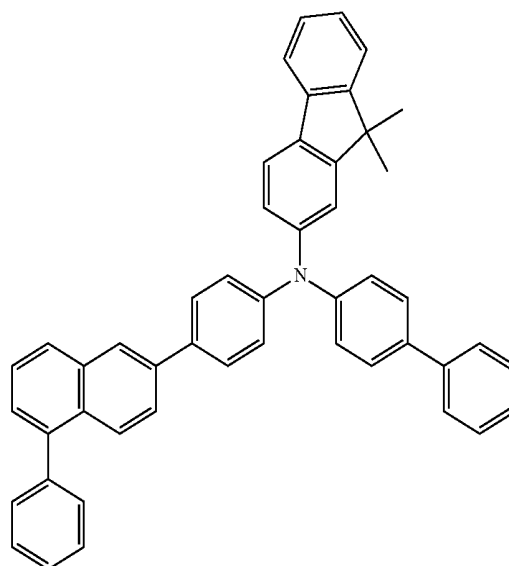


D40

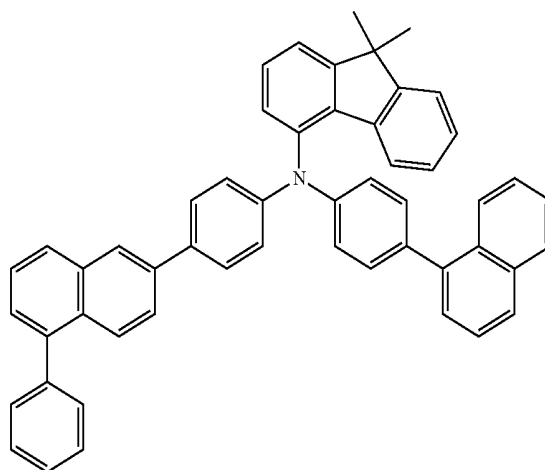


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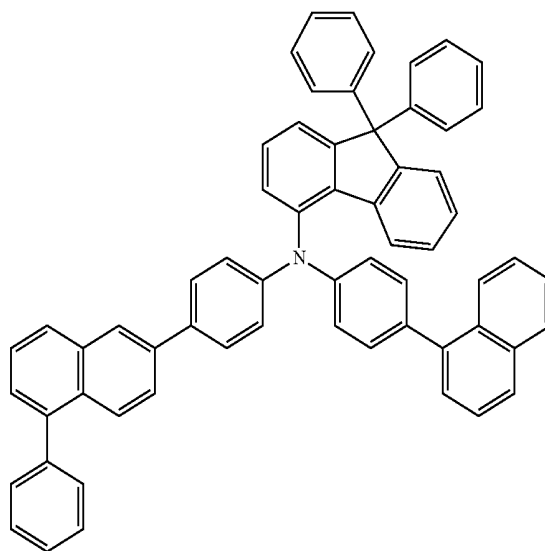
D41



D42

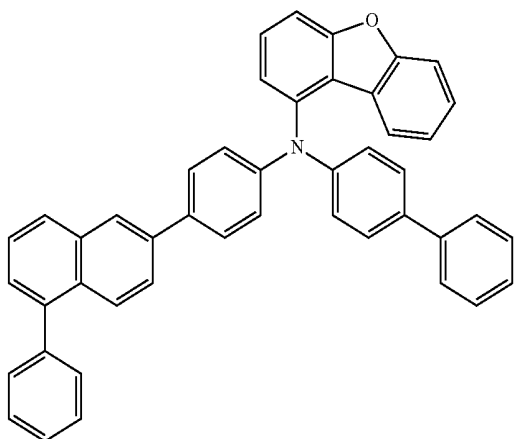


D43



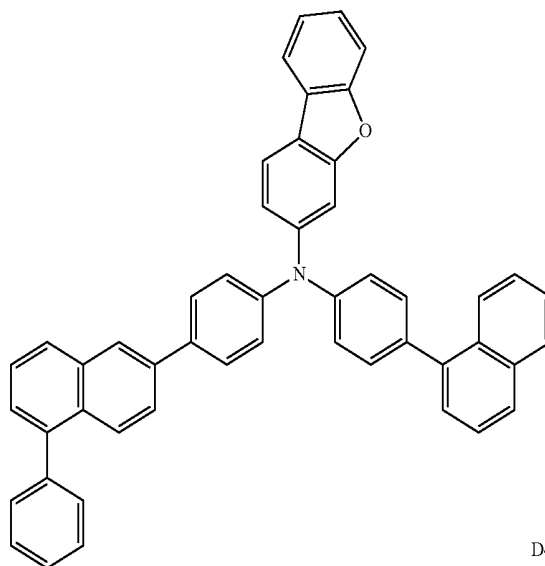
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D44



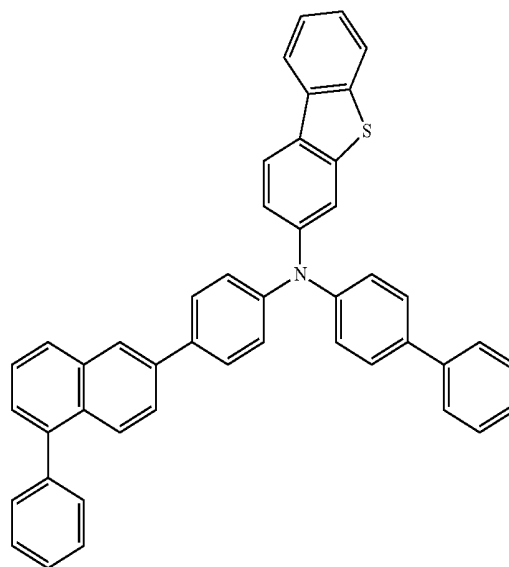
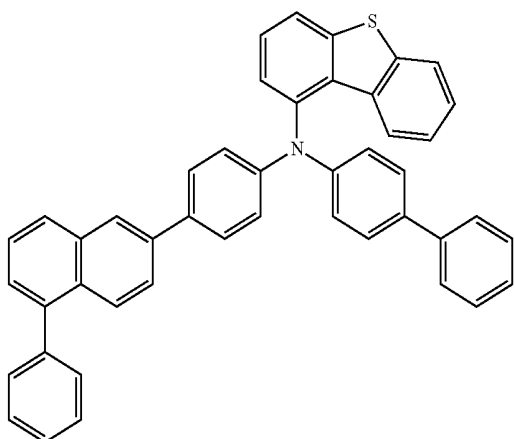
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D47



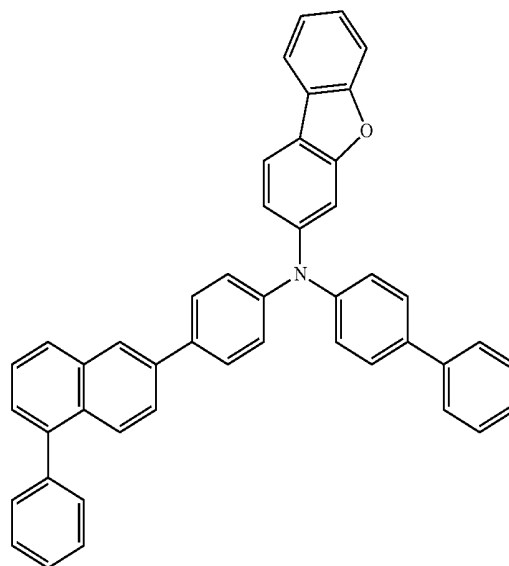
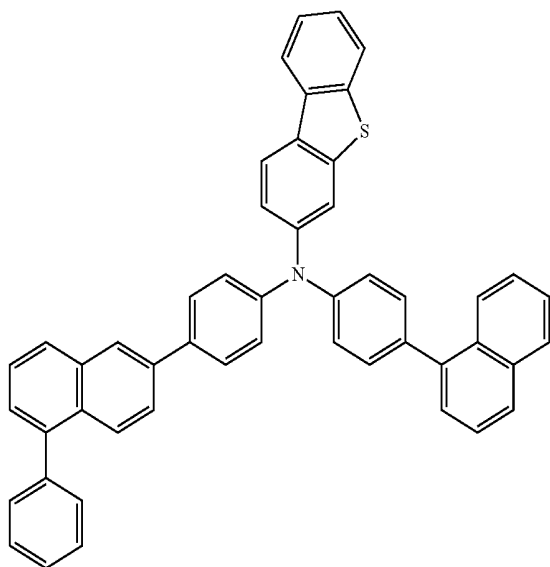
D45

D48



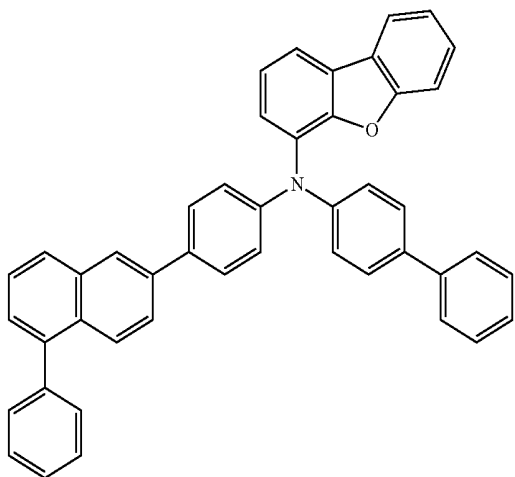
D46

D49



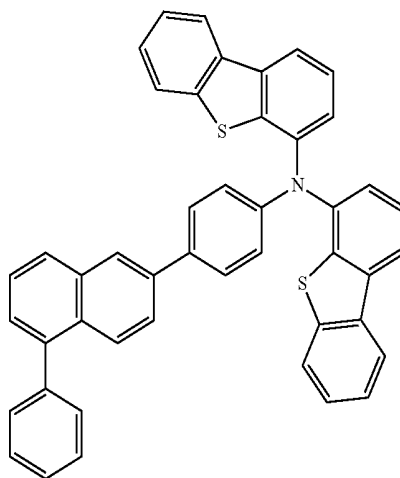
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D50



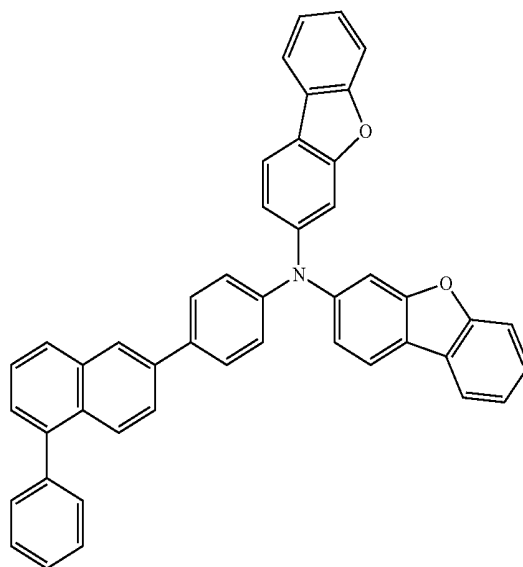
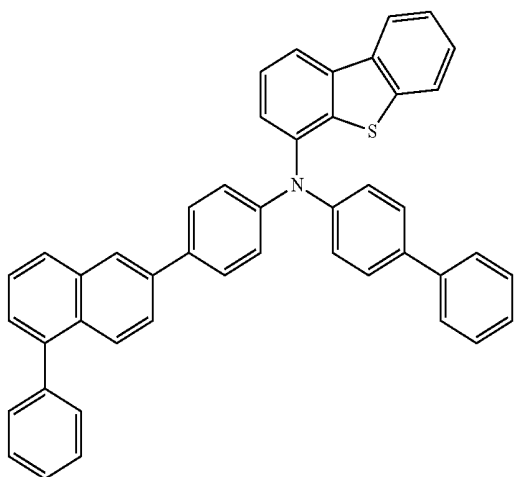
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D53



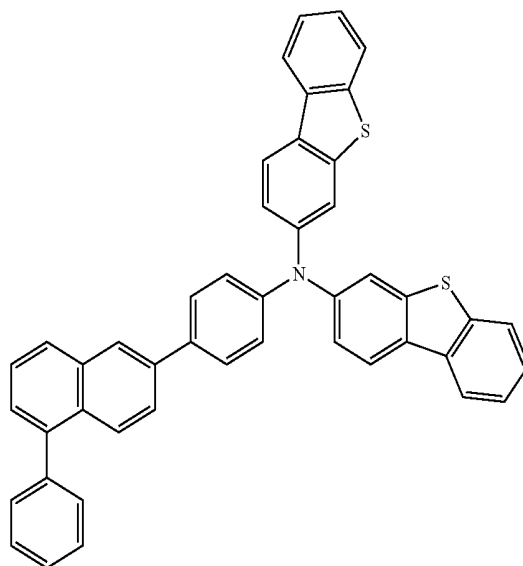
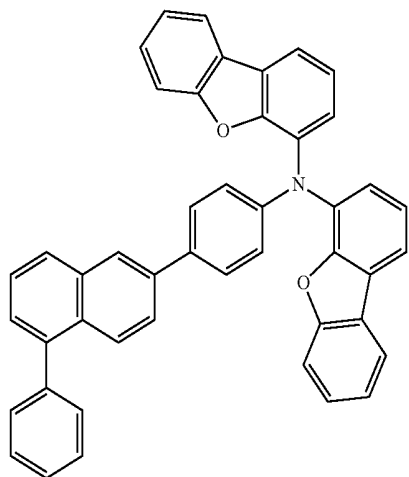
D54

D51



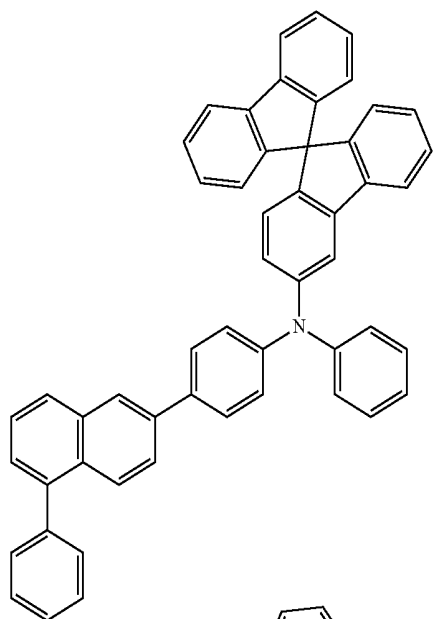
D55

D52



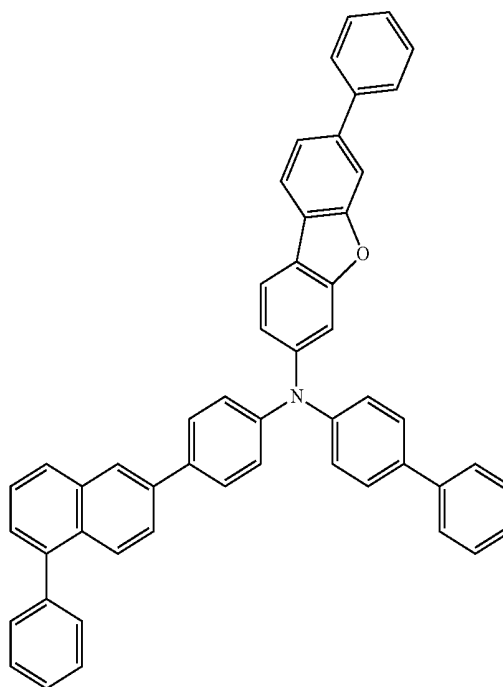
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D56



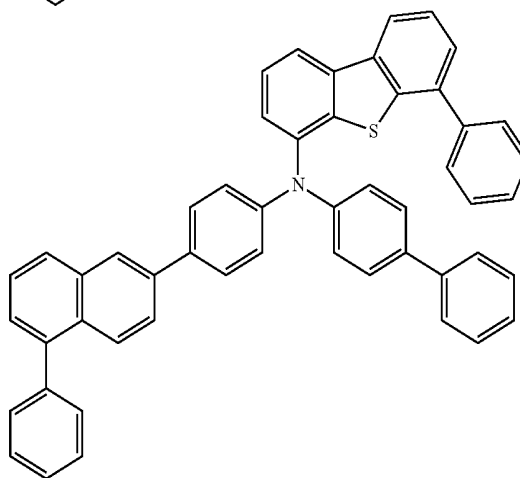
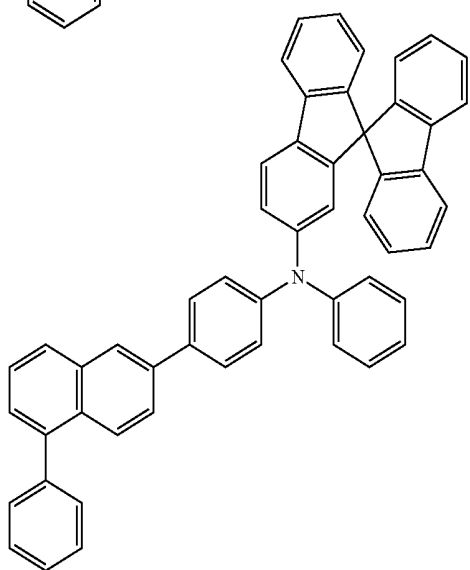
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D59



D57

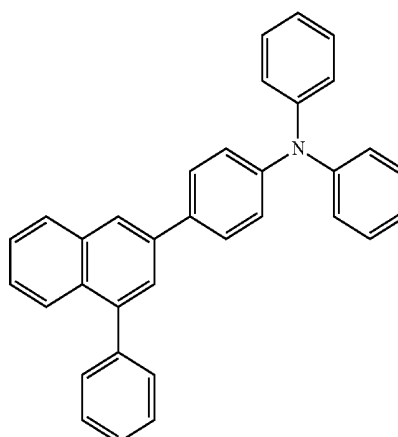
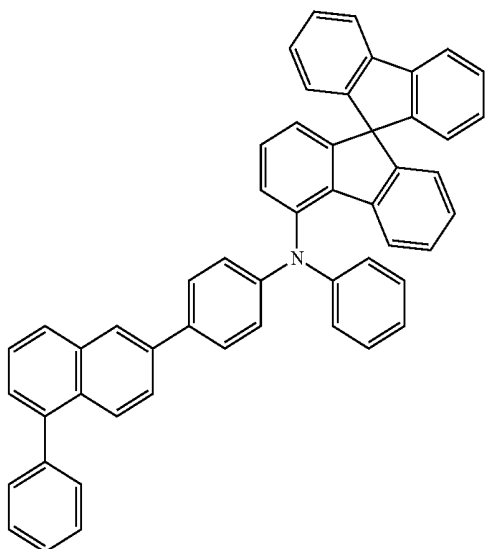
D60



D58

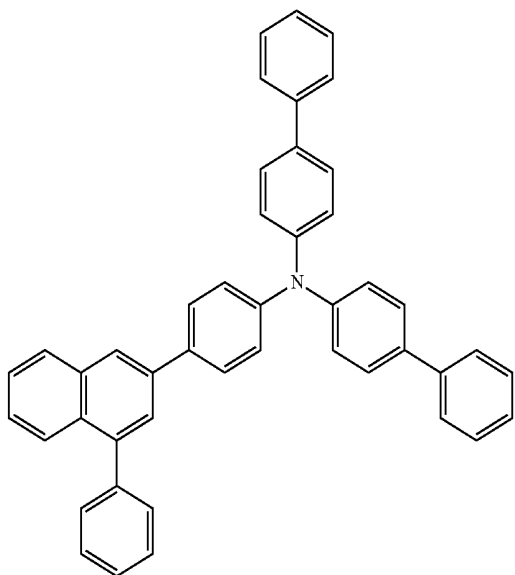
[Compound Group 5]

E1



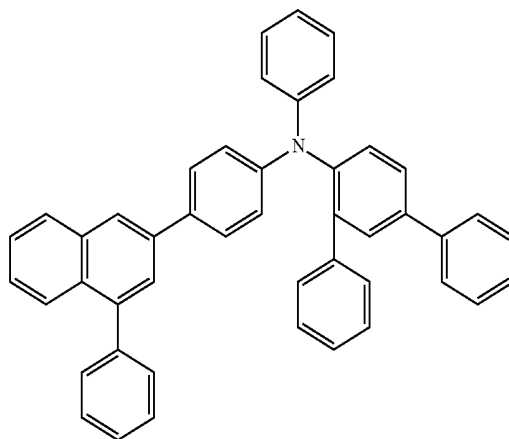
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E2



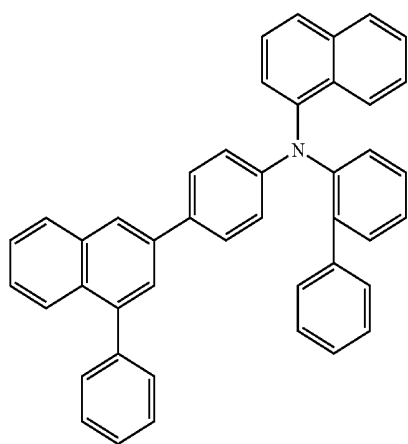
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E5



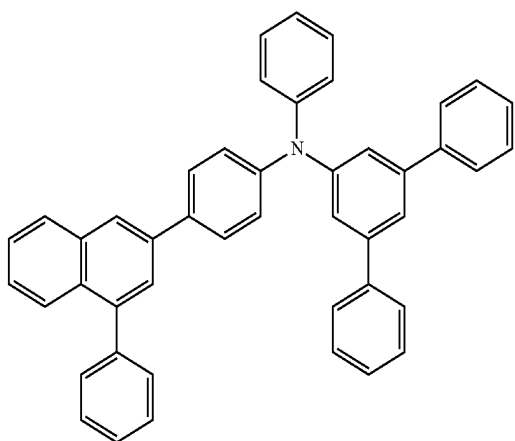
E6

E3

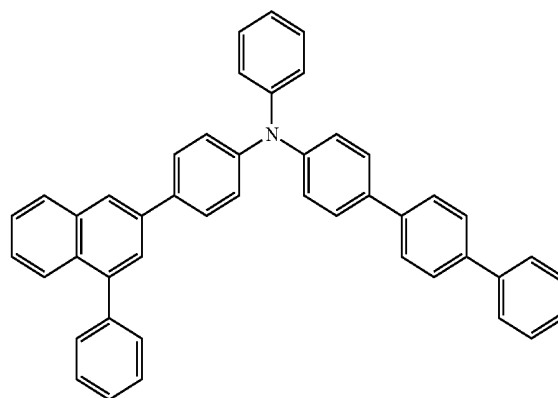


E7

E4

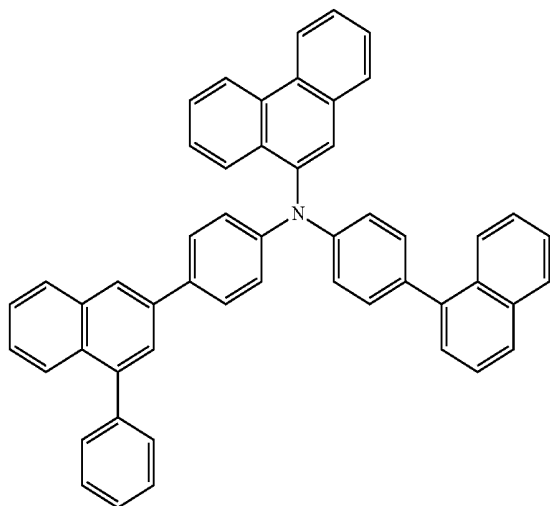


E8



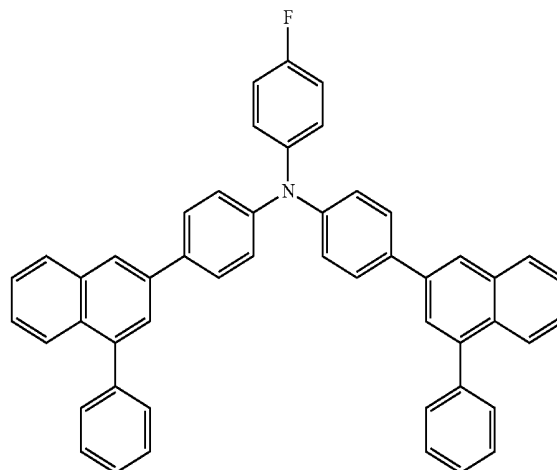
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E9



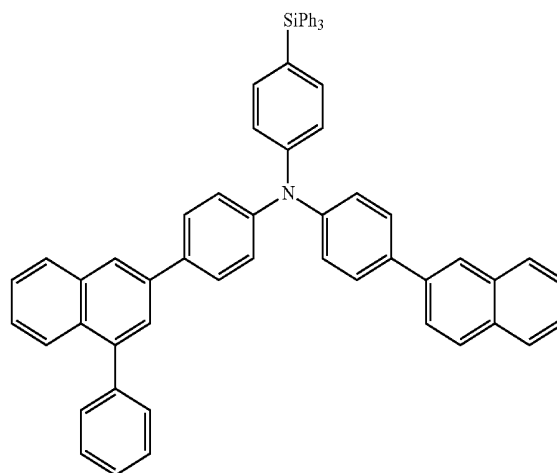
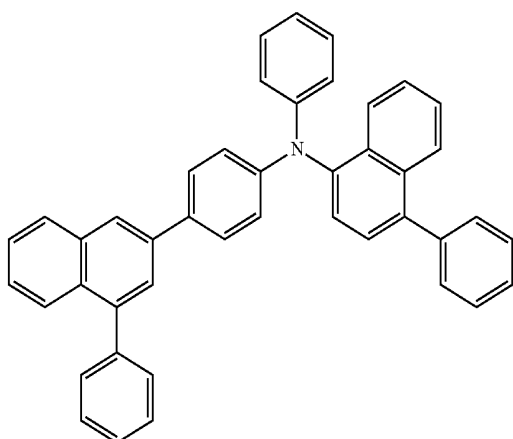
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E12



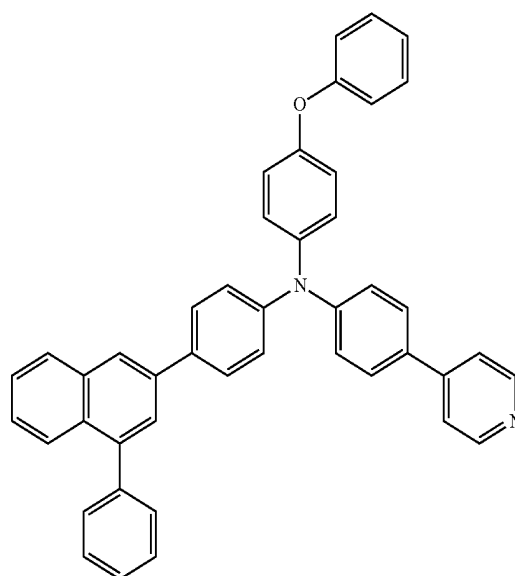
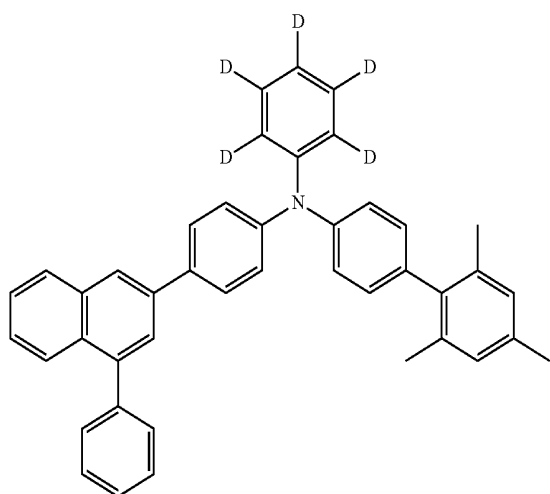
E13

E10



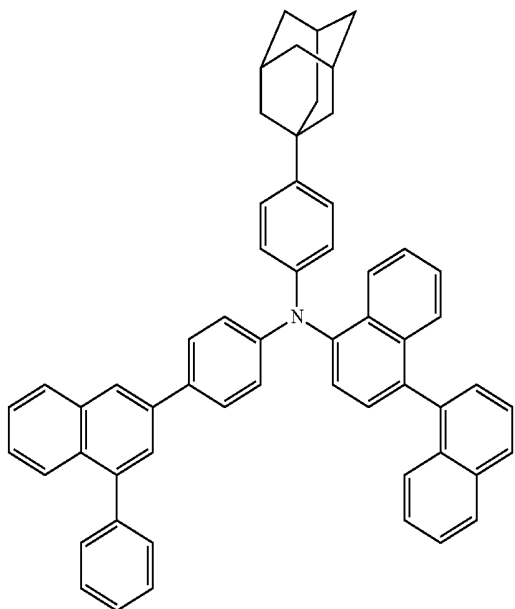
E14

E11



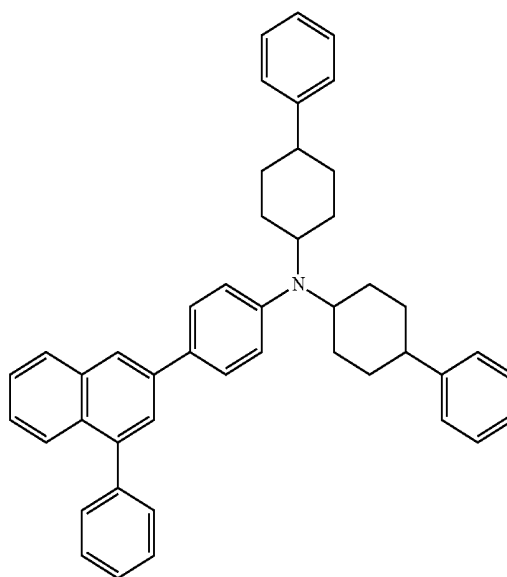
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E15

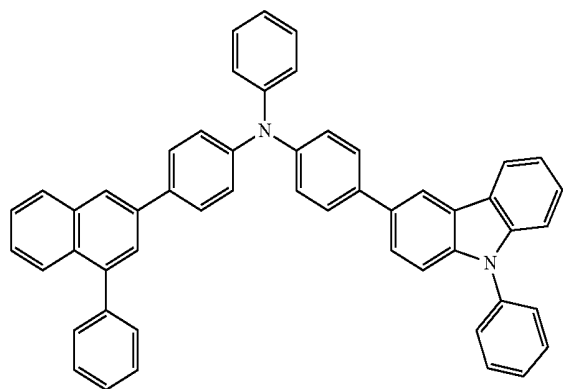


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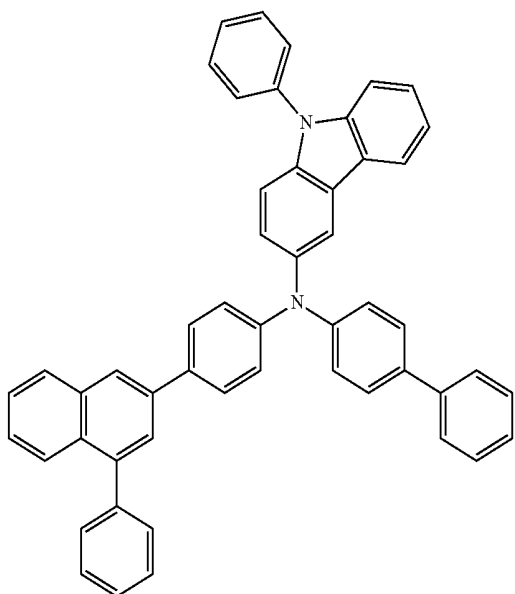
E18



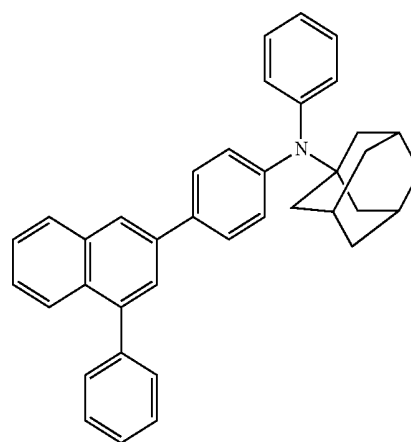
E16



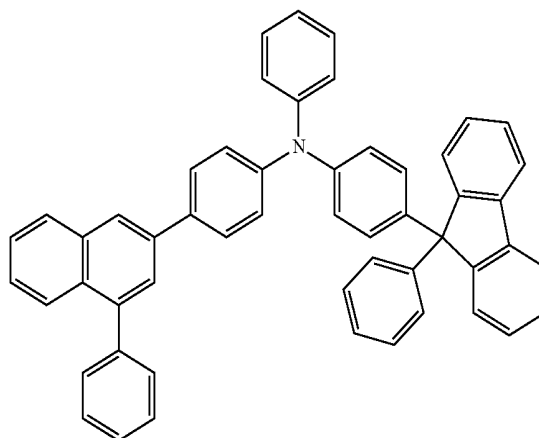
E17



E19

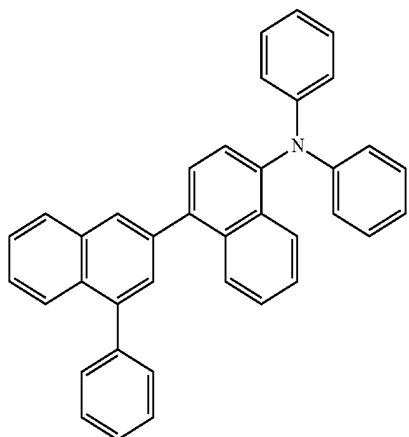


E20



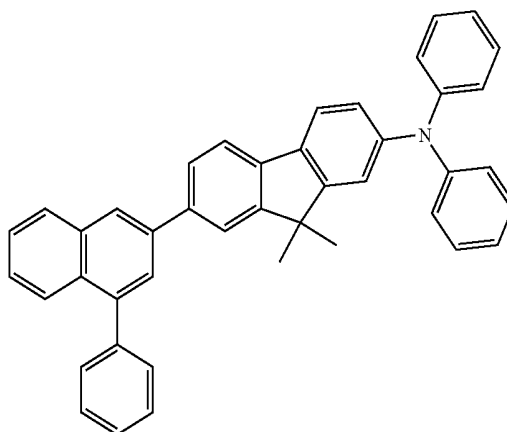
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E21

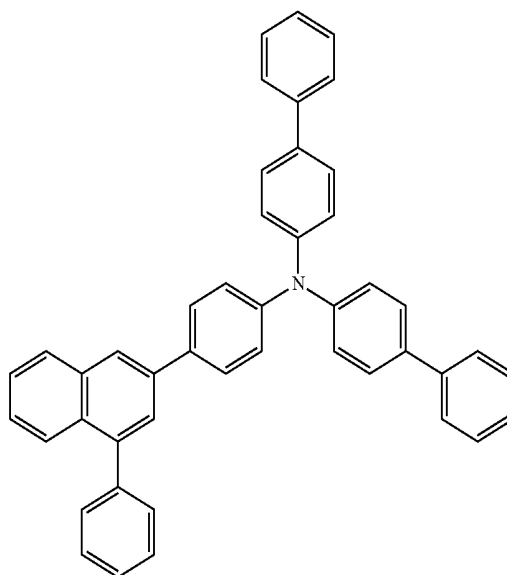


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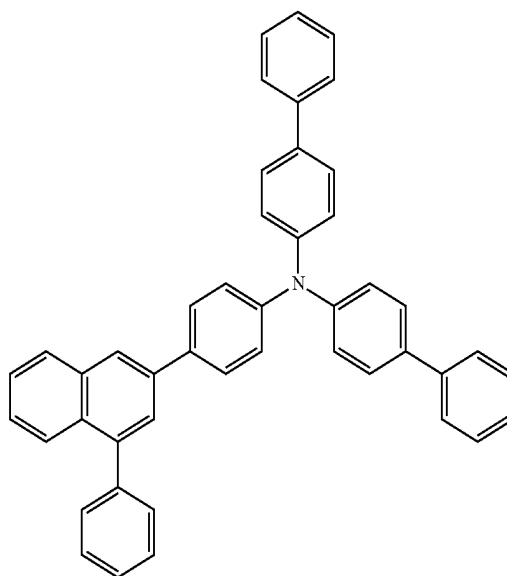
E24



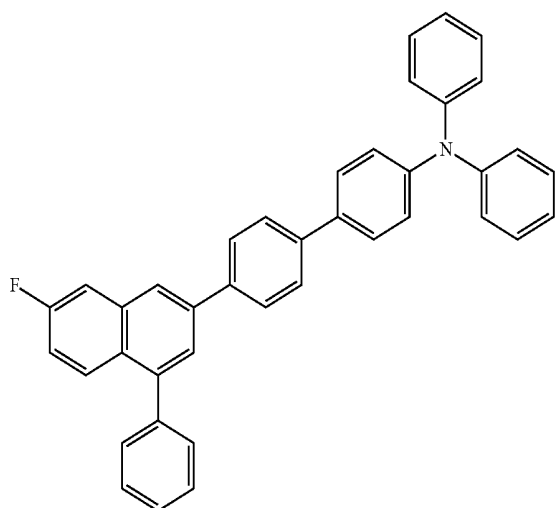
E25



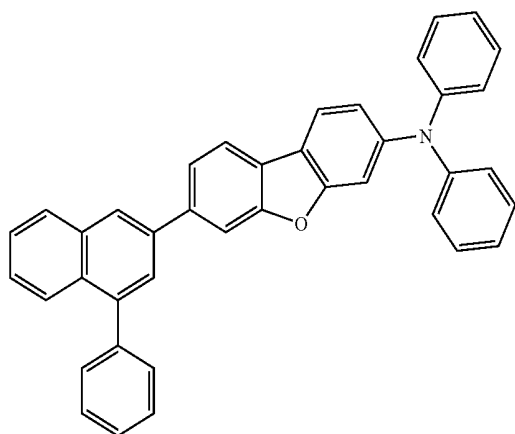
E26



E22

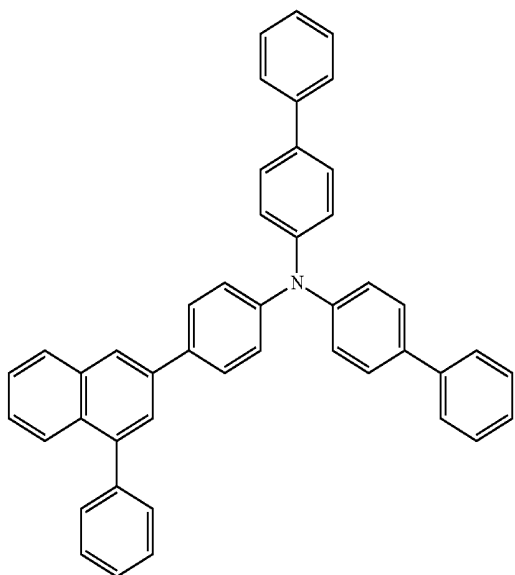


E23



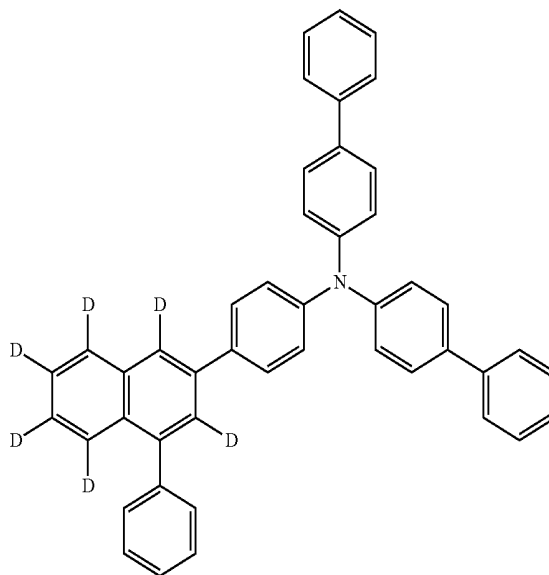
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E27



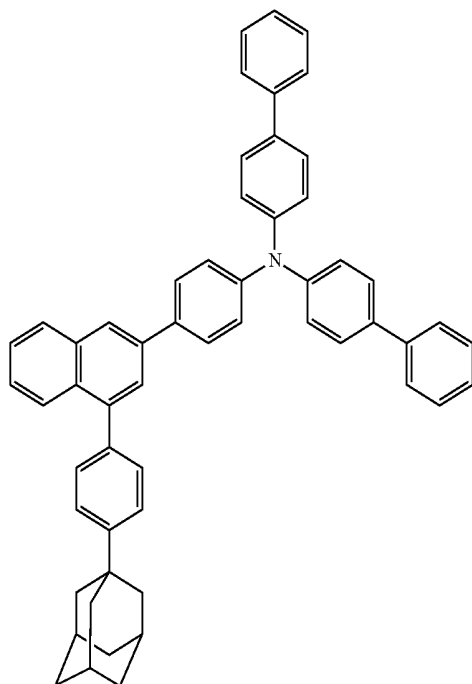
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E29

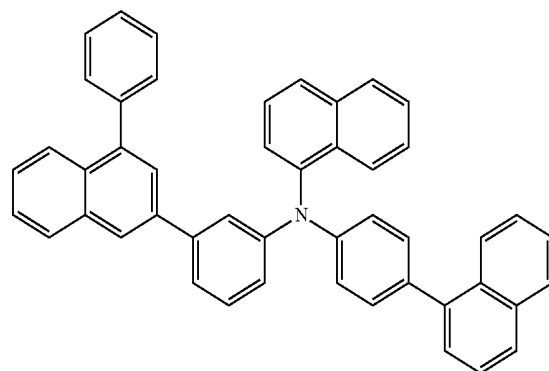


E30

E28

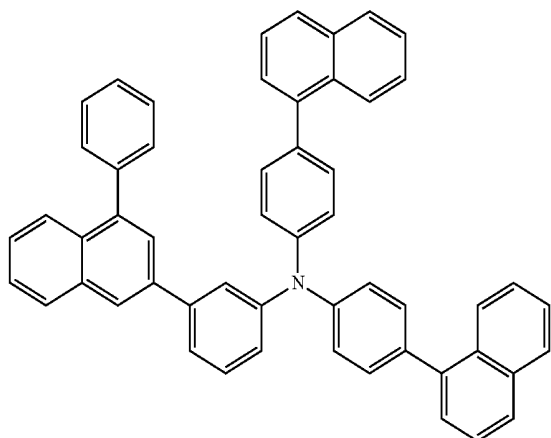


E31



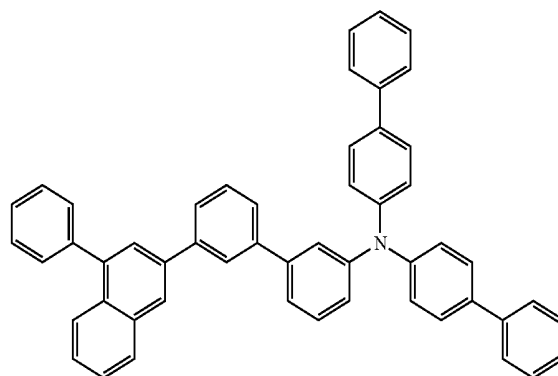
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E32



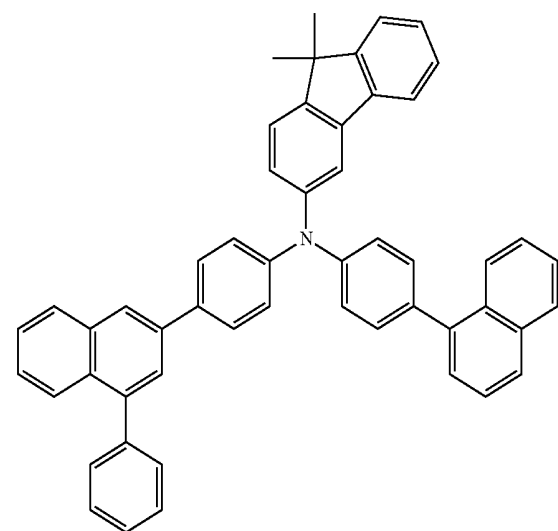
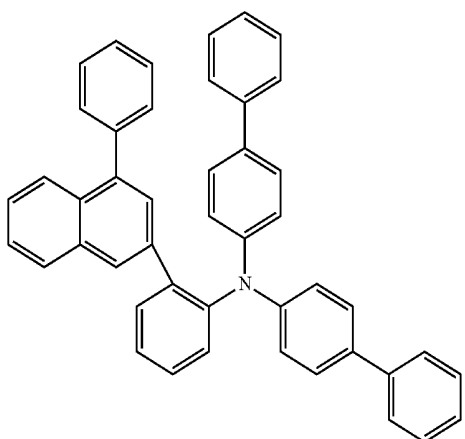
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E35



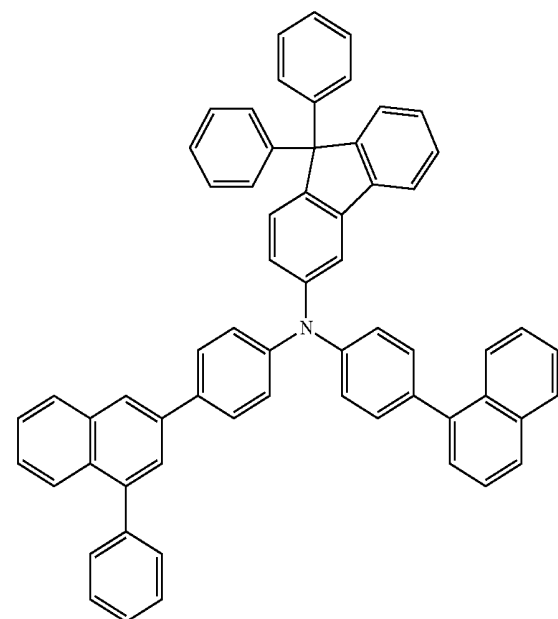
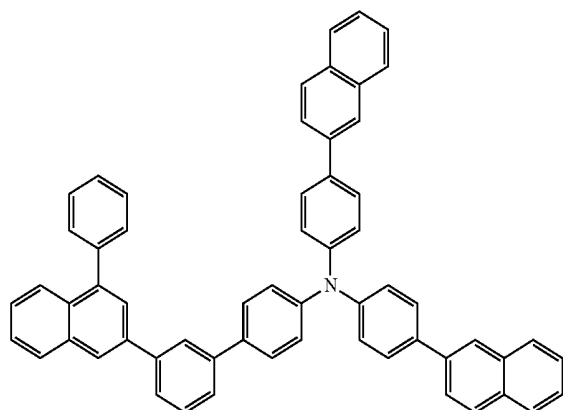
E36

E33



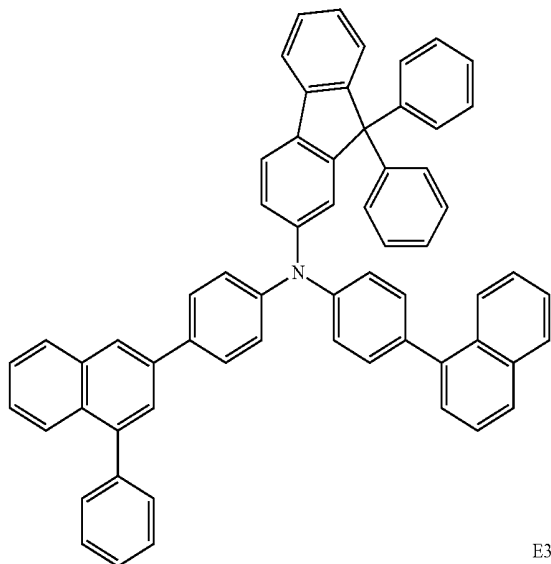
E37

E34

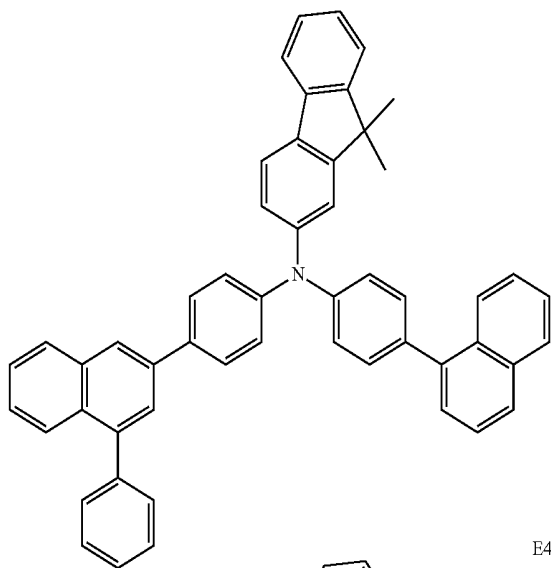


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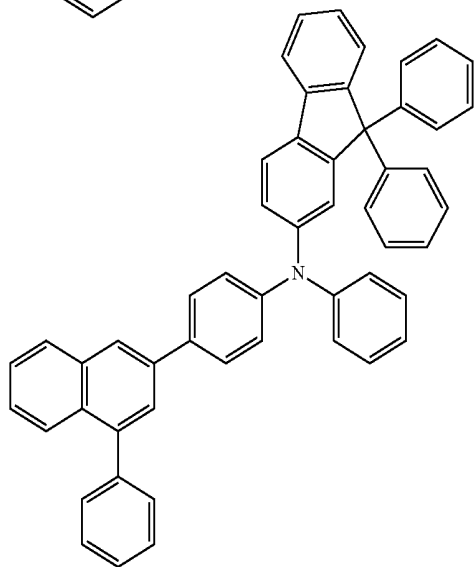
E38



E39

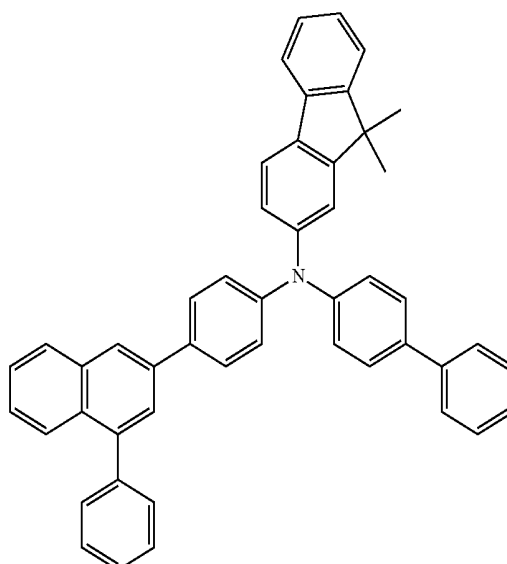


E40

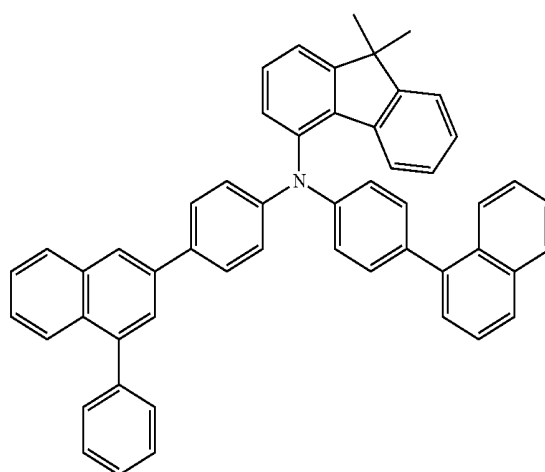


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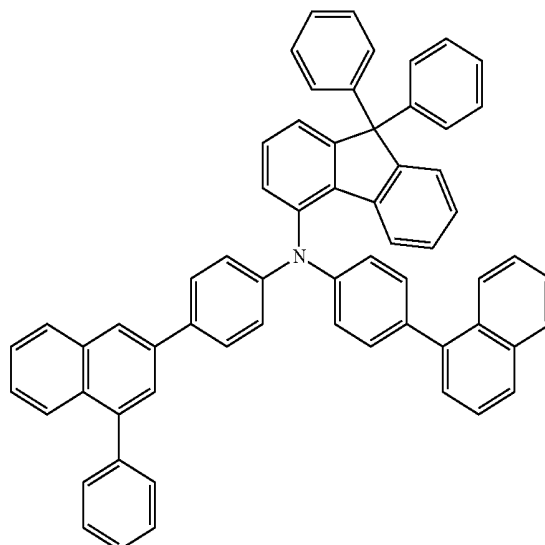
E41



E42

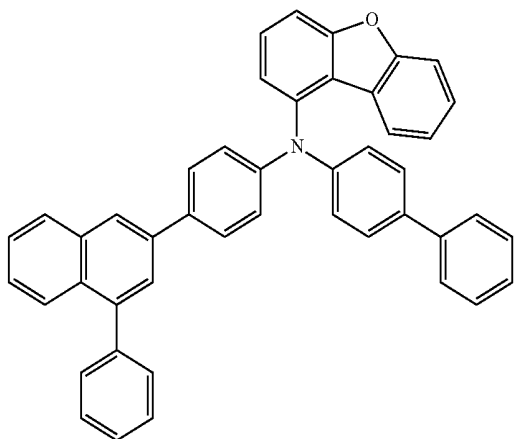


E43



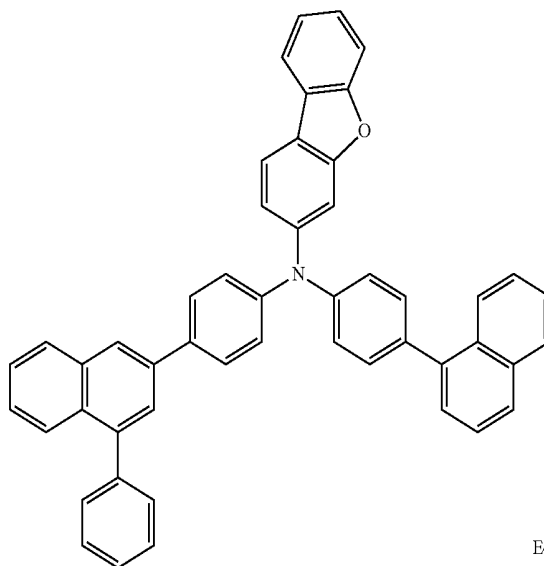
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E44



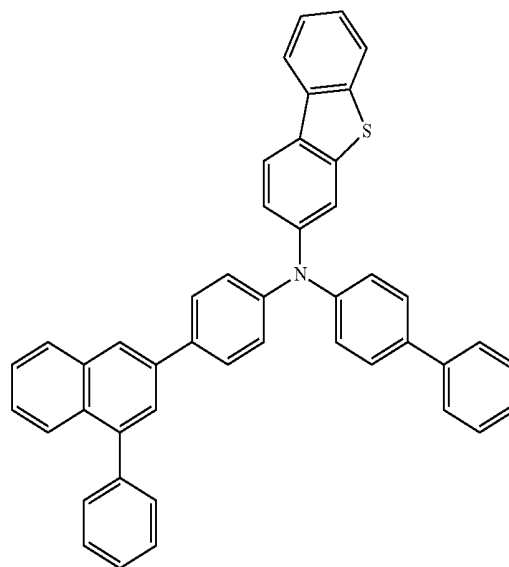
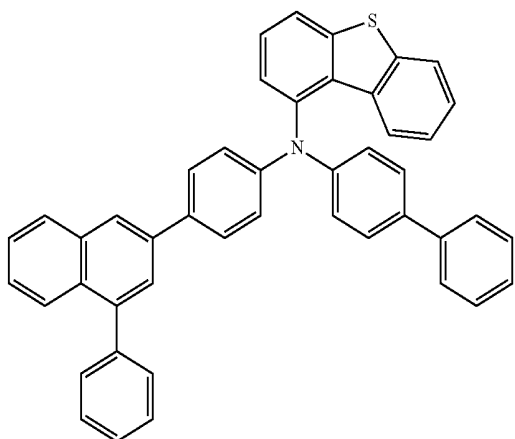
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E47



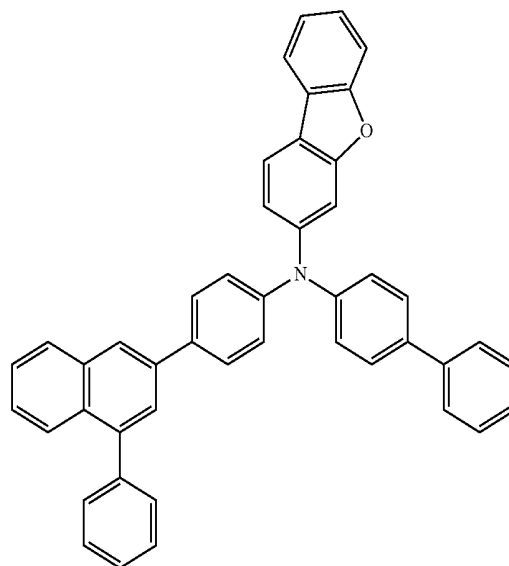
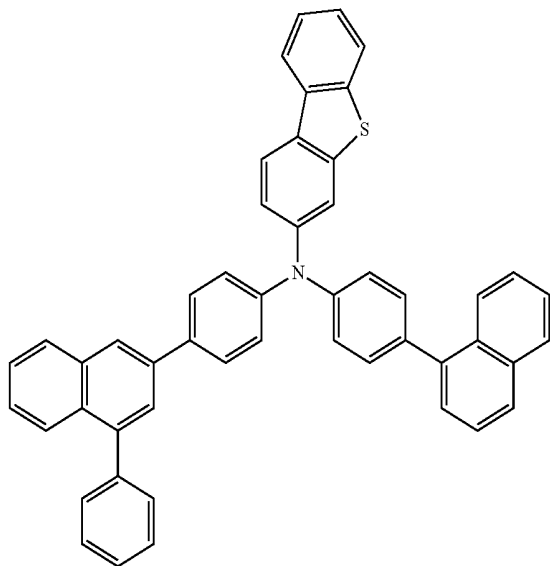
E45

E48



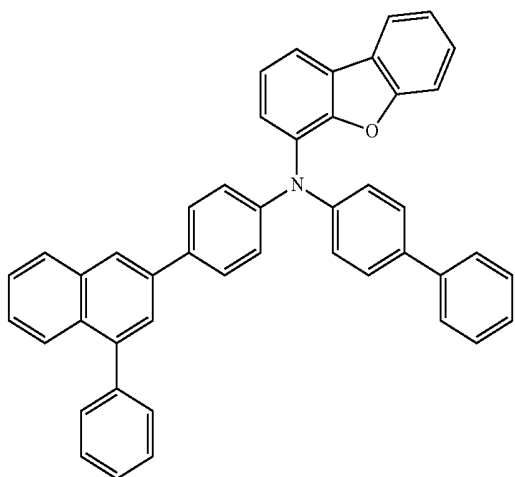
E46

E49



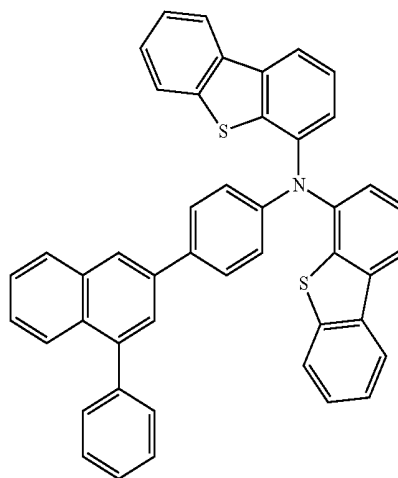
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E50



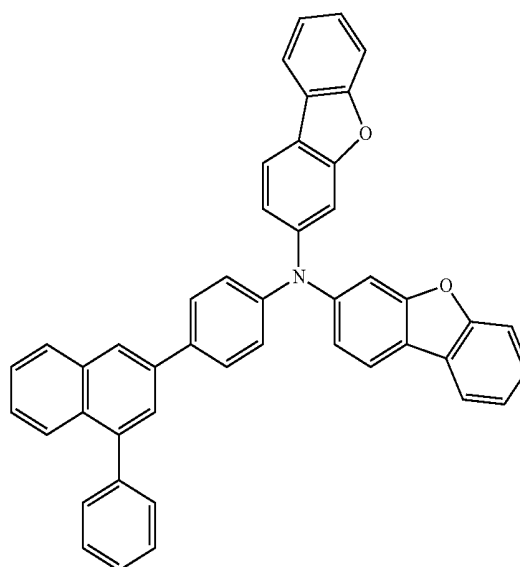
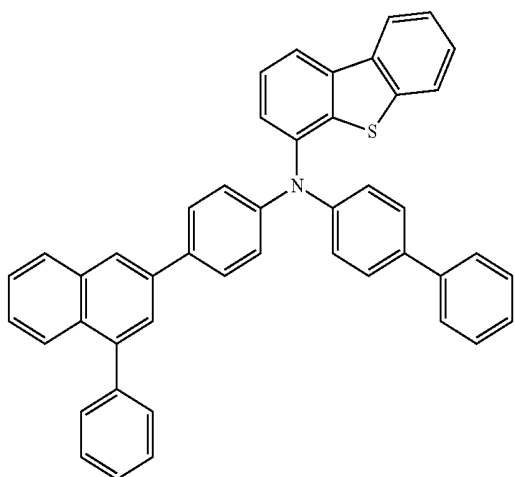
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E53



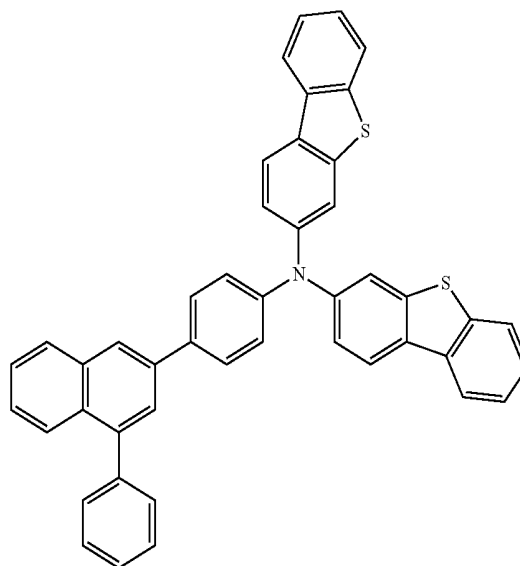
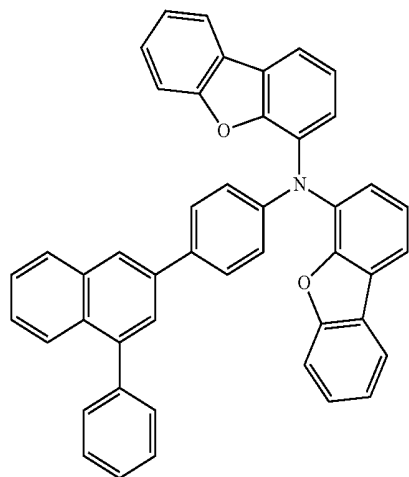
E54

E51



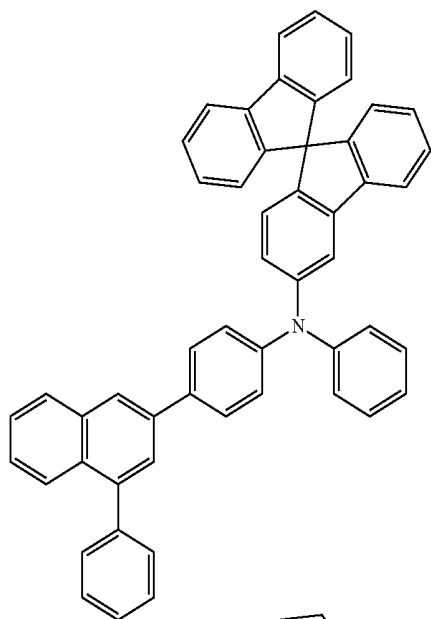
E55

E52



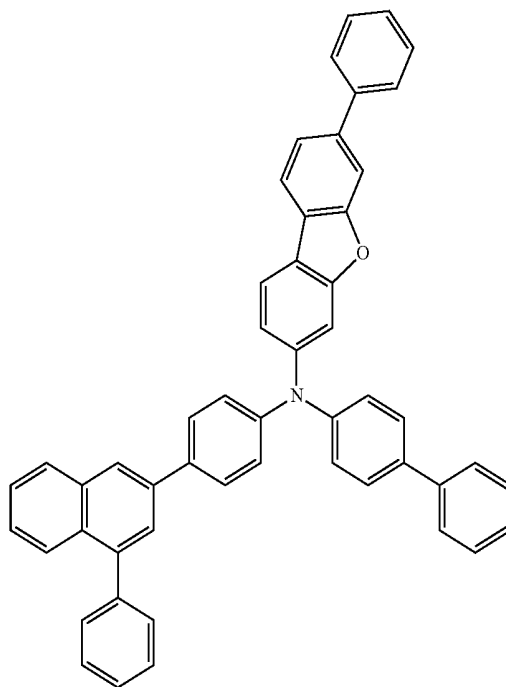
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E56

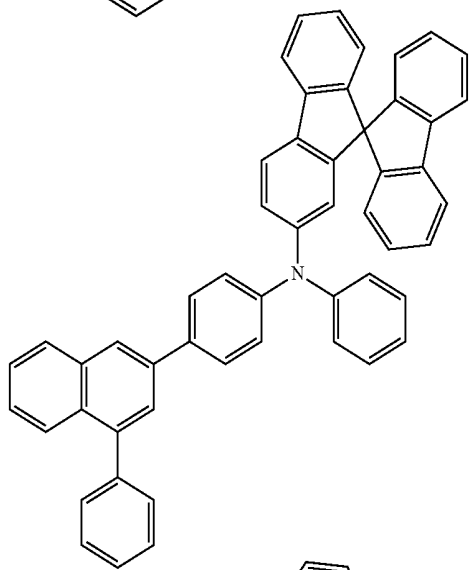


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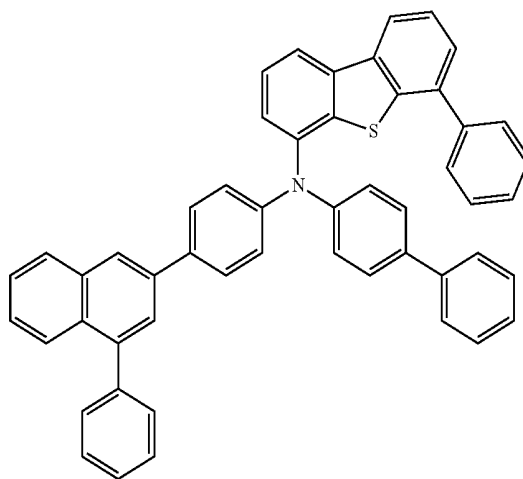
E59



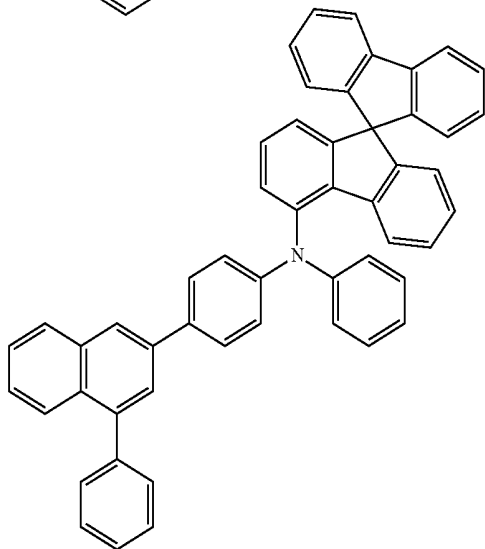
E57



E60

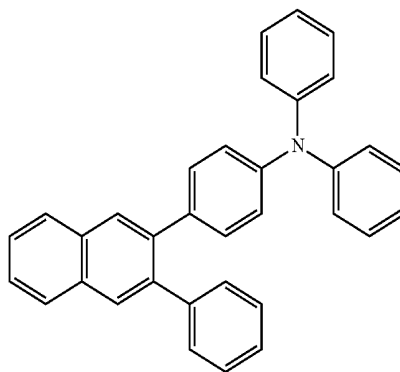


E58



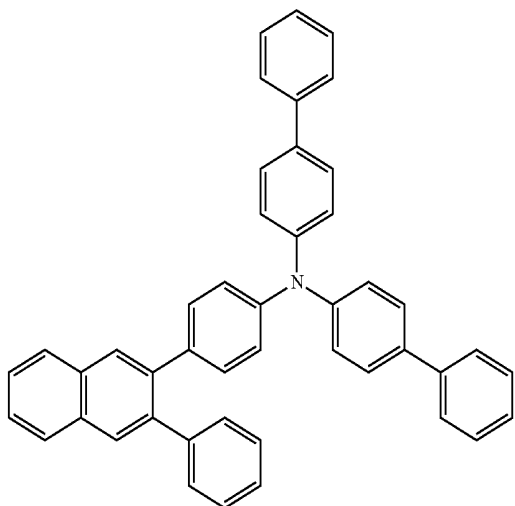
[Compound Group 6]

F1



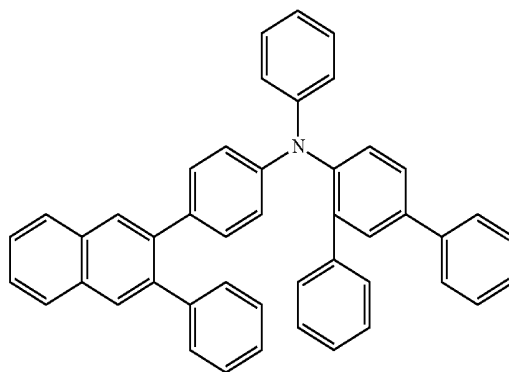
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F2



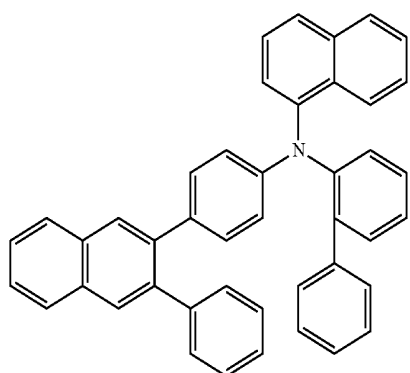
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F5



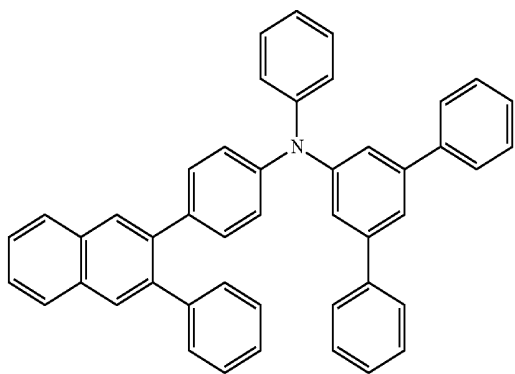
F6

F3

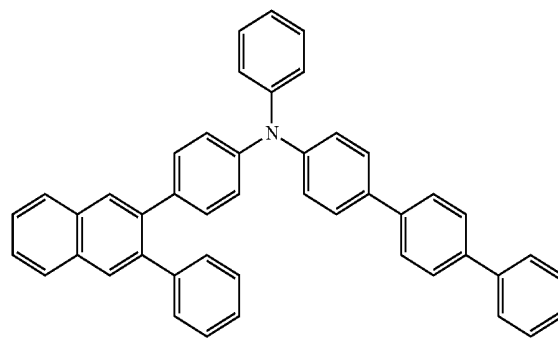
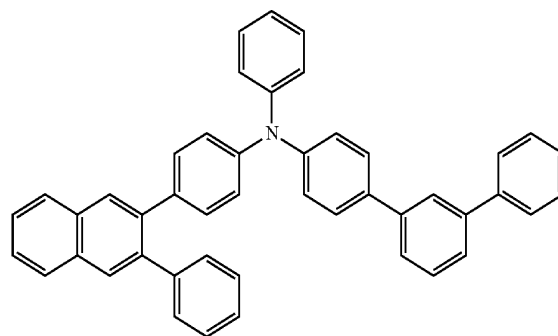


F7

F4

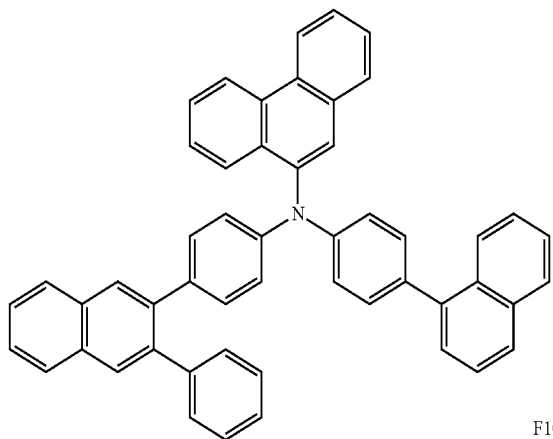


F8



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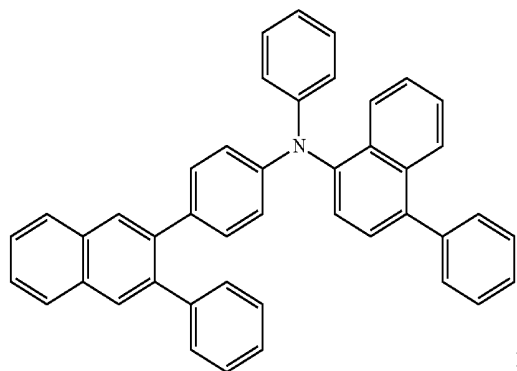
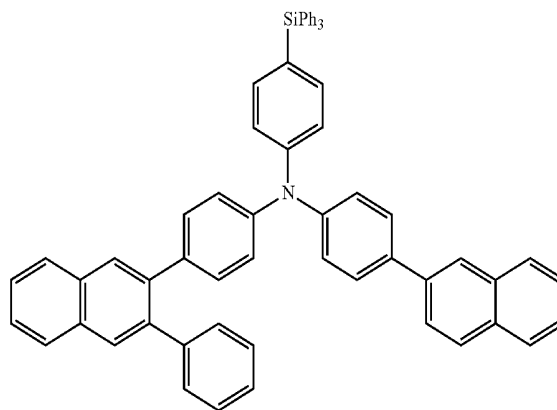
F9



F10

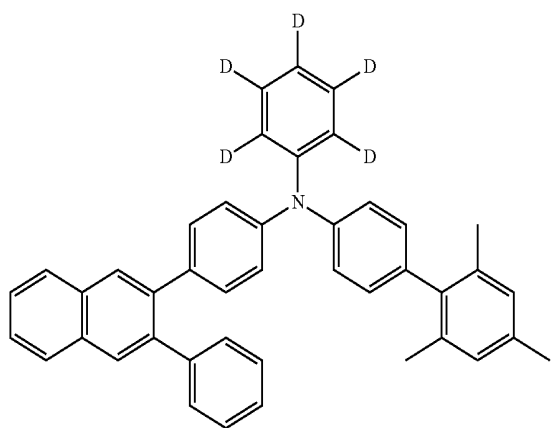
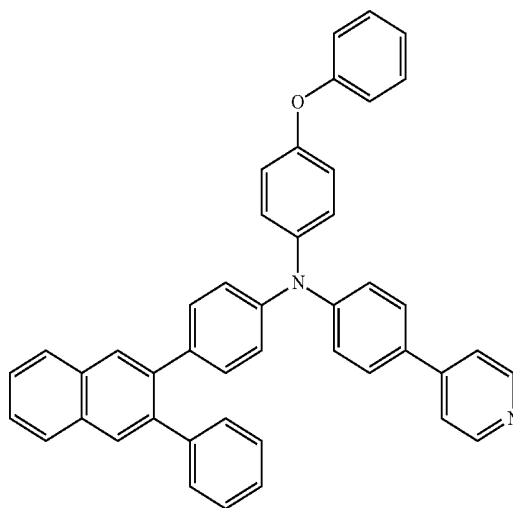
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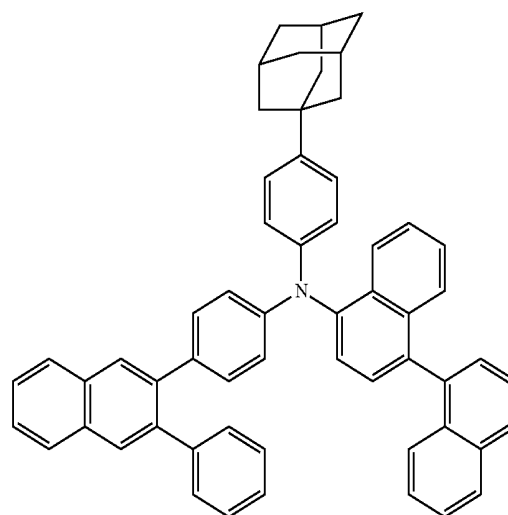
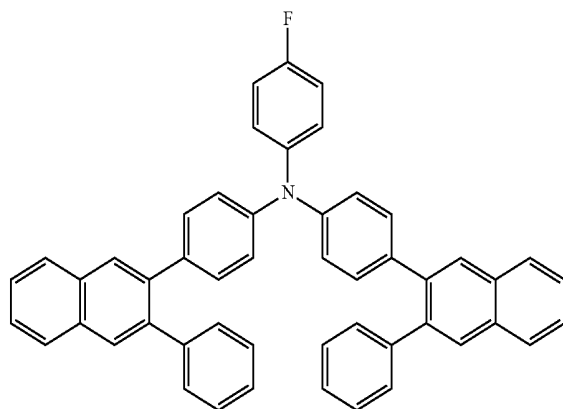
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F14



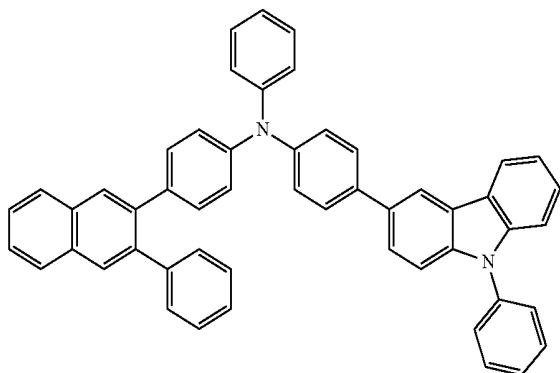
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F15



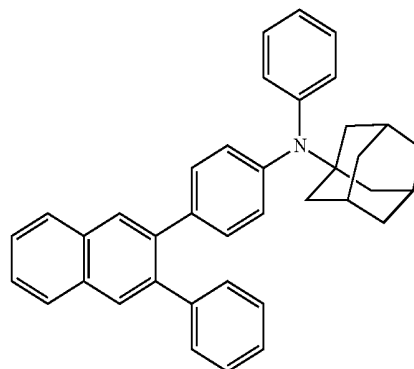
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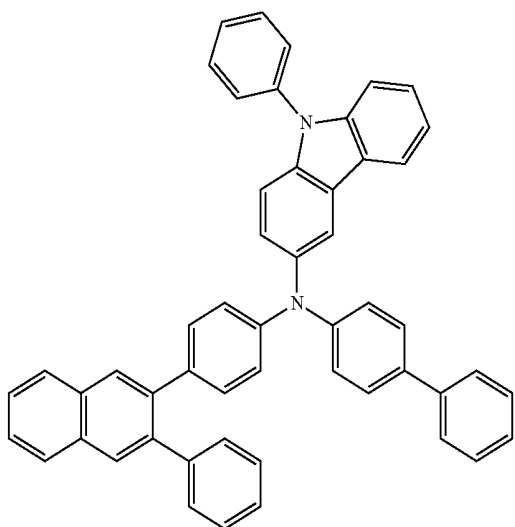
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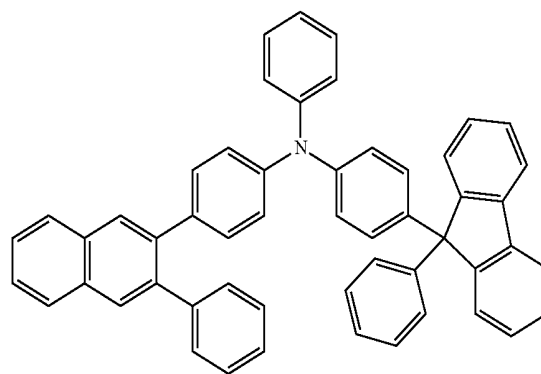
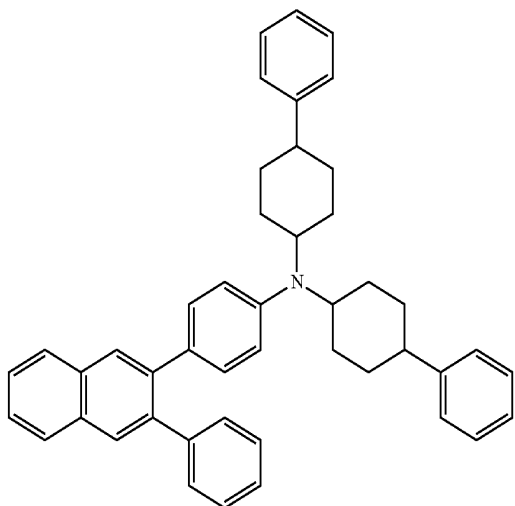


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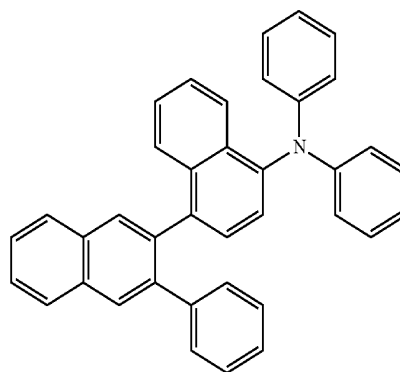
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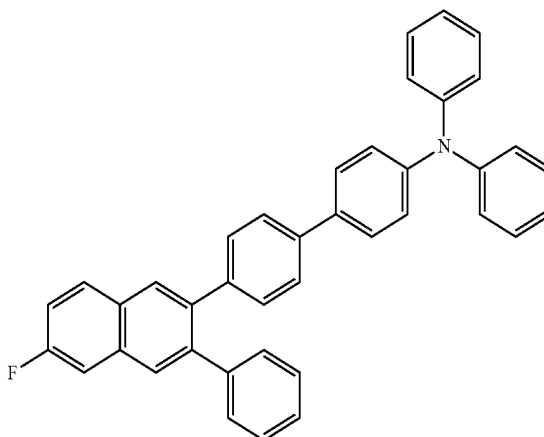
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F21

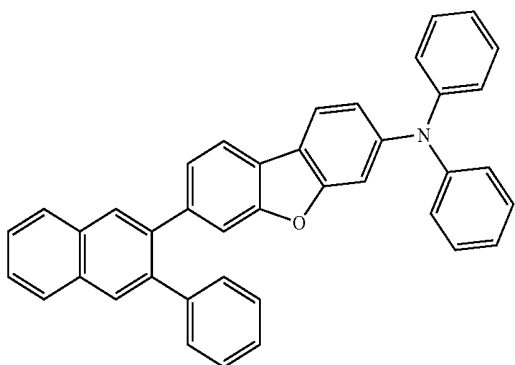


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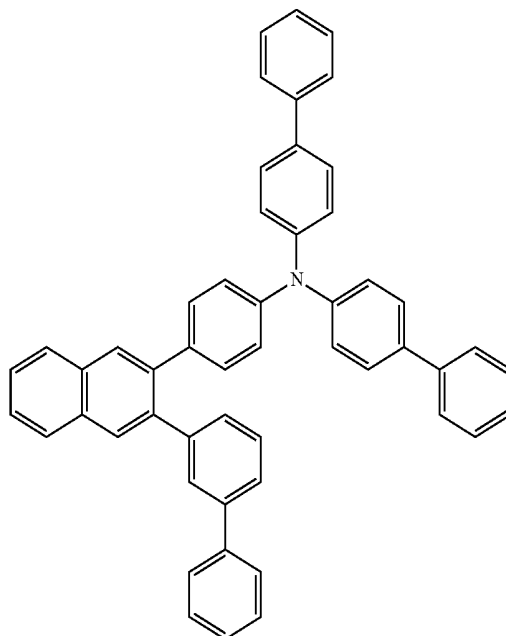
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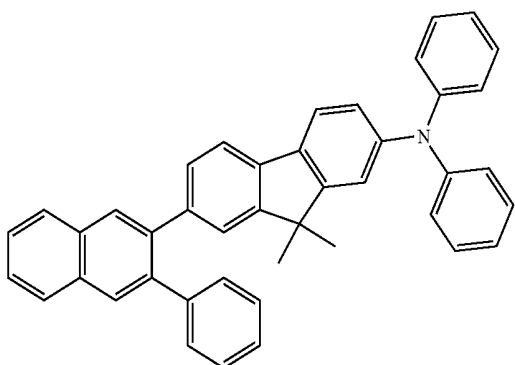


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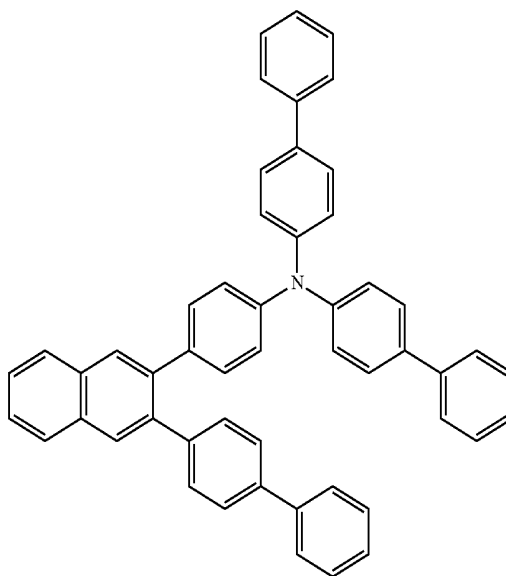
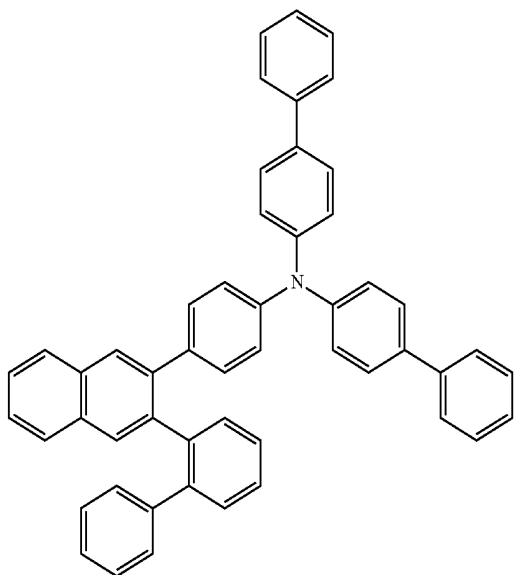


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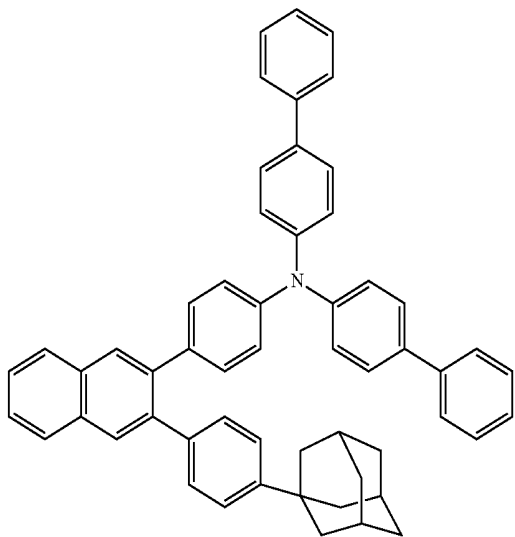
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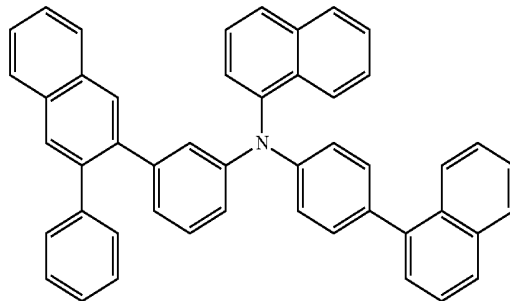
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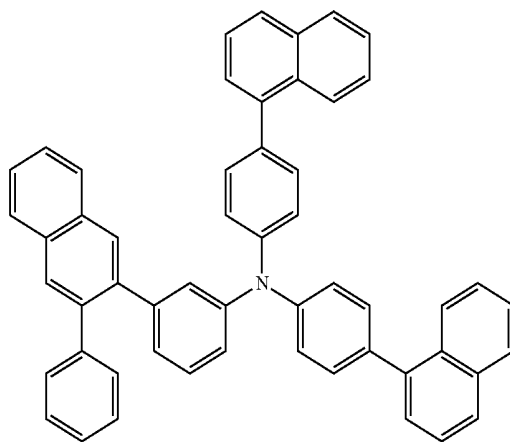
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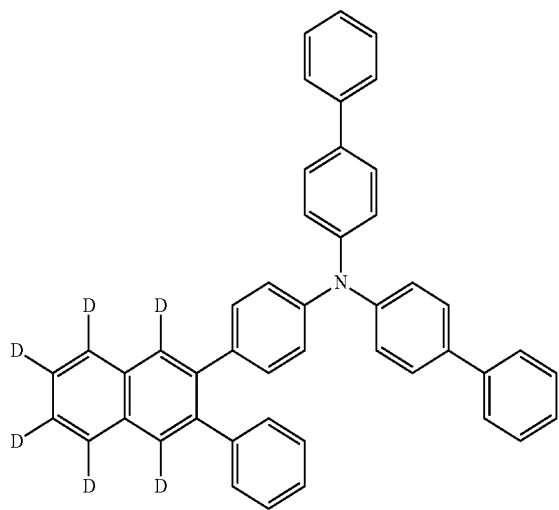


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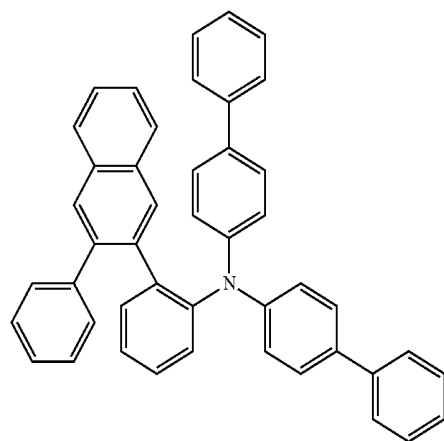
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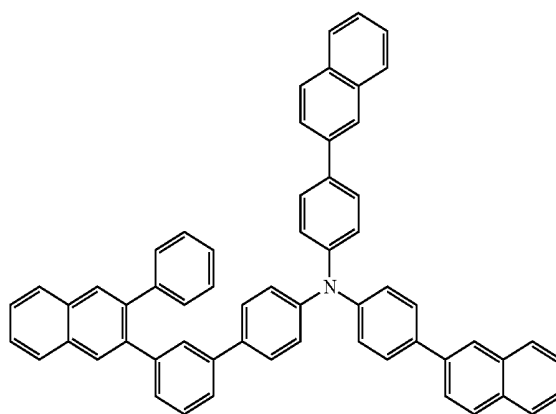
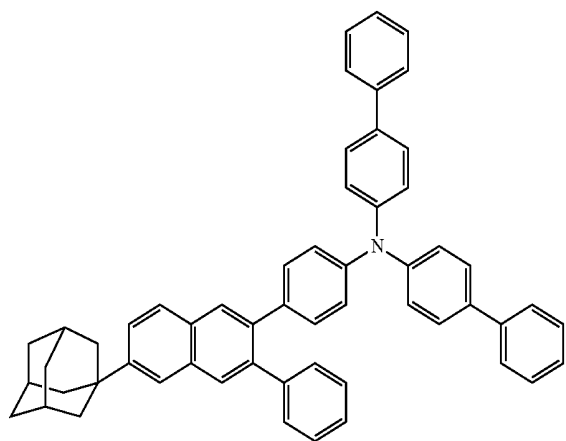
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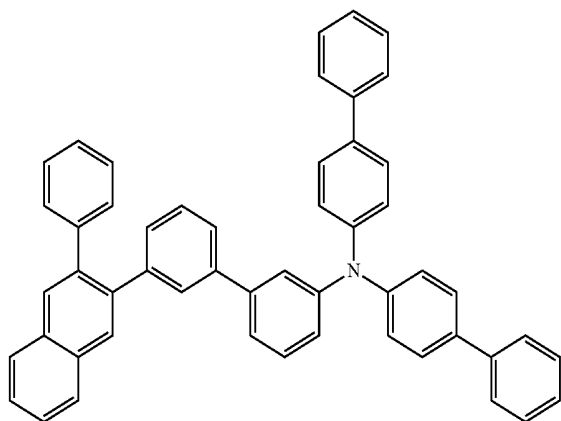


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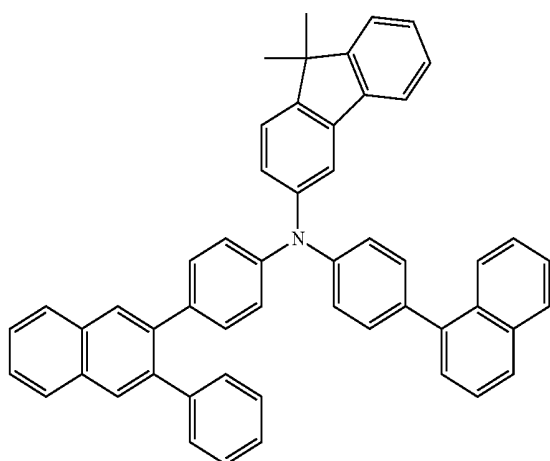


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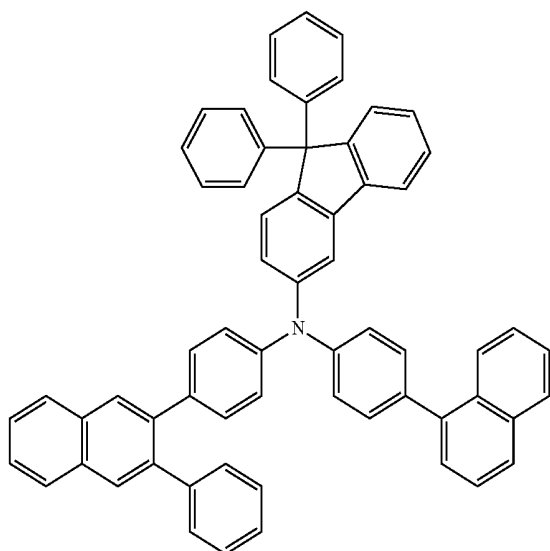
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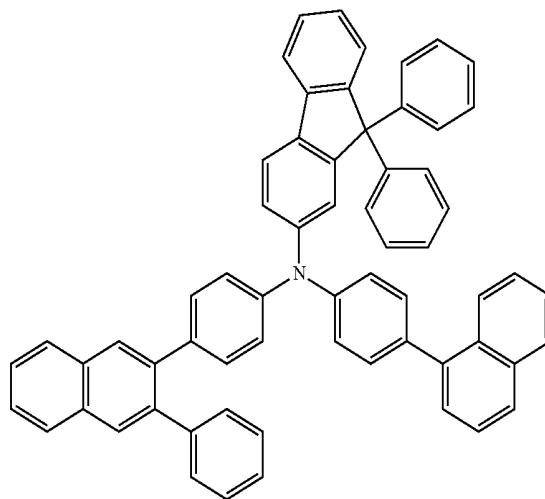


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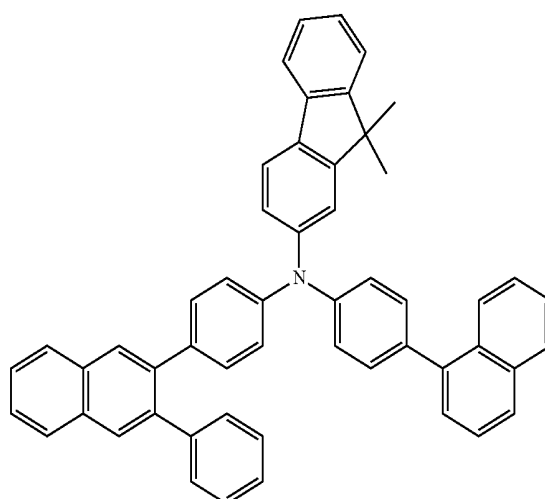


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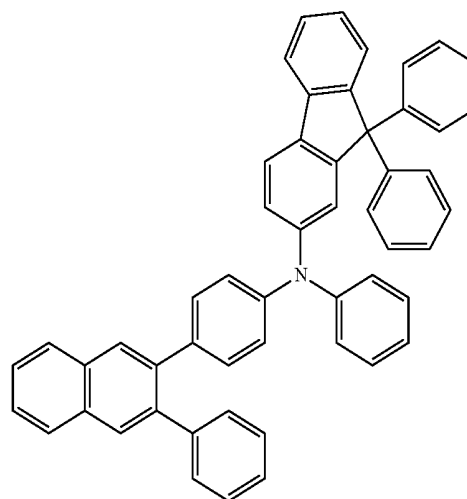
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F39

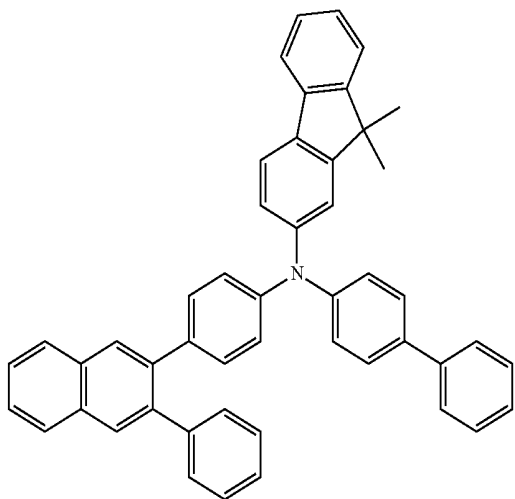


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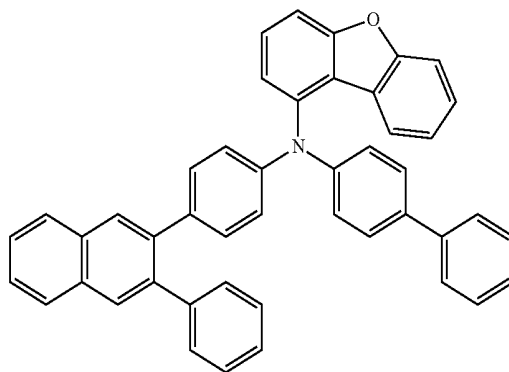
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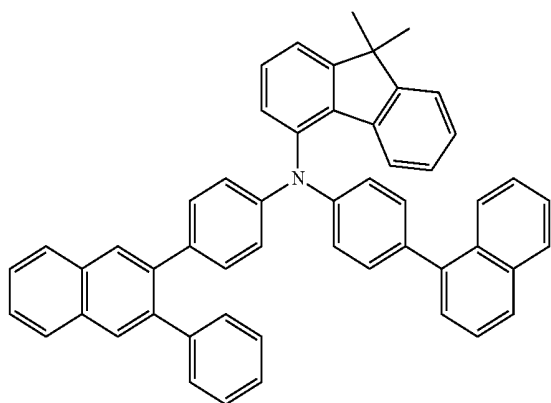


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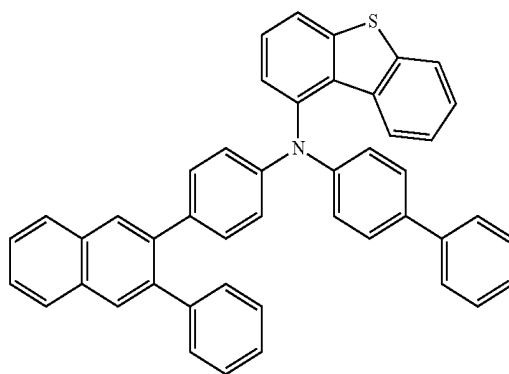
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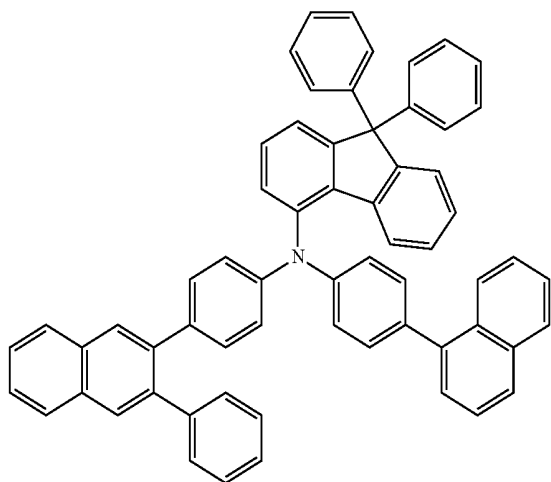
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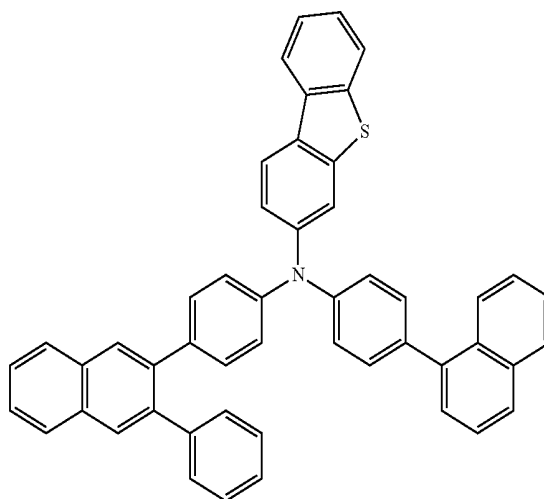
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F43

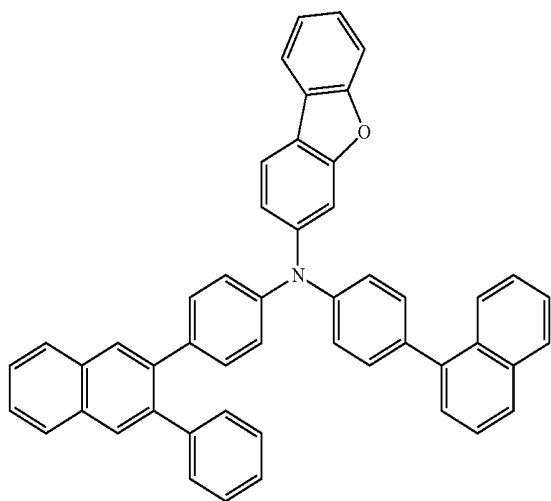


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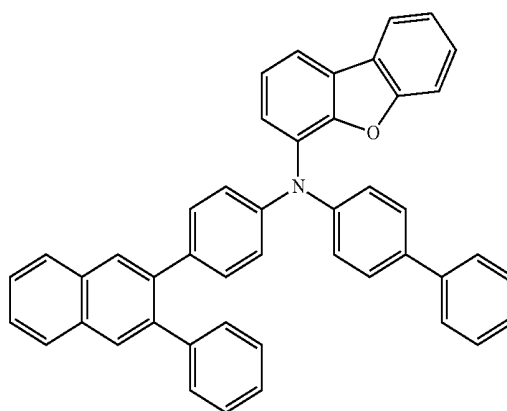
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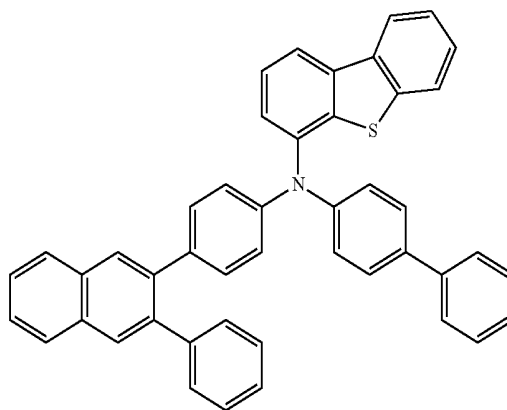
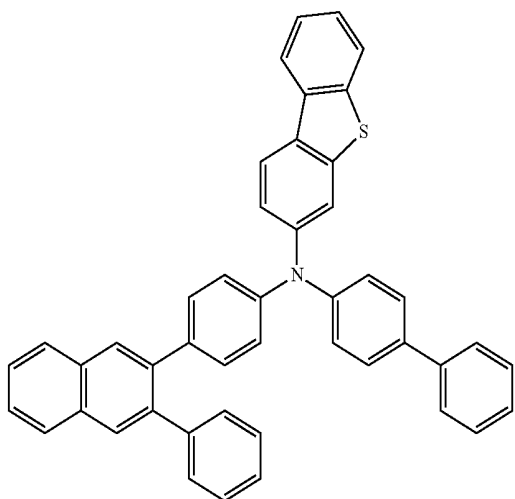
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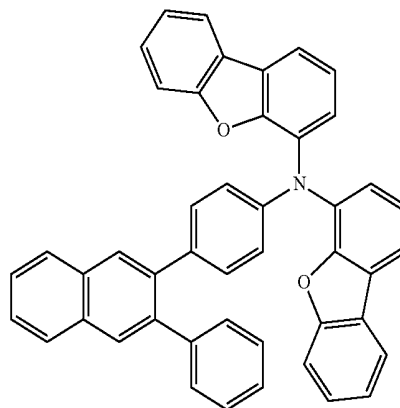
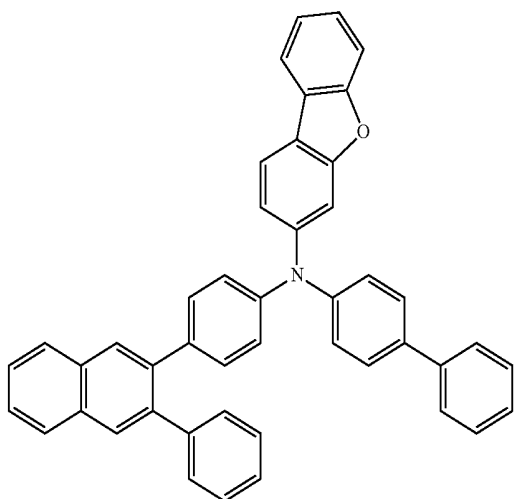
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F48

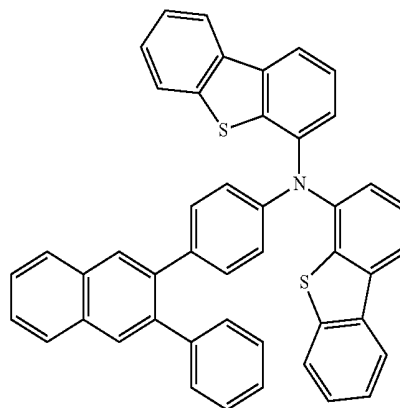


F52

F49

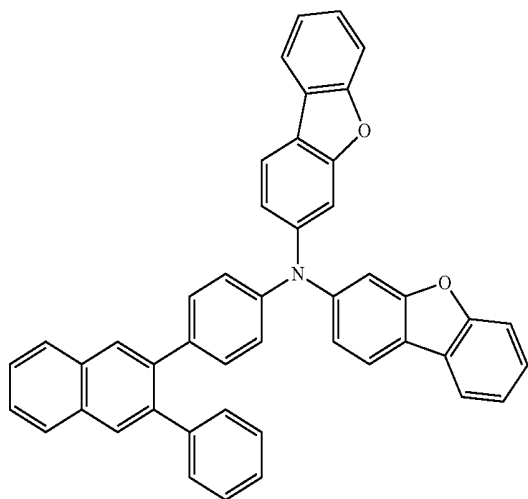


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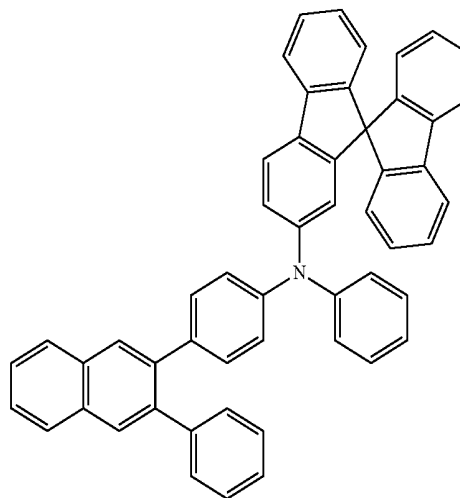
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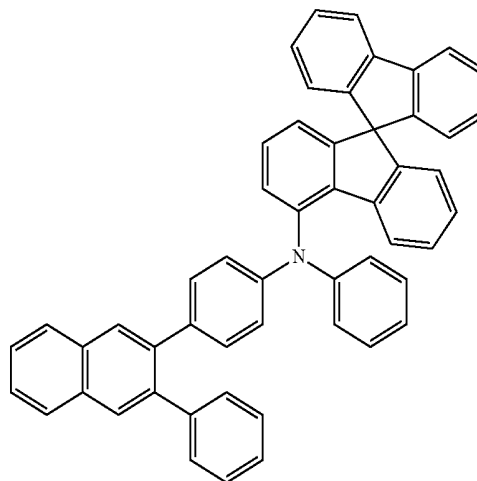
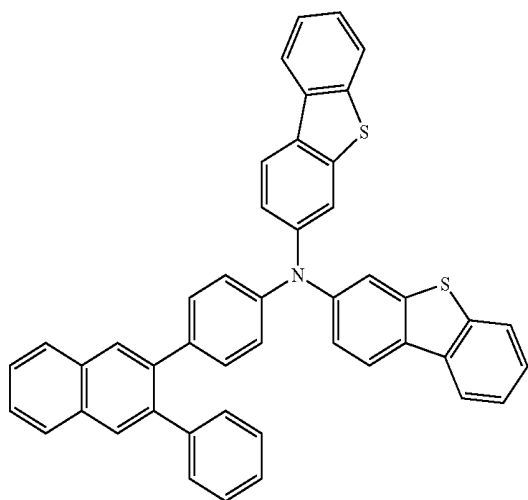
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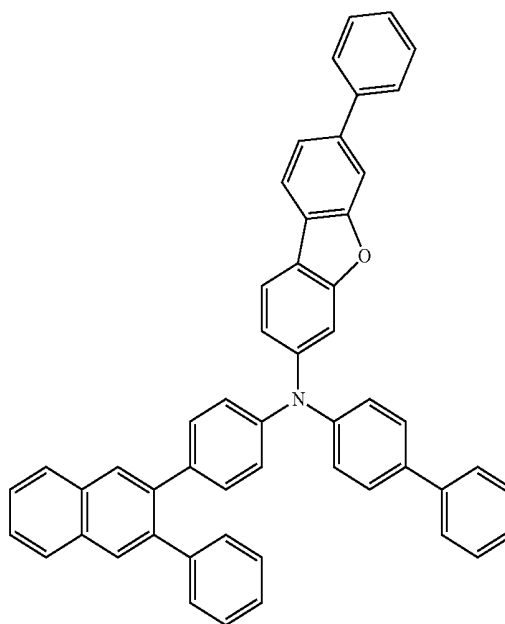
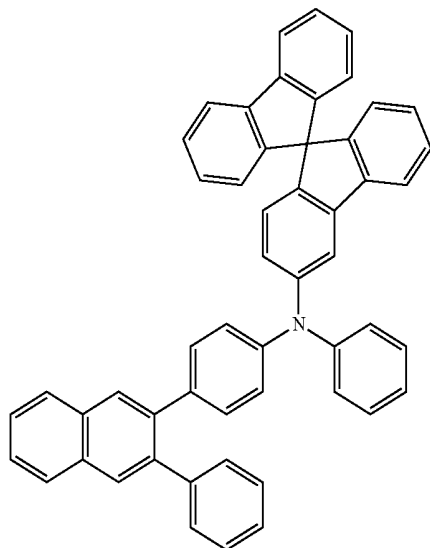
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F55



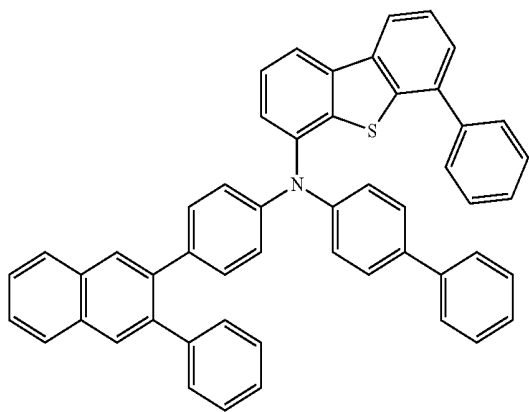
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F56



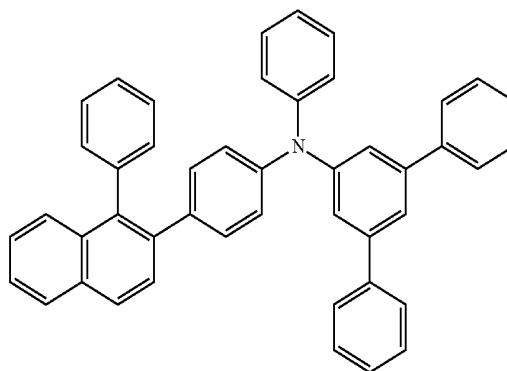
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F60



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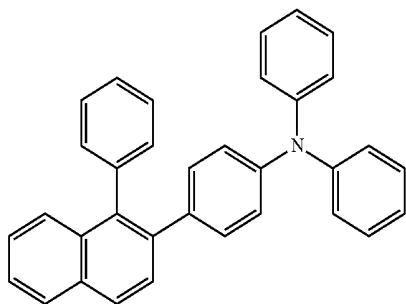
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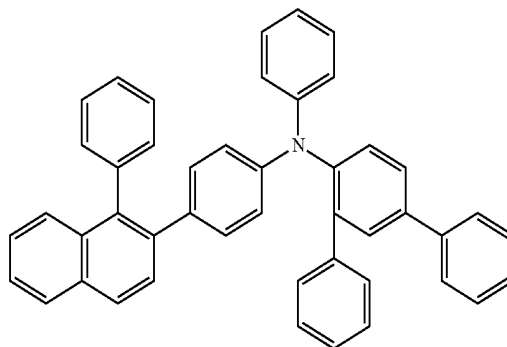
[Compound Group 7]

G5

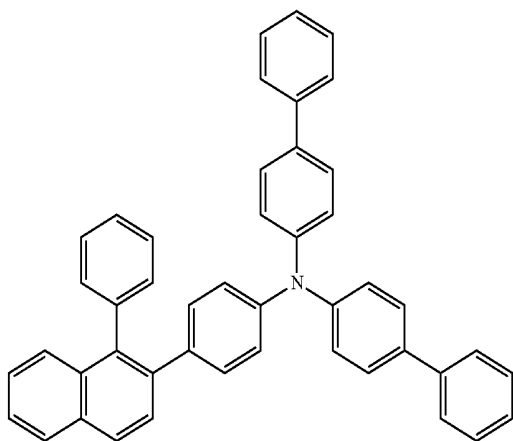
G1



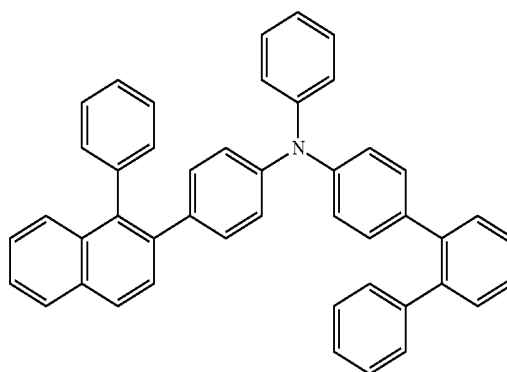
G2



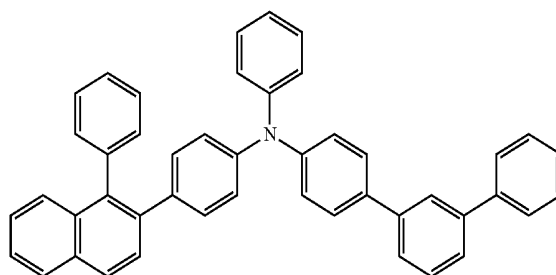
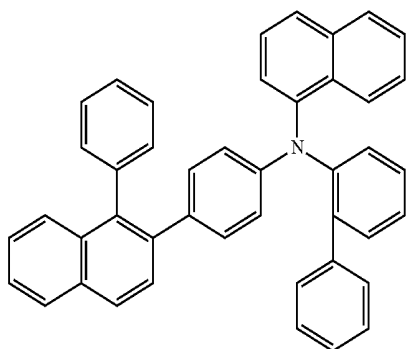
G6



G3

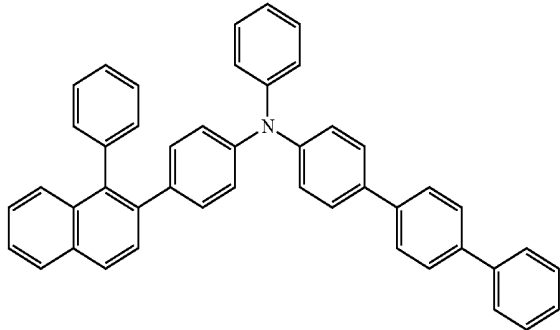


G7



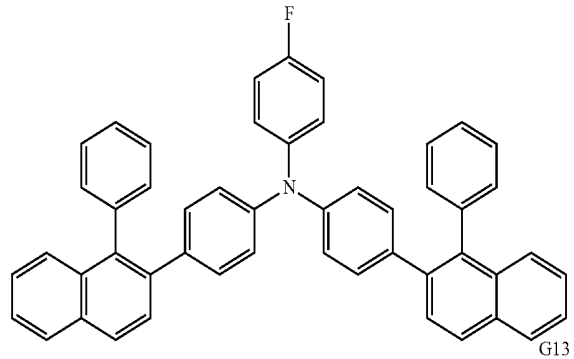
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G8

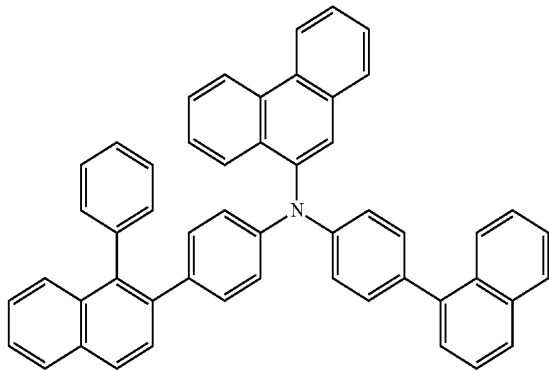


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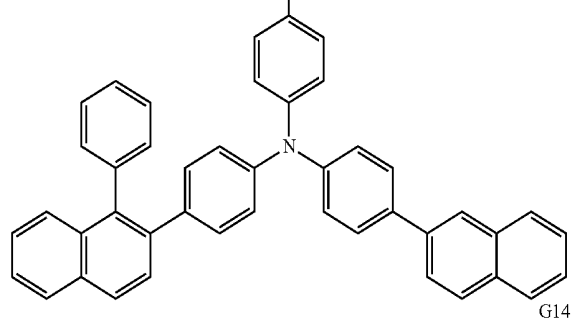
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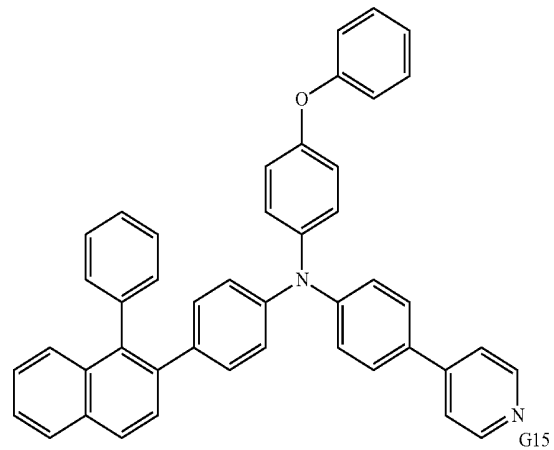
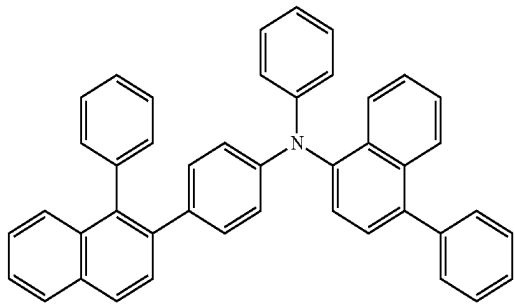
G9



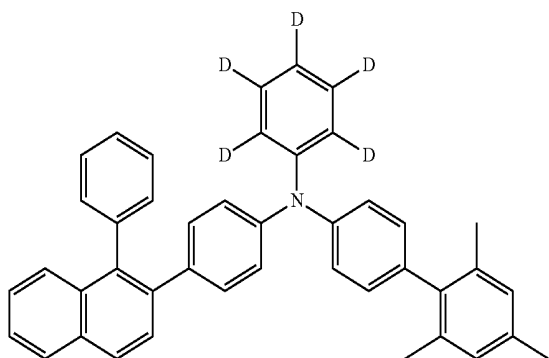
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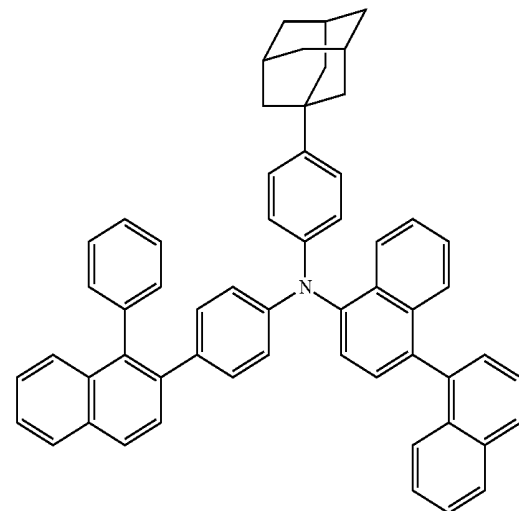
G10



G11

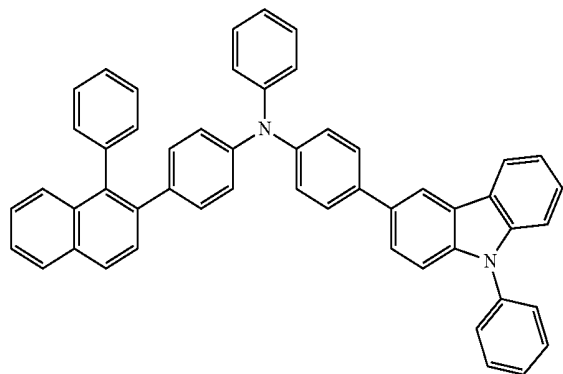


G15



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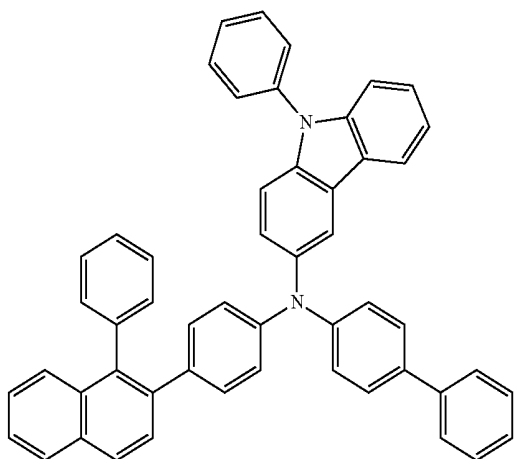
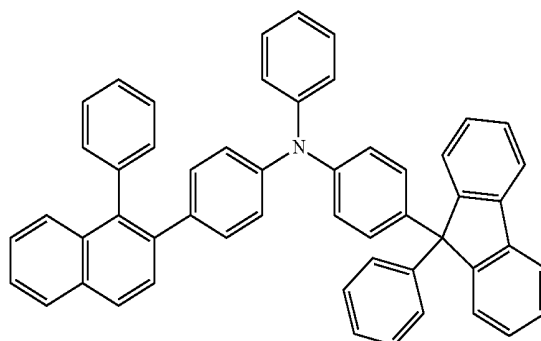
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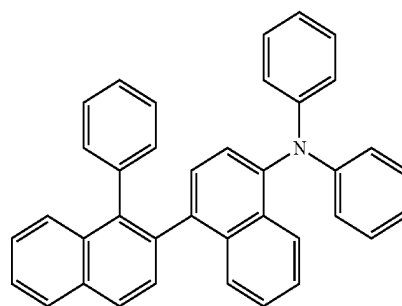
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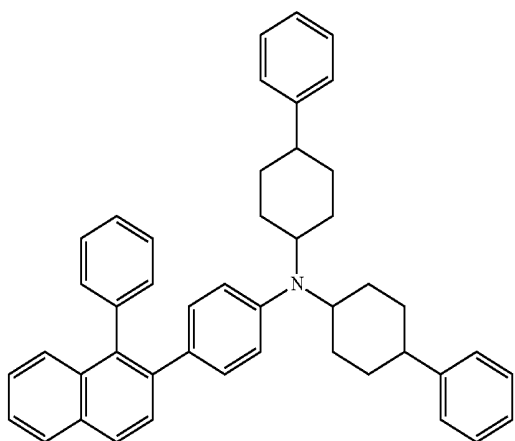
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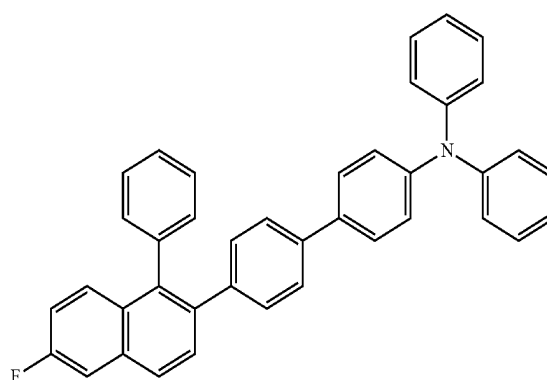
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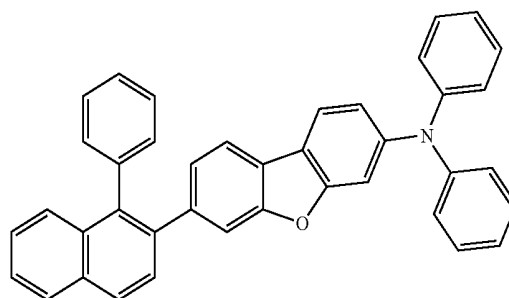
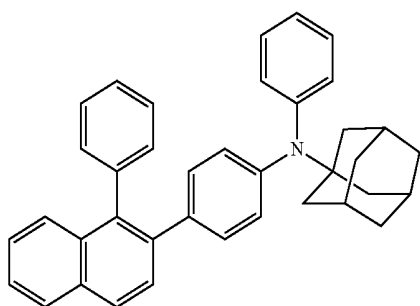
G21



G19



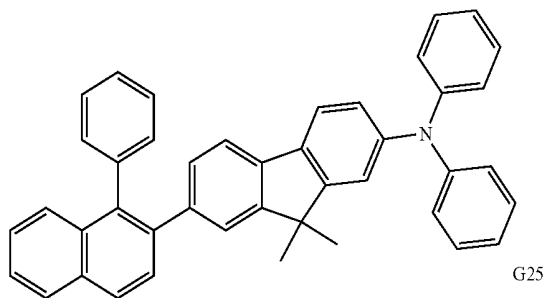
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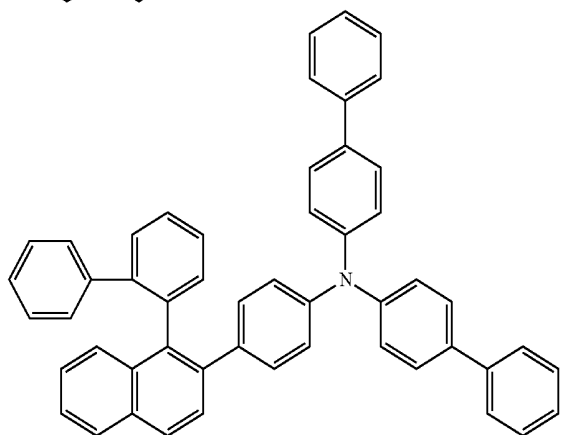
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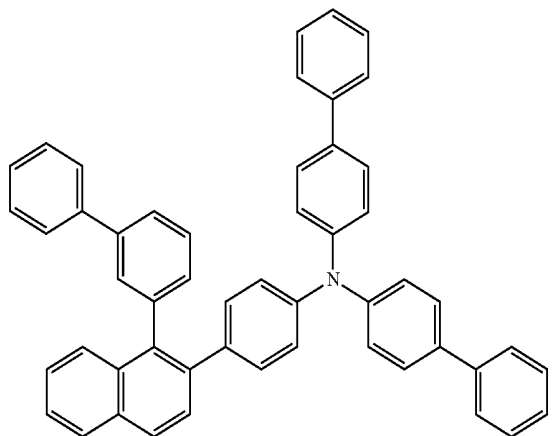
G24



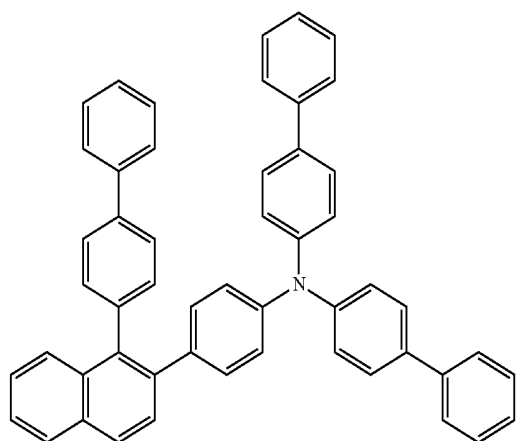
G25



G26

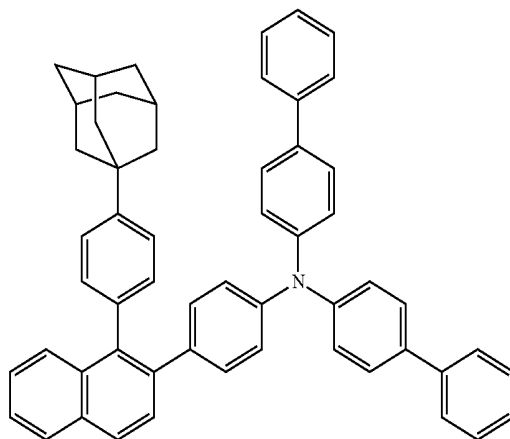


G27

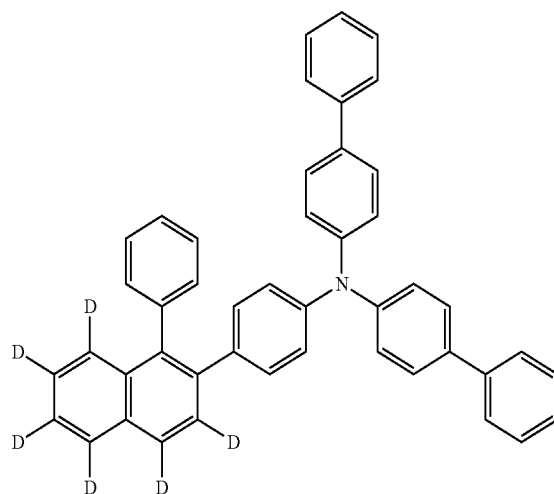


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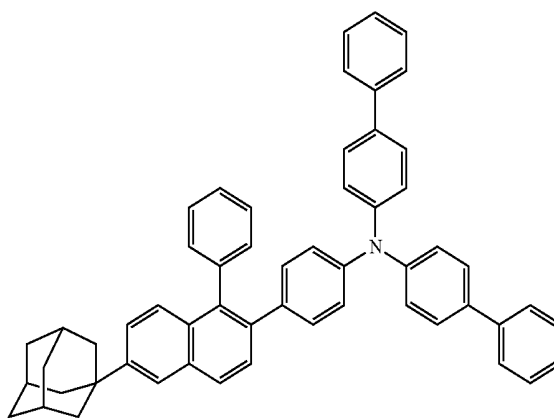
G28



G29

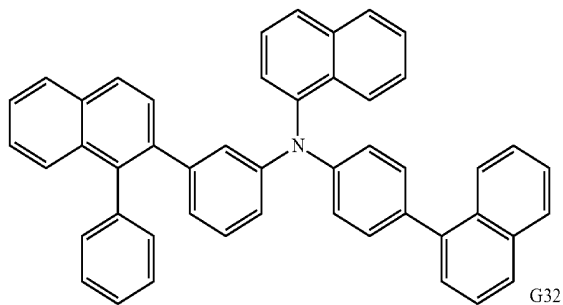


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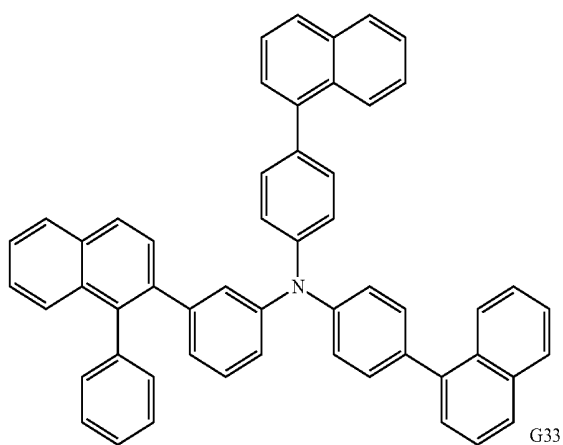


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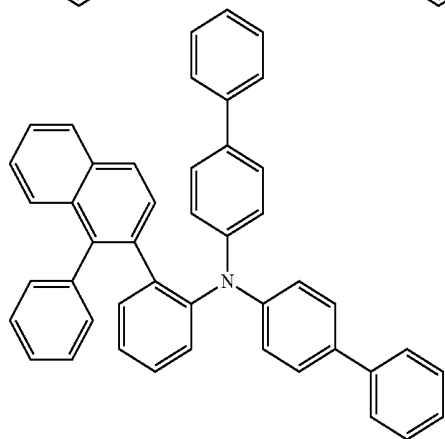
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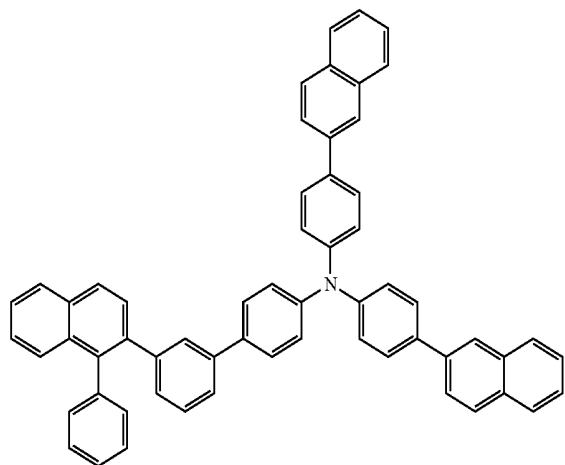
G32



G33

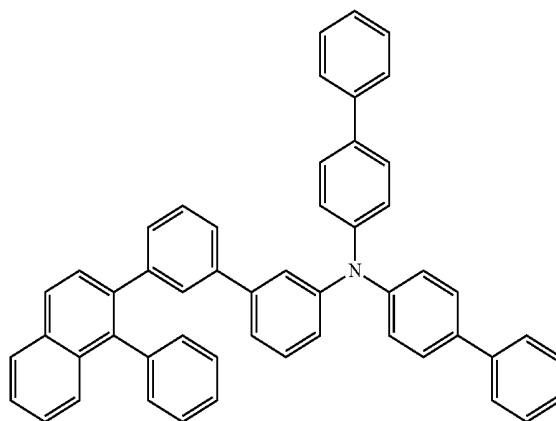


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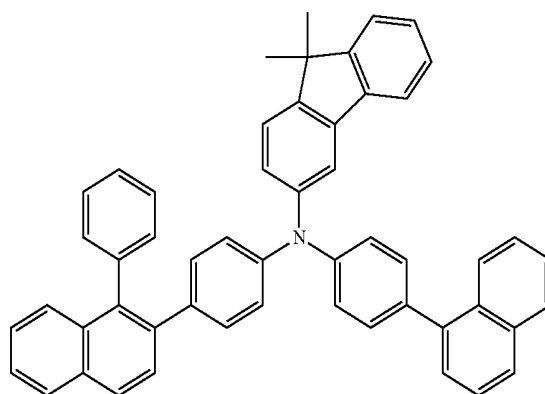


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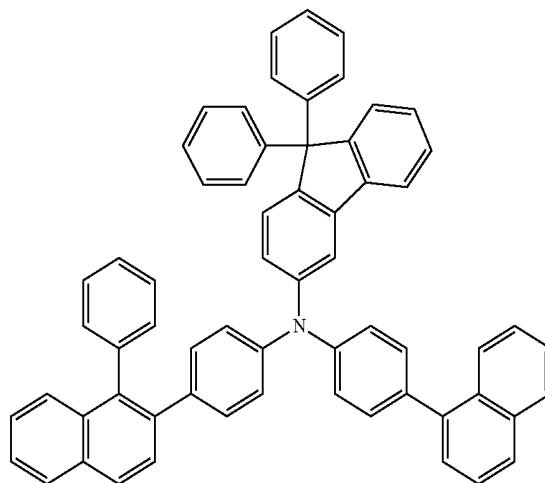
G35



G36

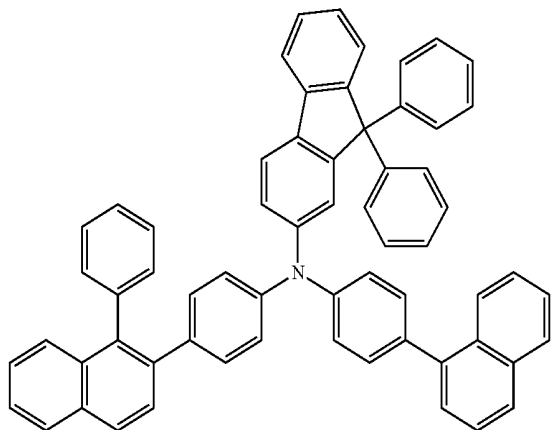


G37



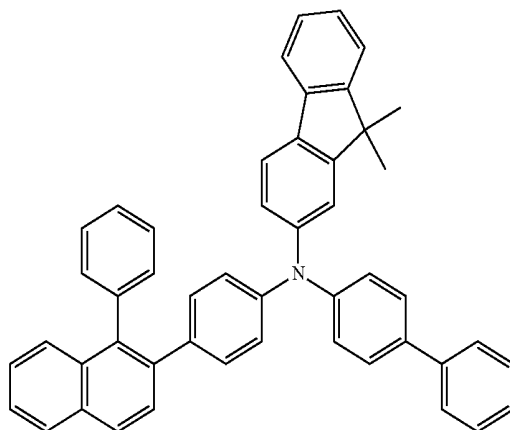
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G38



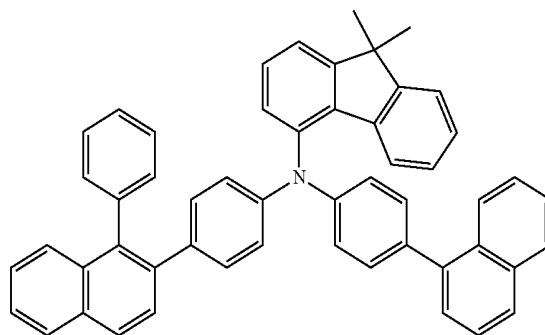
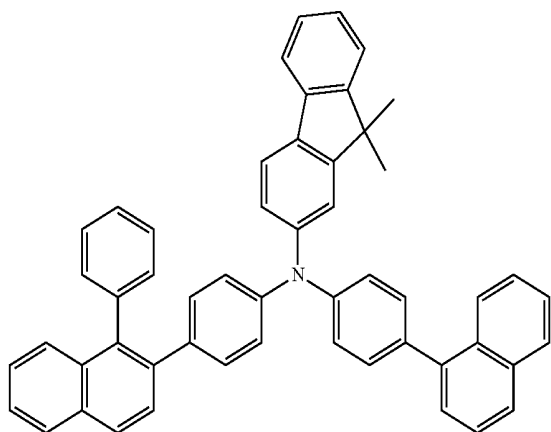
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G41



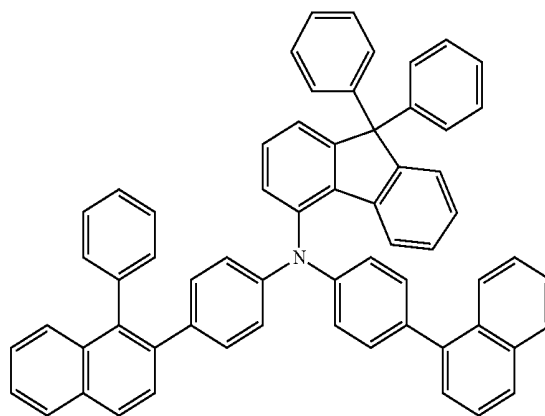
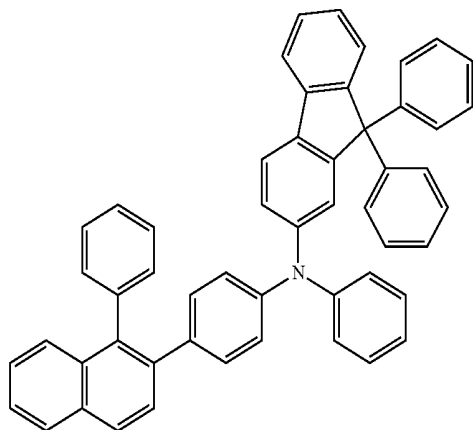
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G39

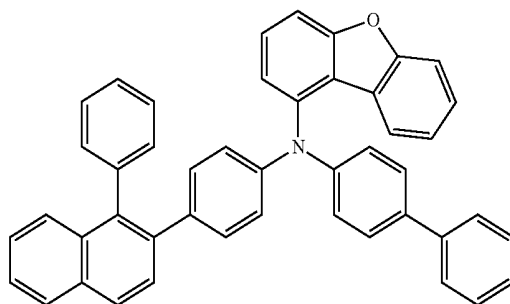


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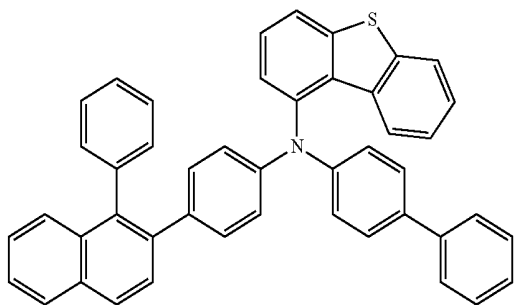


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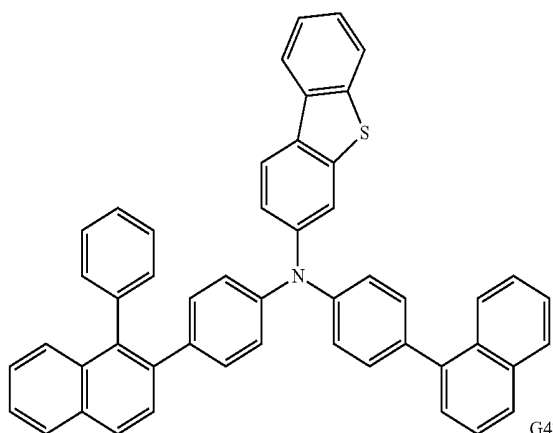


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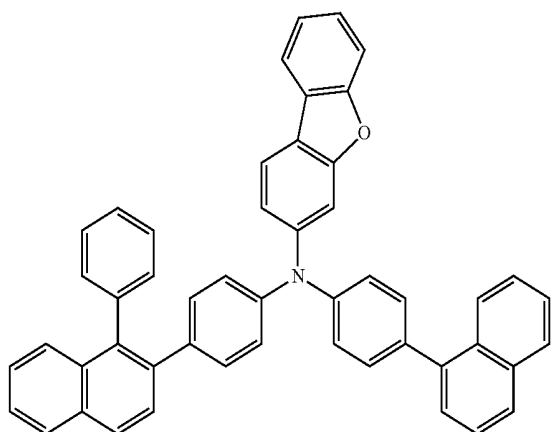
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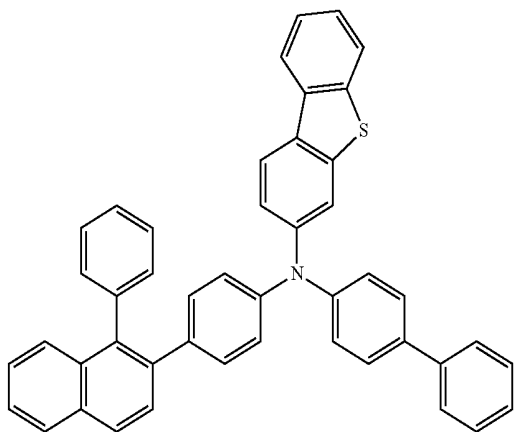
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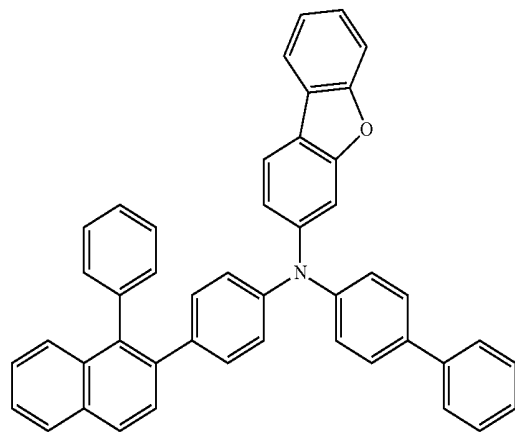


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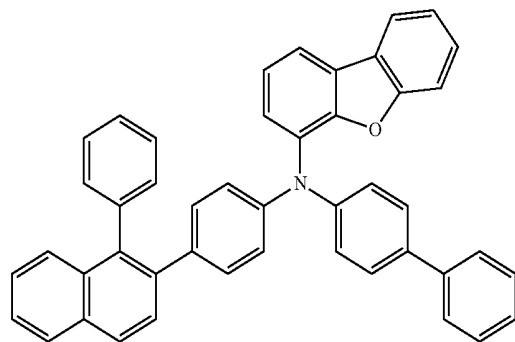


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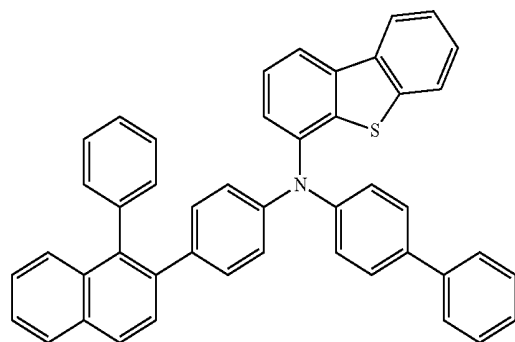
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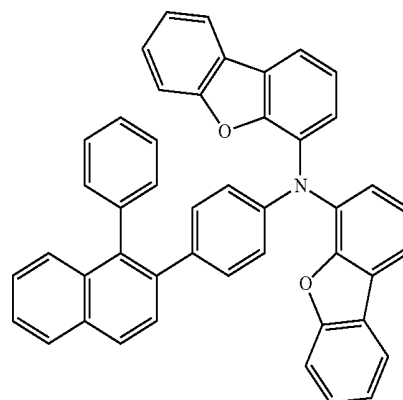
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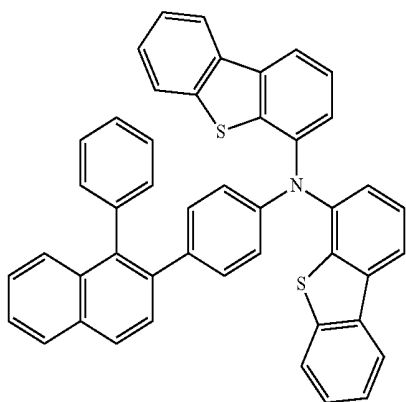
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G52

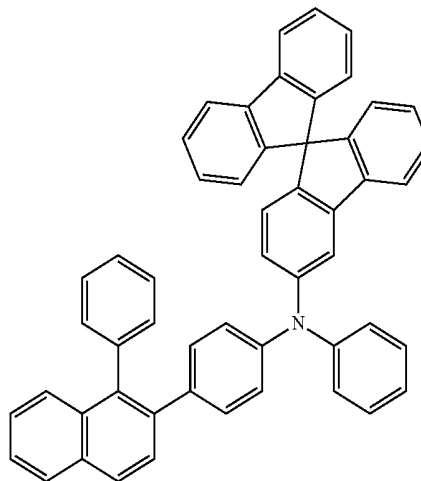


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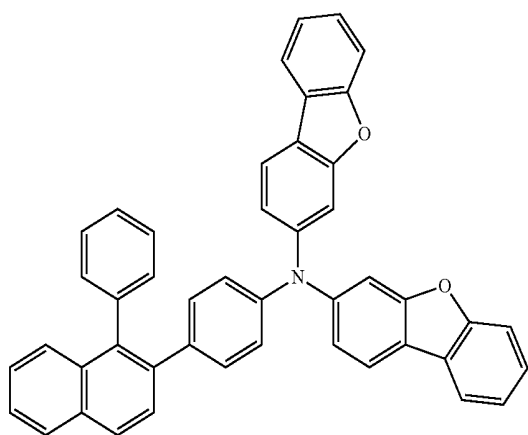
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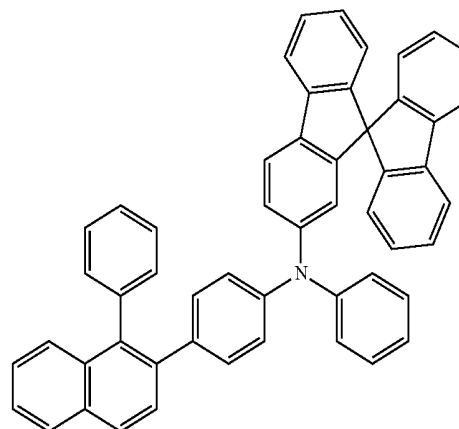


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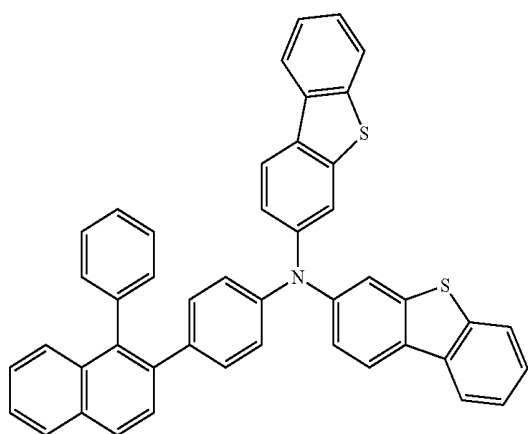
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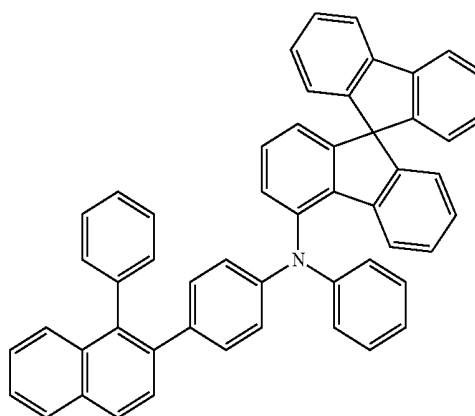
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G55

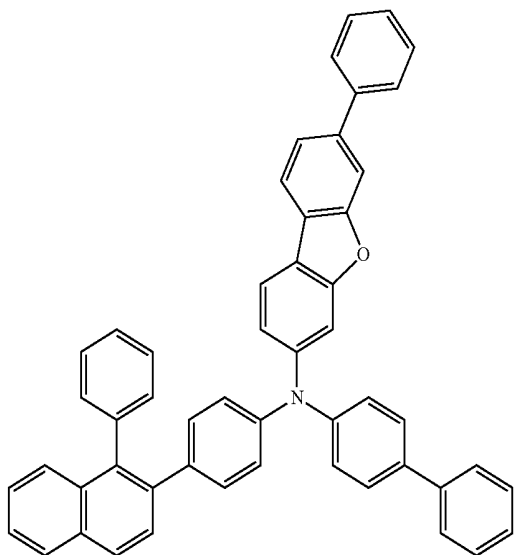


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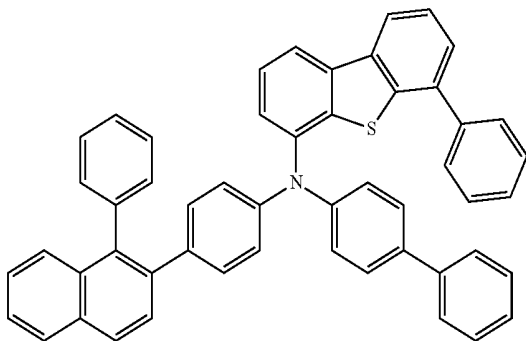


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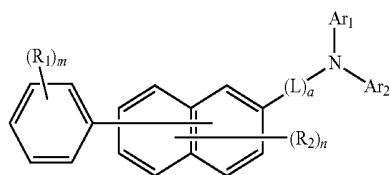
G59



G60



14. A monoamine compound represented by the following Formula 1:



[Formula 1]

wherein in Formula 1,

Ar_1 and Ar_2 are each independently a substituted or unsubstituted alkyl group having 1 to 10 carbon atoms, a substituted or unsubstituted cycloalkyl group having 3 to 20 ring carbon atoms, a substituted or unsubstituted aryl group having 6 to 30 ring carbon atoms, or a substituted or unsubstituted heteroaryl group having 2 to 30 ring carbon atoms, provided that when any one of Ar_1 and Ar_2 is 3-dibenzofuranyl, the other one of Ar_1 and Ar_2 is not 9-phenanthryl,

L is a substituted or unsubstituted arylene group having 6 to 30 ring carbon atoms, or a substituted or unsubstituted heteroarylene group having 2 to 30 ring carbon atoms,

R_1 is a hydrogen atom, a deuterium atom, a halogen atom, a substituted or unsubstituted alkyl group having 1 to 20 carbon atoms, a substituted or unsubstituted cycloalkyl group having 3 to 20 ring carbon atoms, or a substituted or unsubstituted aryl group having 6 to 30 ring carbon atoms,

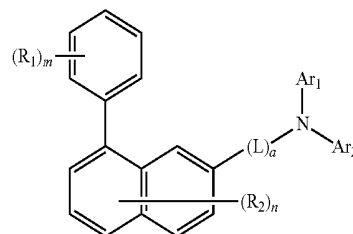
R_2 is a hydrogen atom, a deuterium atom, a halogen atom, a substituted or unsubstituted alkyl group having 1 to 20 carbon atoms, or a substituted or unsubstituted cycloalkyl group having 3 to 20 ring carbon atoms,

a is an integer of 0 to 3,

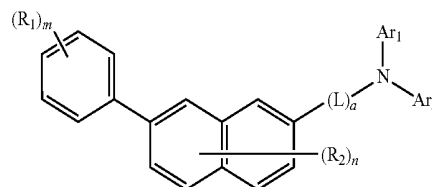
m is an integer of 0 to 1, and

n is an integer of 0 to 6.

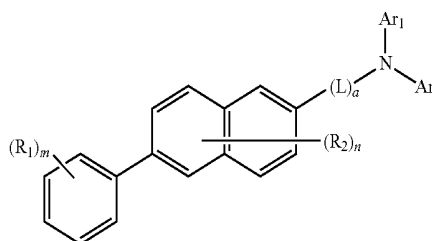
15. The monoamine compound as claimed in claim 14, wherein Formula 1 is represented by any one of the following Formulae 2 to 8:



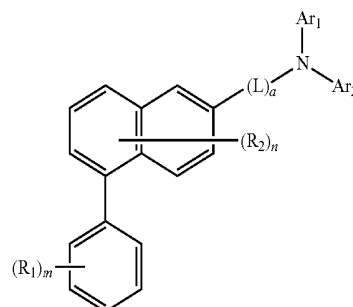
[Formula 2]



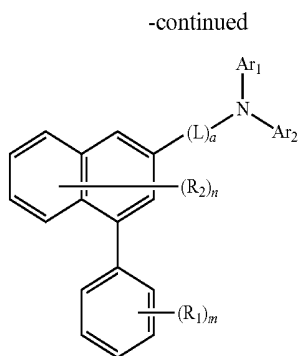
[Formula 3]



[Formula 4]

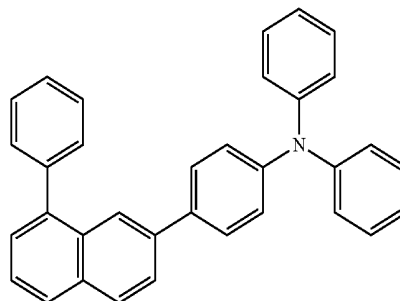


[Formula 5]

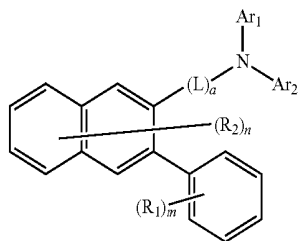


[Formula 6]

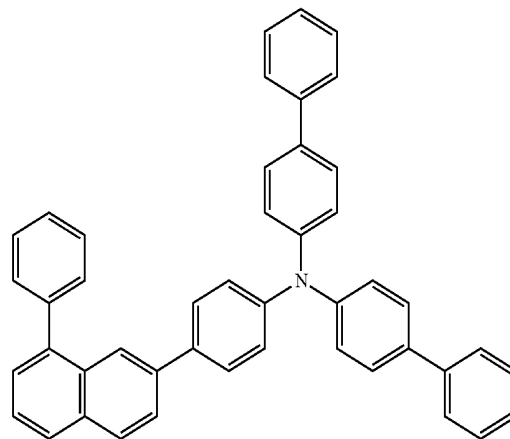
[Compound Group 1]



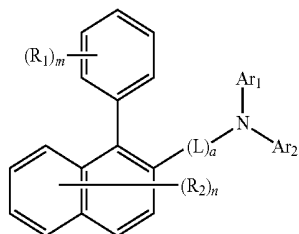
A1



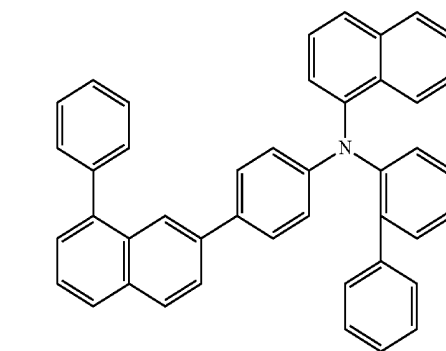
[Formula 7]



A2



[Formula 8]



A3

wherein in Formula 2 to 8,

Ar₁, Ar₂, L, R₁, R₂, a, m, and n are the same as defined in Formula 1.

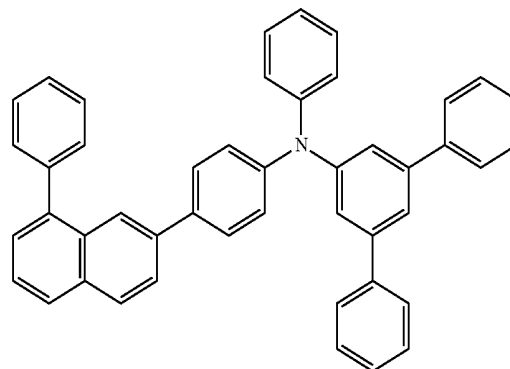
16. The monoamine compound as claimed in claim 14, wherein L is a substituted or unsubstituted phenylene group.

17. The monoamine compound as claimed in claim 14, wherein Ar₁ and Ar₂ are each independently a substituted or unsubstituted aryl group having 6 to 12 ring carbon atoms.

18. The monoamine compound as claimed in claim 14, wherein Ar₁ and Ar₂ are each independently a substituted or unsubstituted heteroaryl group having 5 to 12 ring carbon atoms.

19. The monoamine compound as claimed in claim 14, wherein R₂ is a hydrogen atom or a deuterium atom.

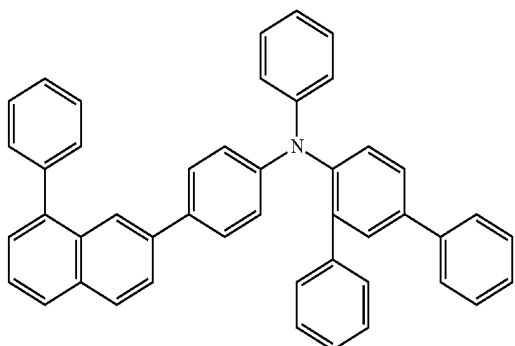
20. The monoamine compound as claimed in claim 14, wherein the monoamine compound represented by Formula 1 is at least one selected from the group of compounds represented in the following Compound Groups 1 to 7:



A4

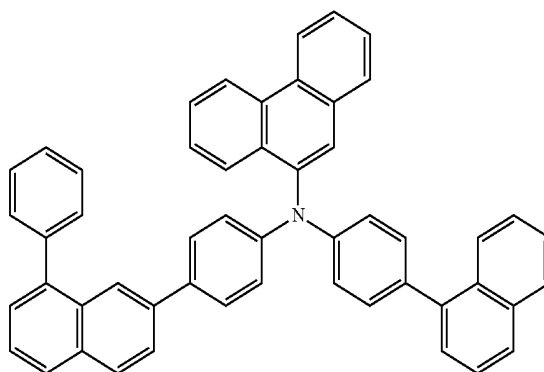
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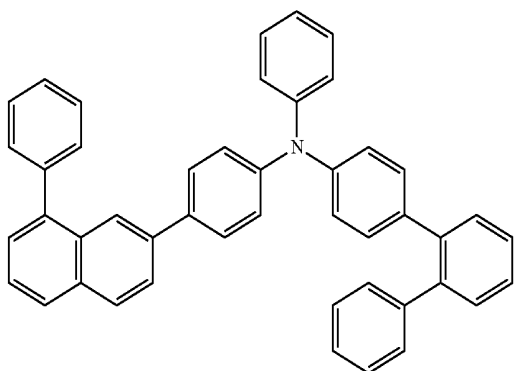


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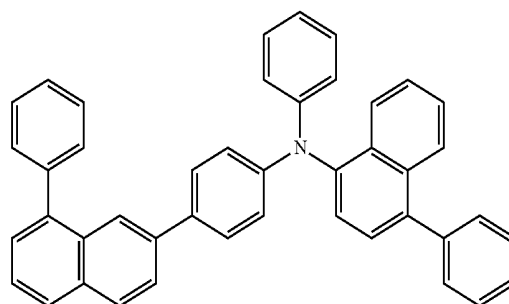
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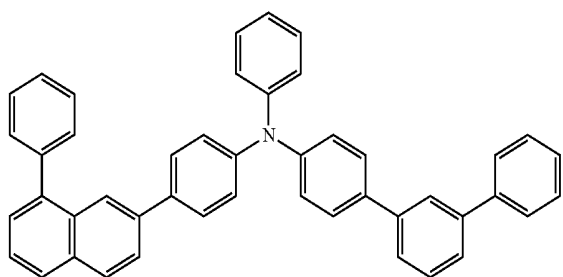
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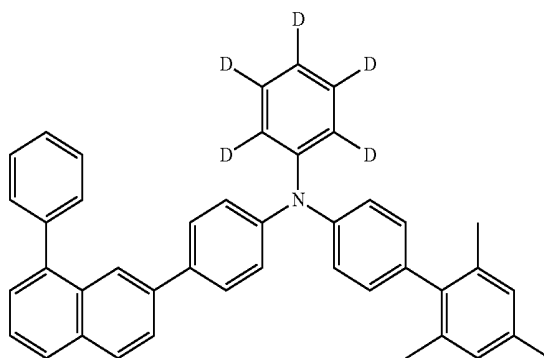
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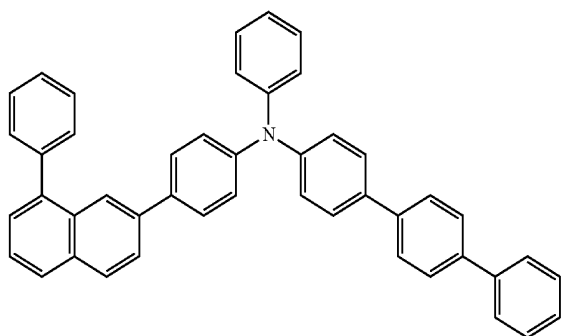
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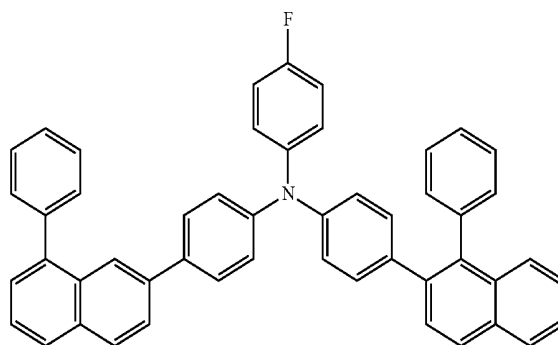
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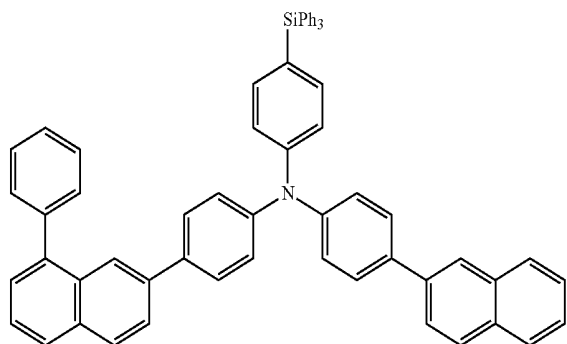


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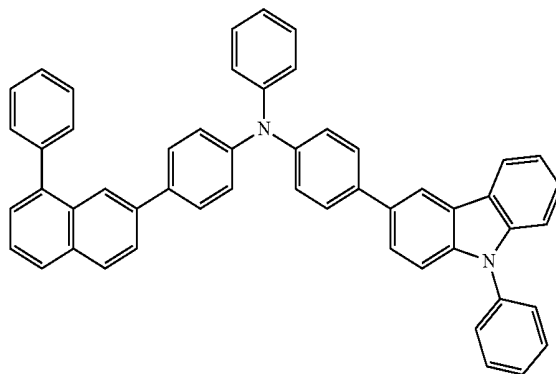
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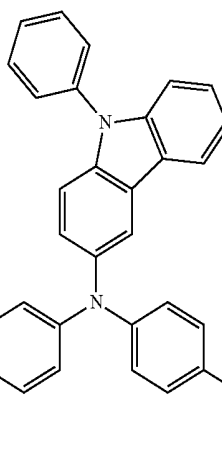
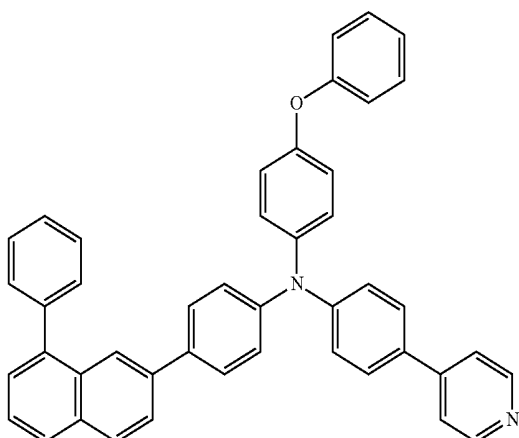
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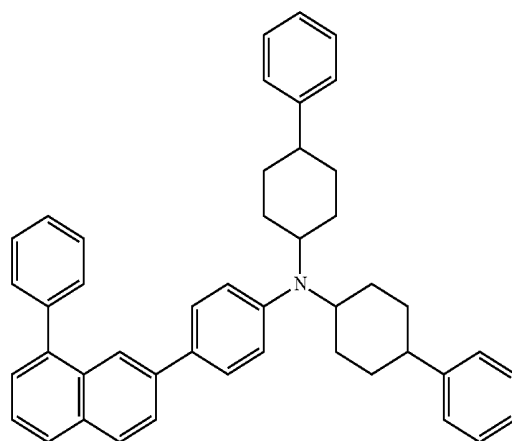
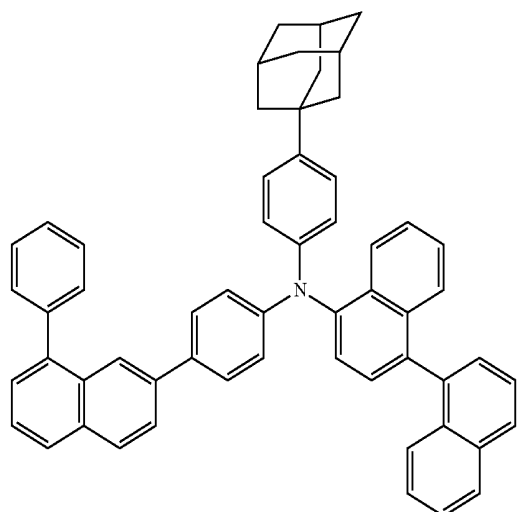
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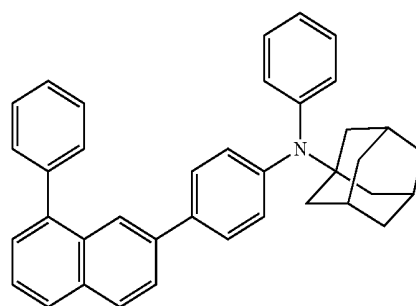


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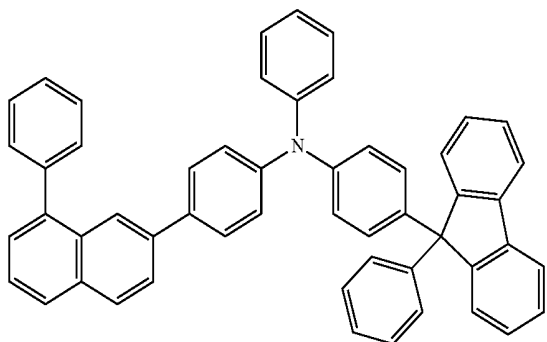


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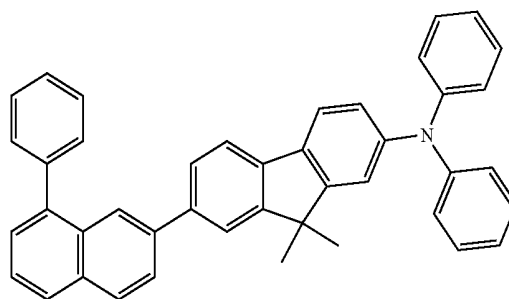
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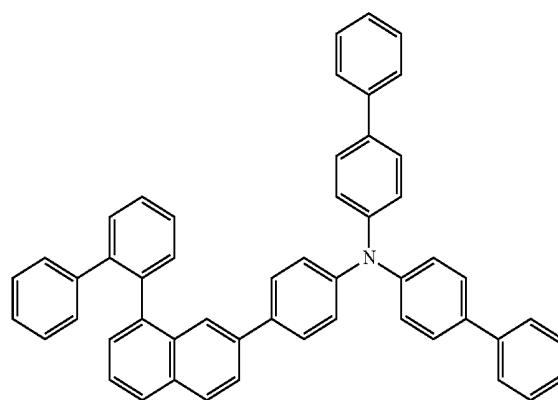
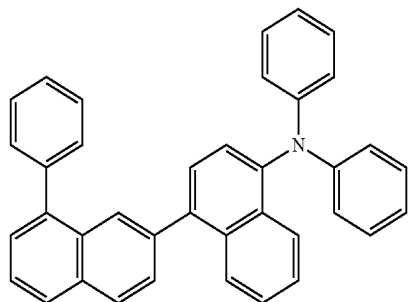
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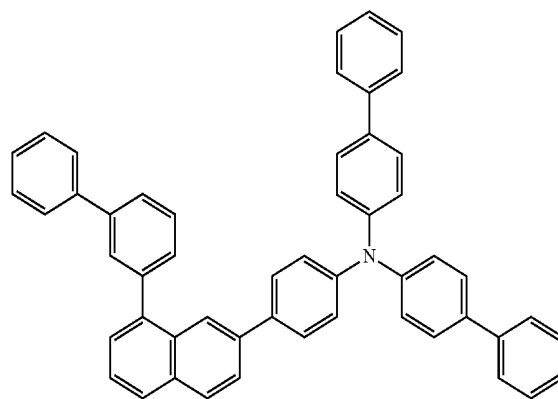
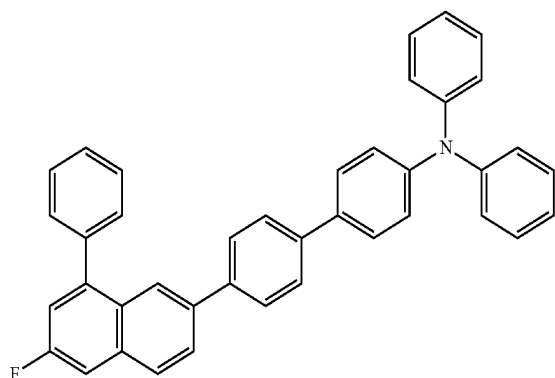
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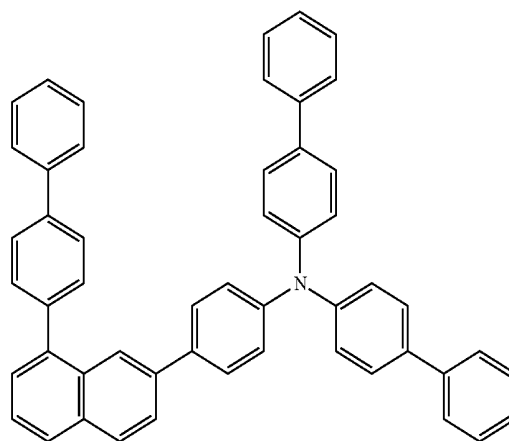
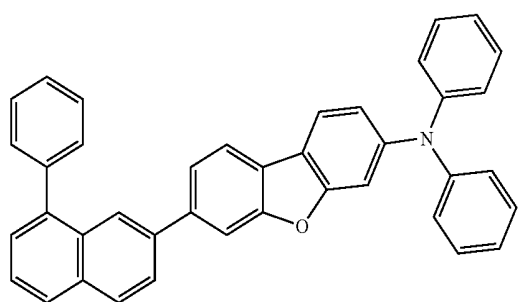
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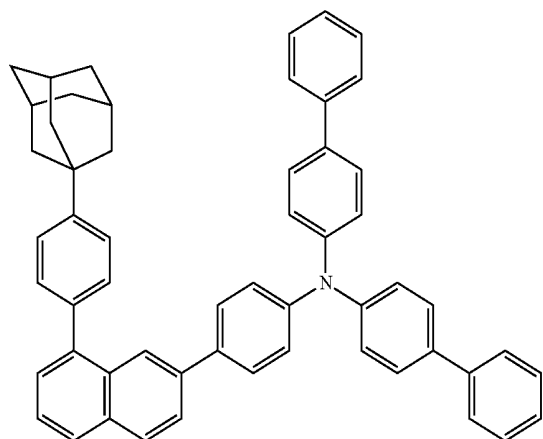
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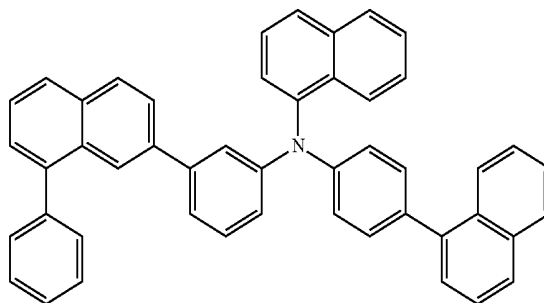
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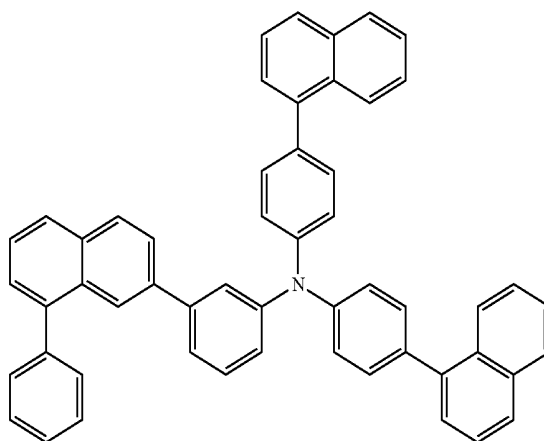
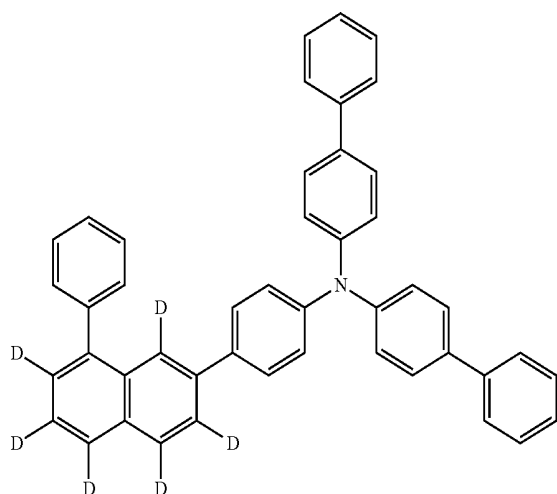
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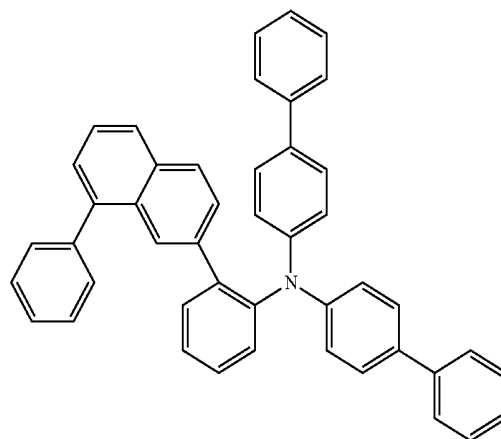
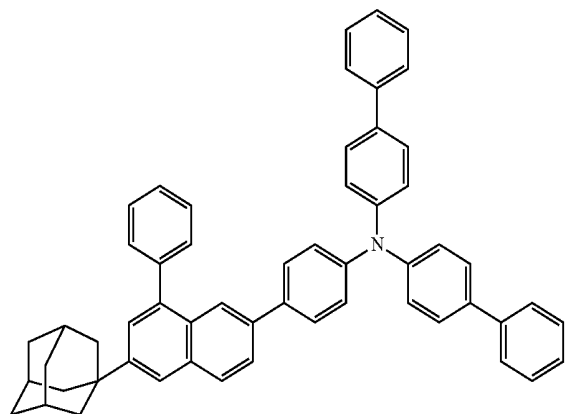
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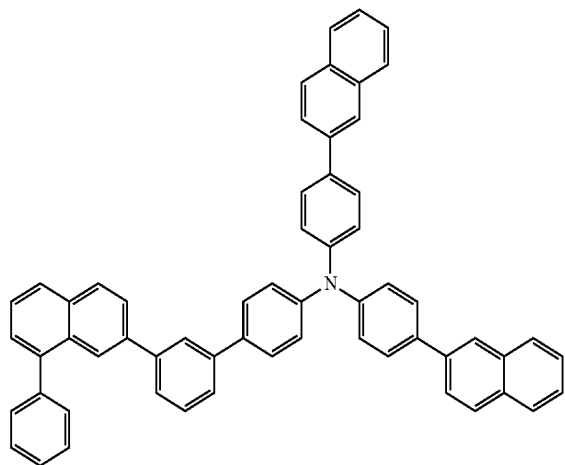
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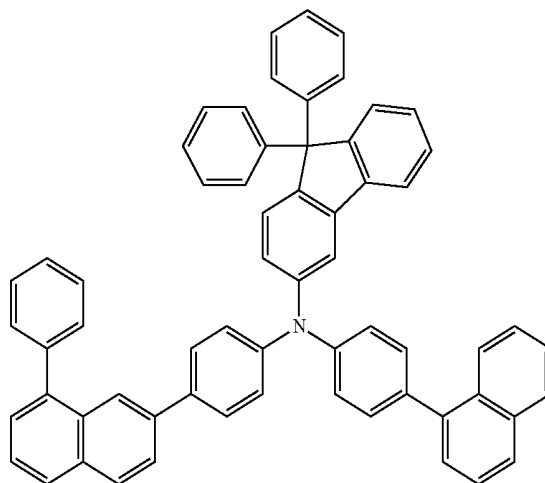
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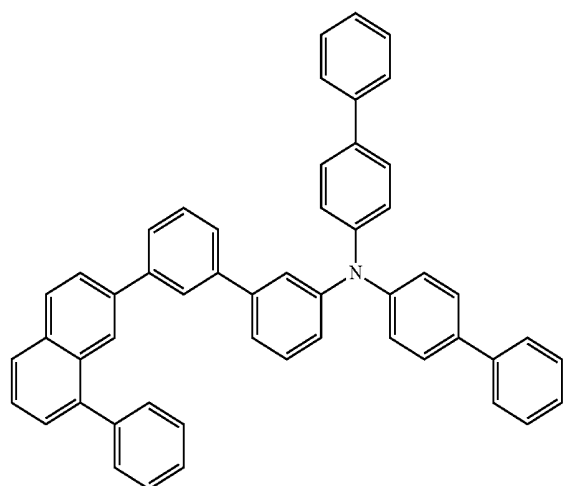


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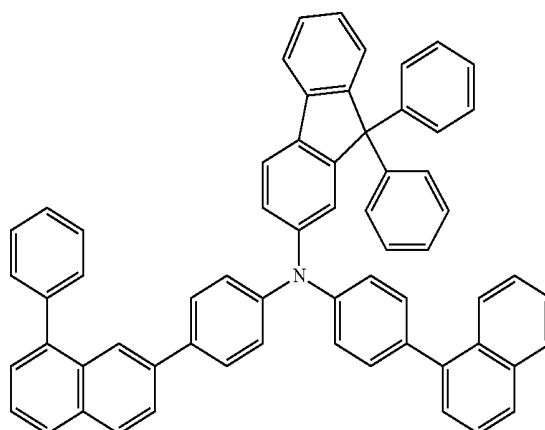
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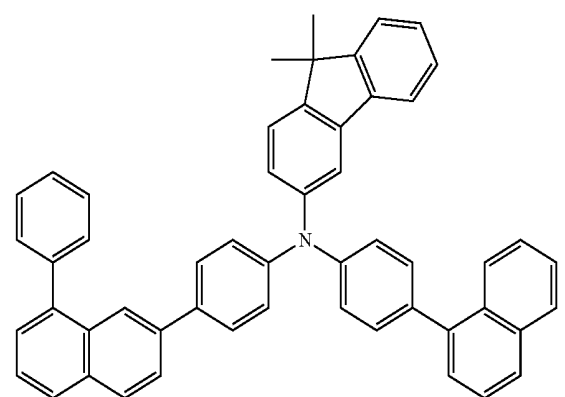
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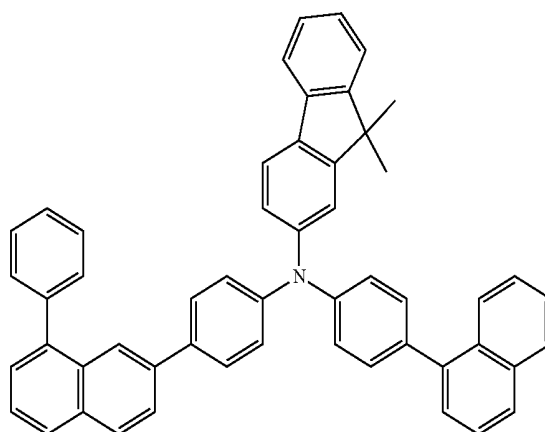
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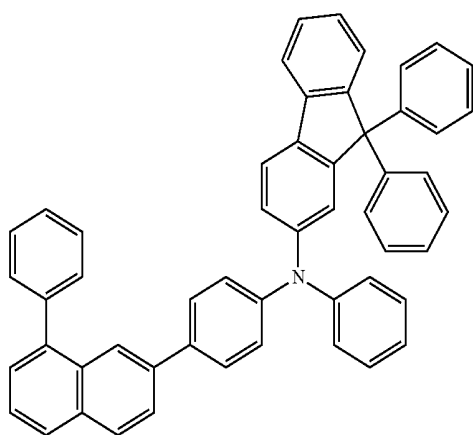
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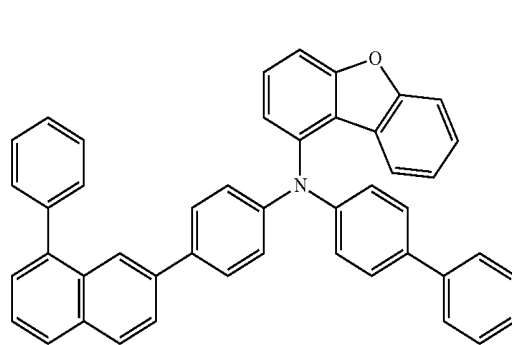
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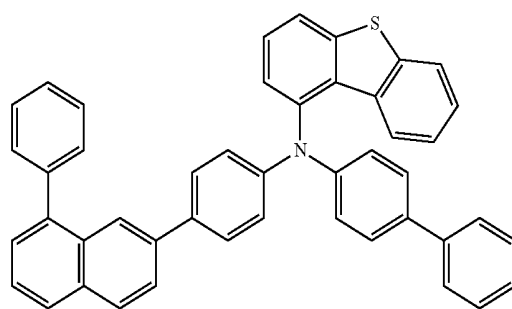
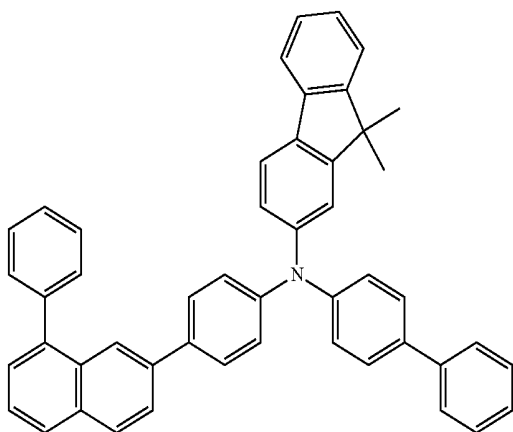
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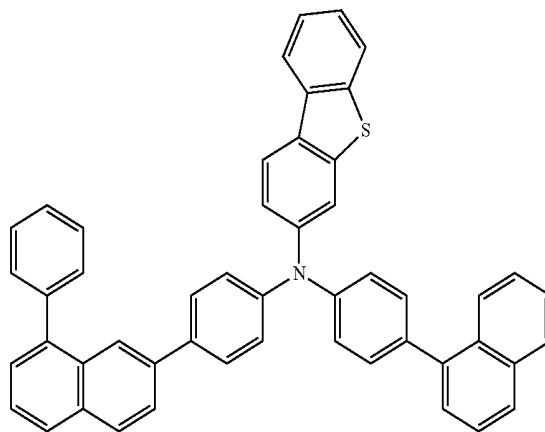
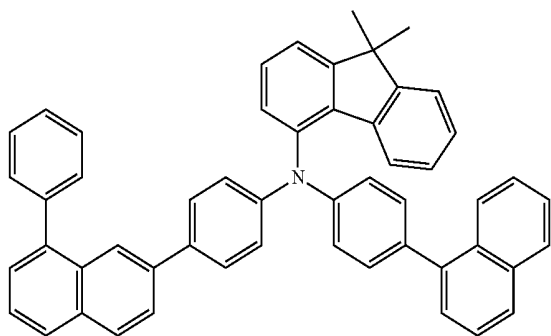
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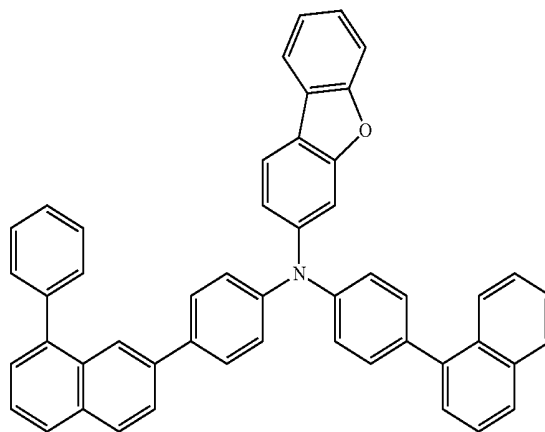
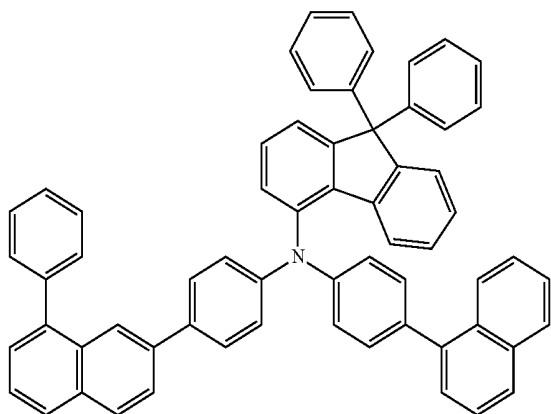
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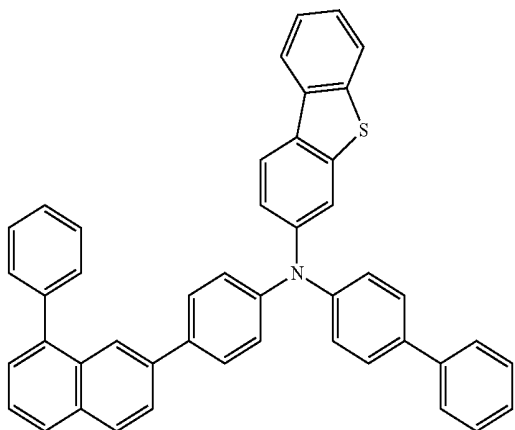
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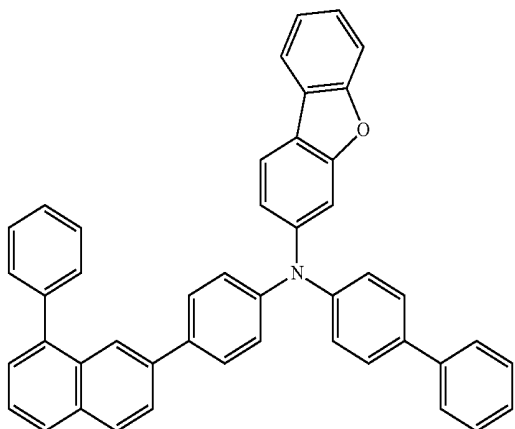


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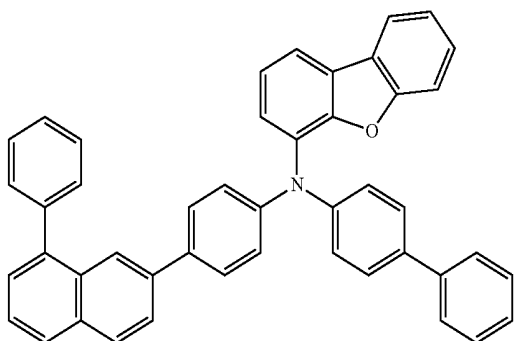
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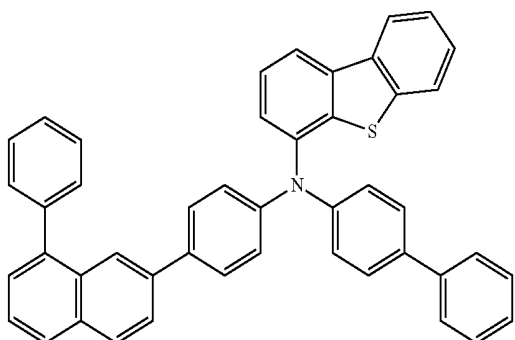
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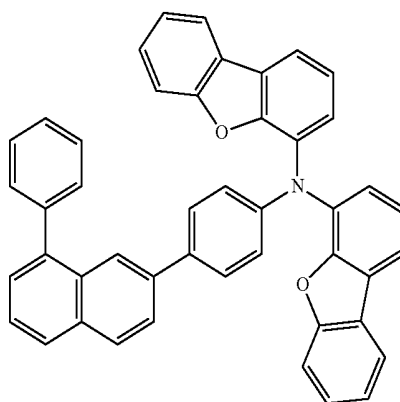


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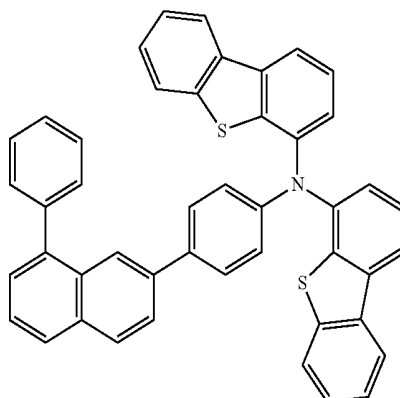


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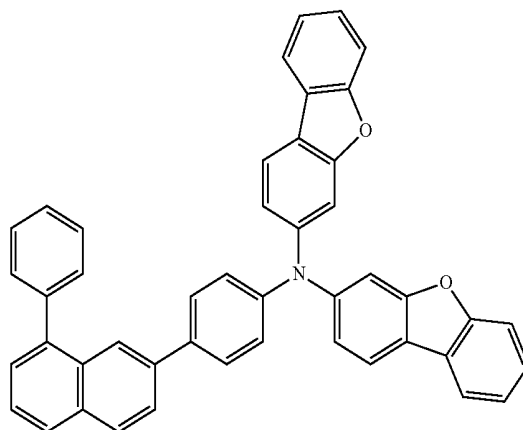
A52



A53

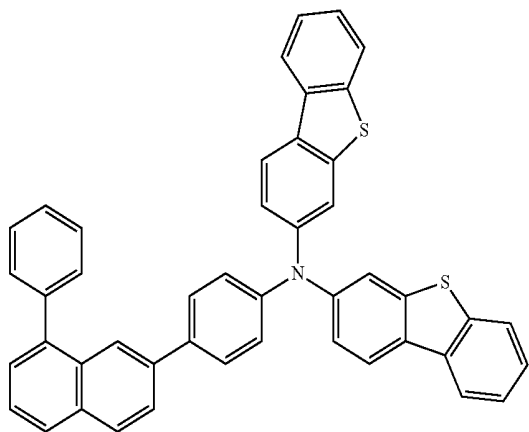


A54



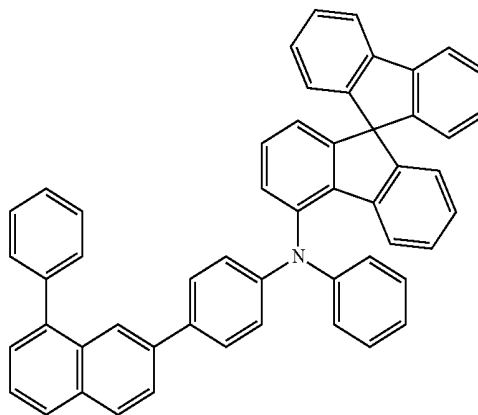
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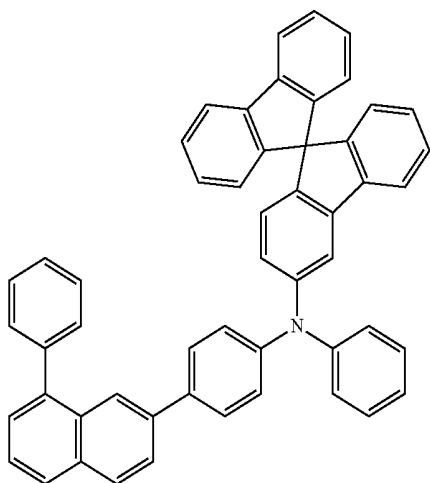


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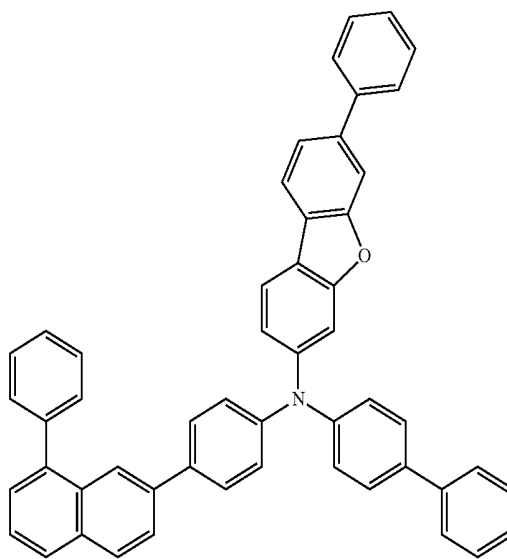
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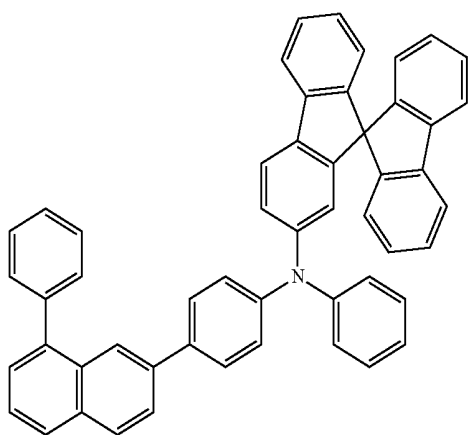
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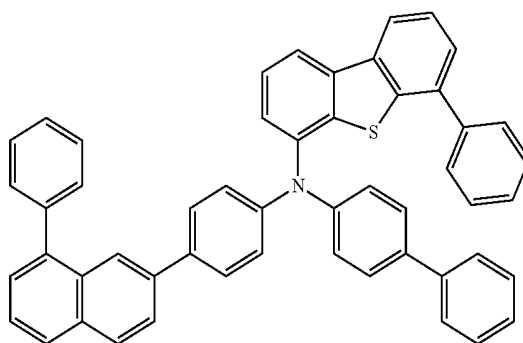
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A57

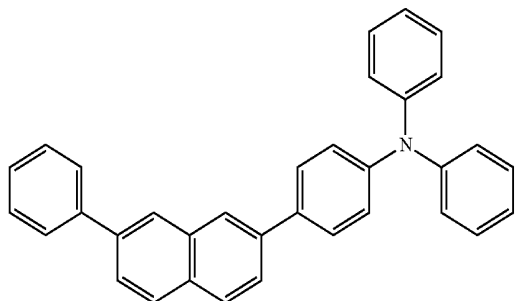


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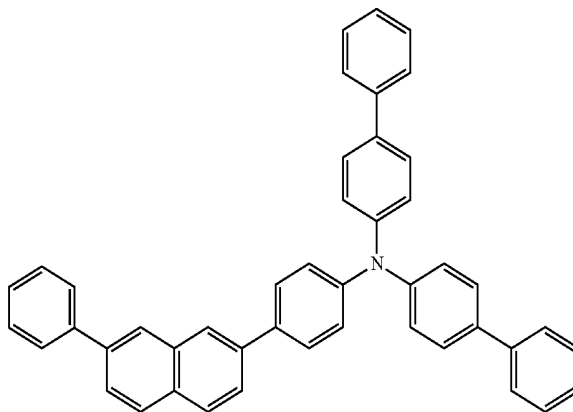


[Compound Group 2]

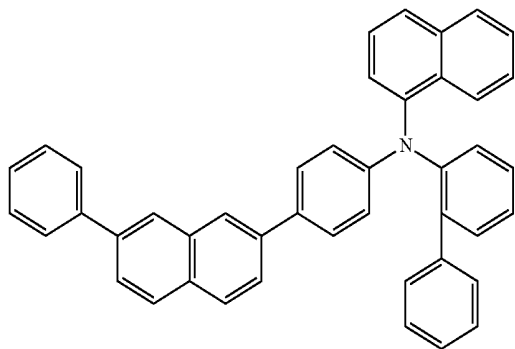
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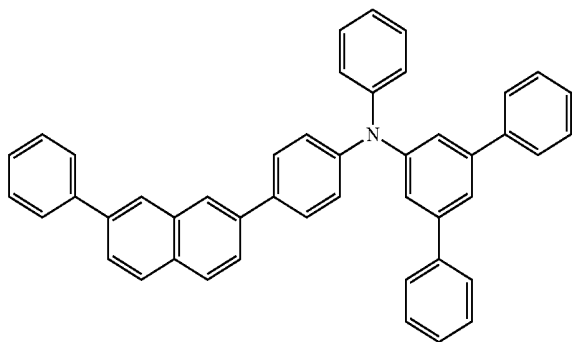
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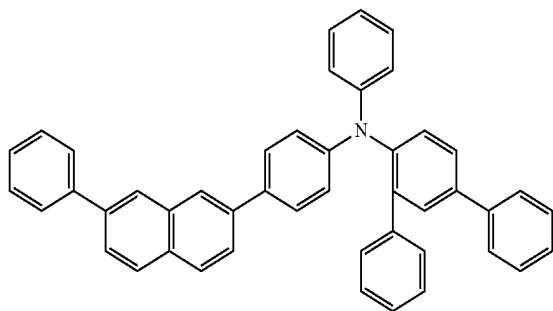
B3



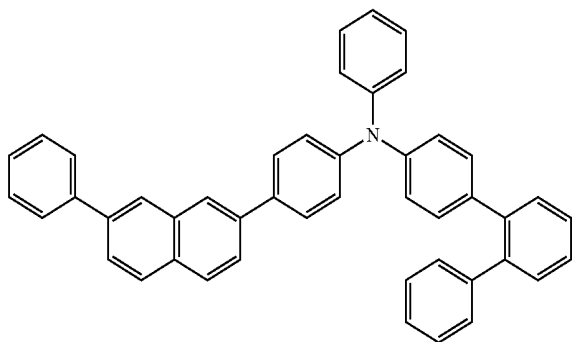
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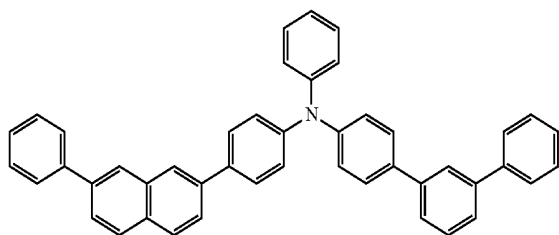
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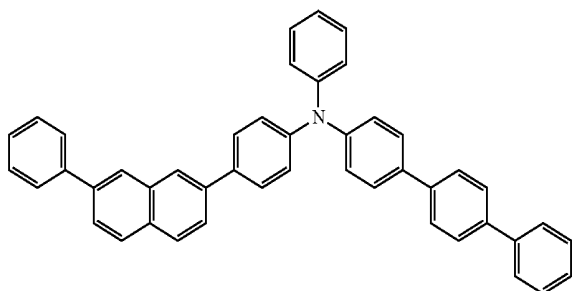
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B7

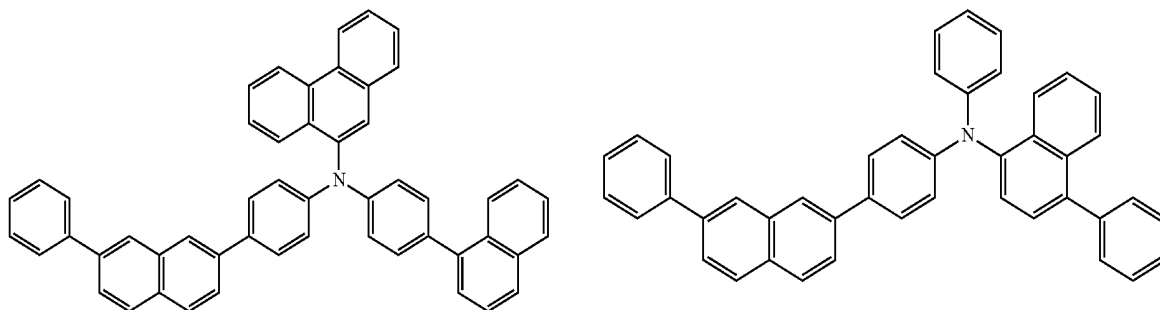


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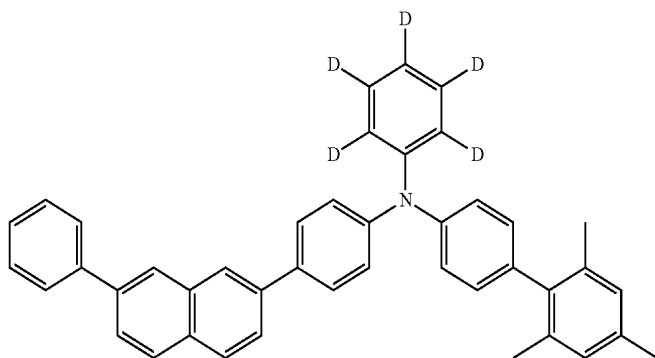


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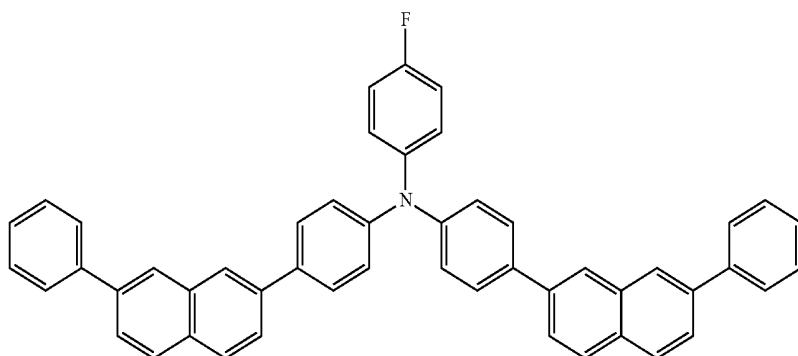
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B11

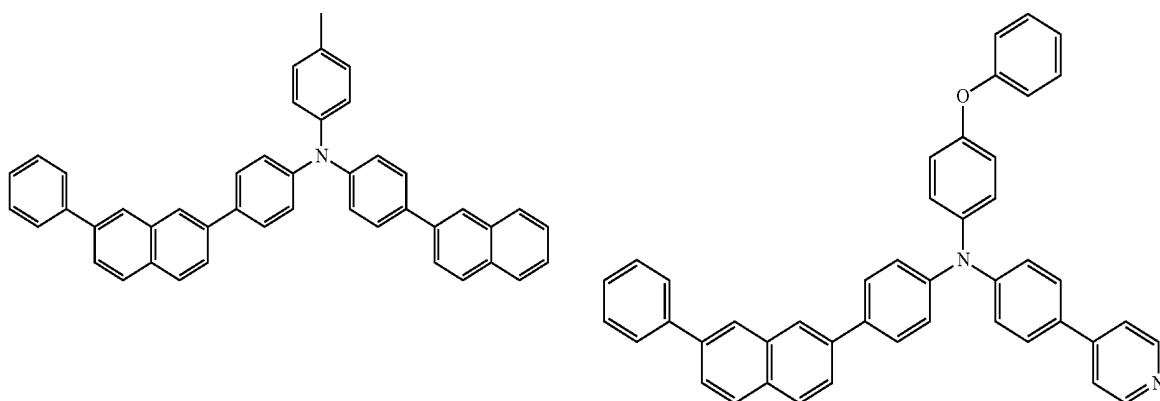


B12



B13

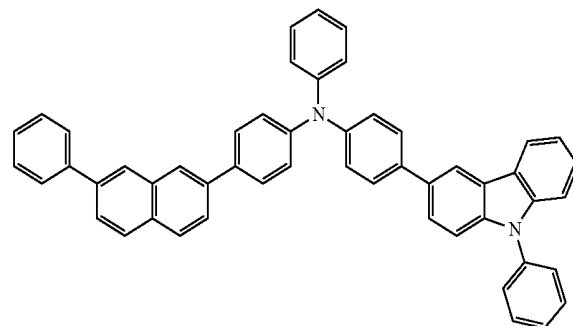
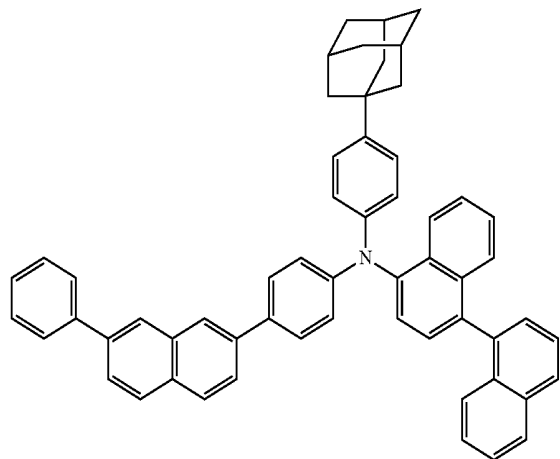
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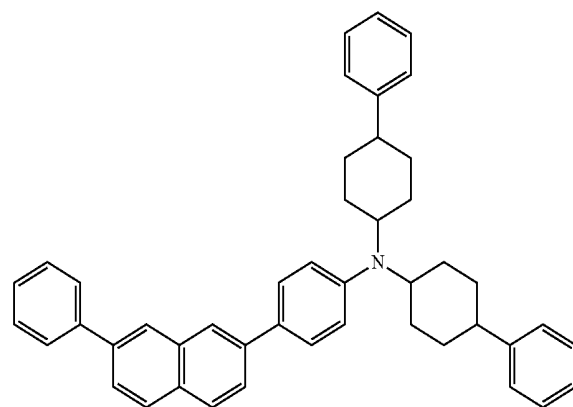
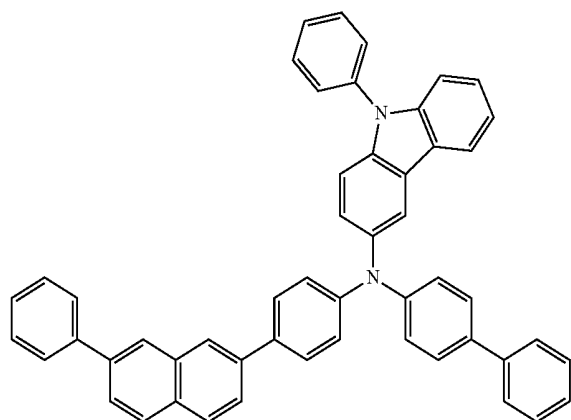
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B16



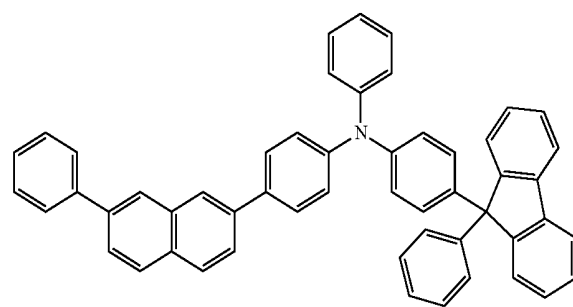
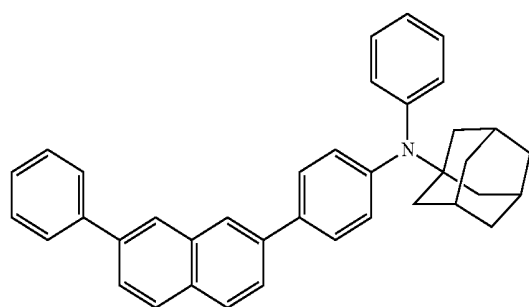
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B18



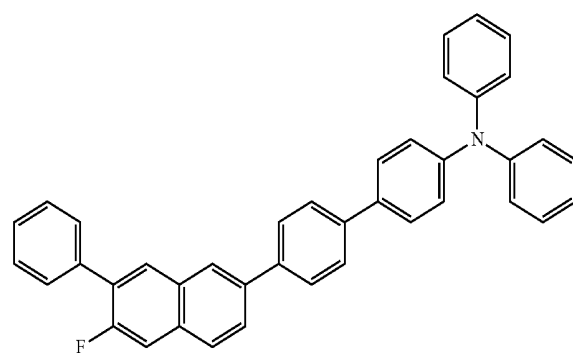
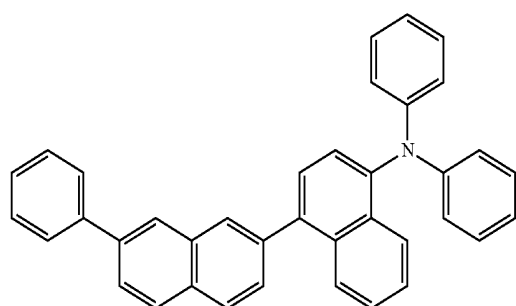
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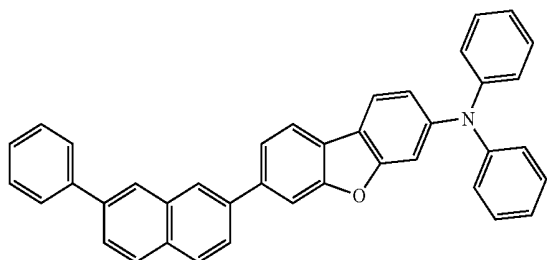
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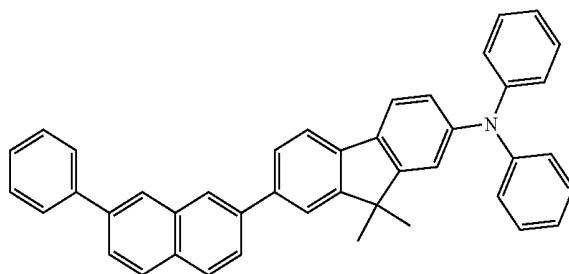


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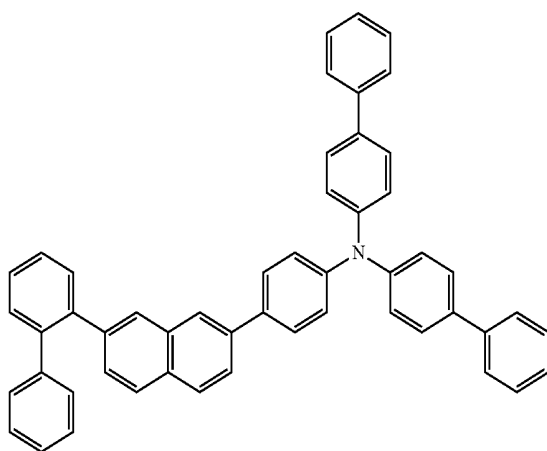
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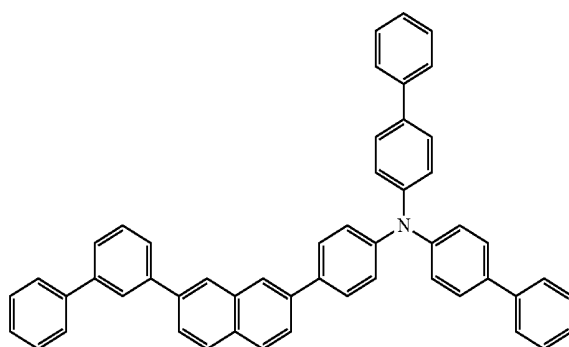
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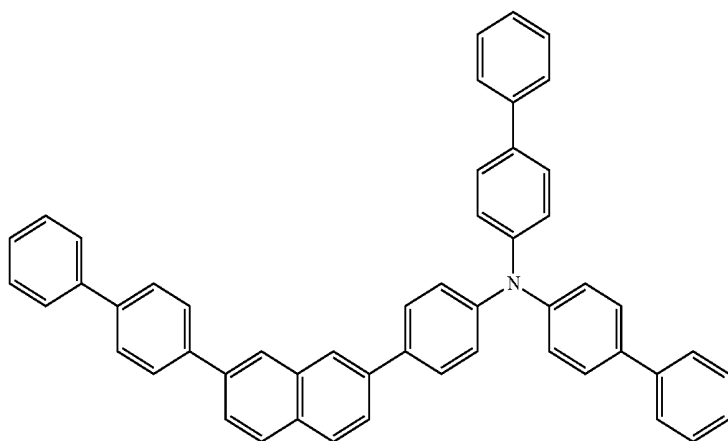
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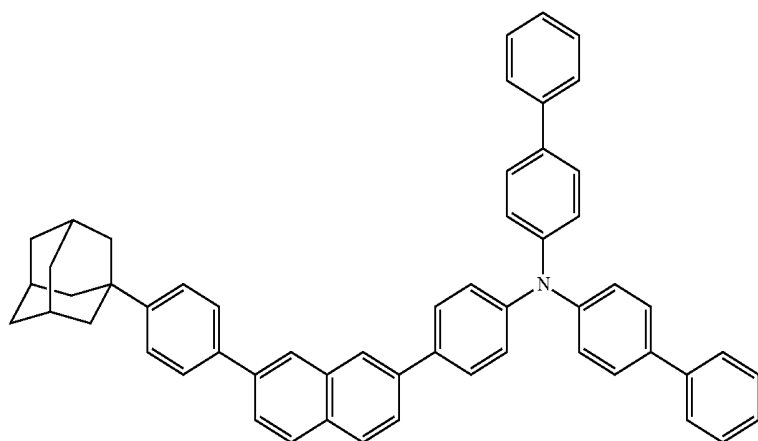
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B27

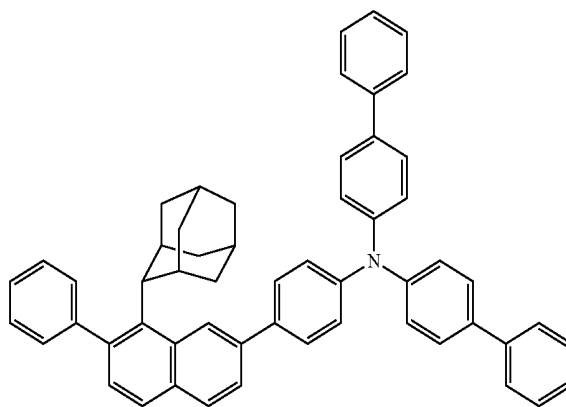
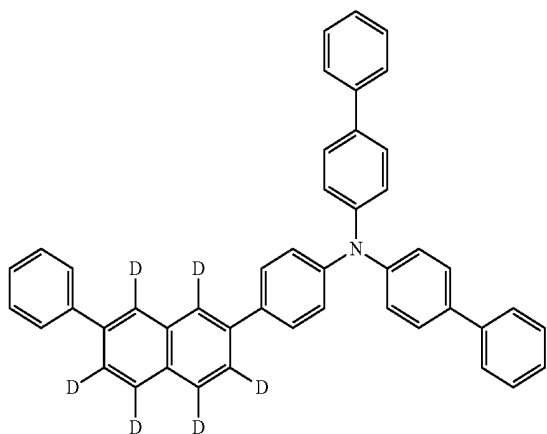


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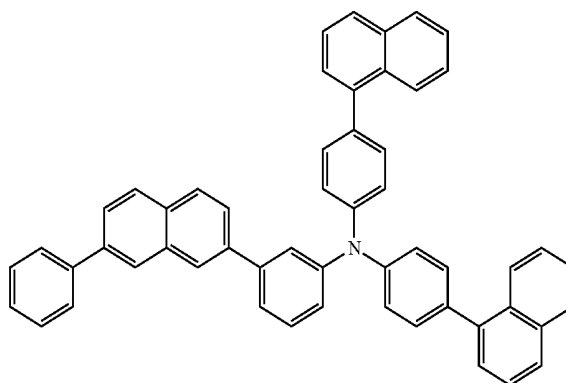
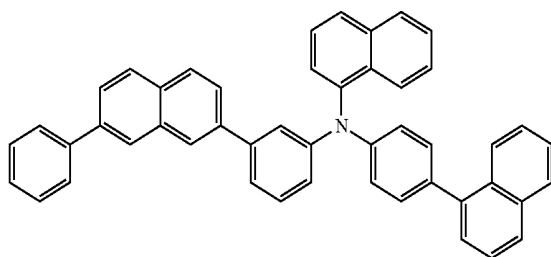
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B30

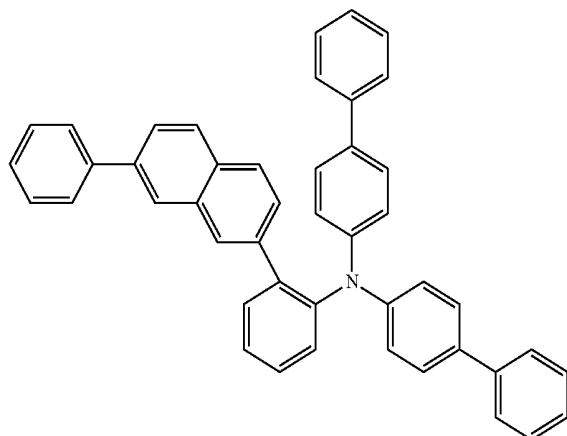


B31

B32

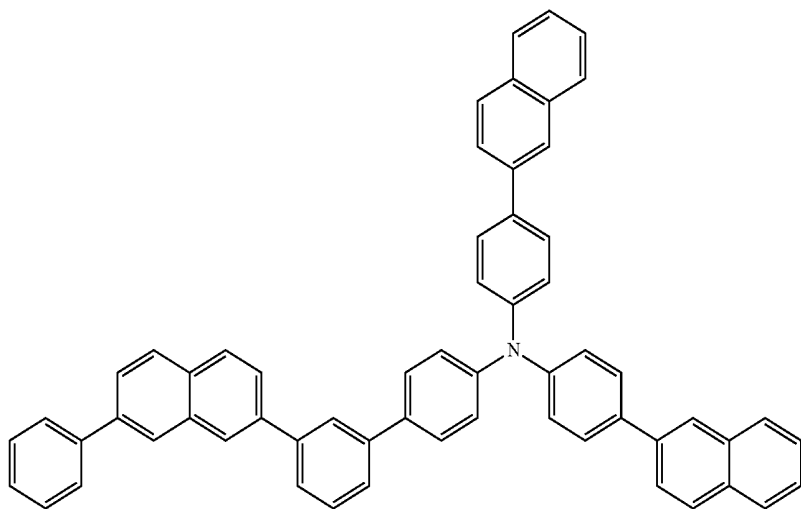


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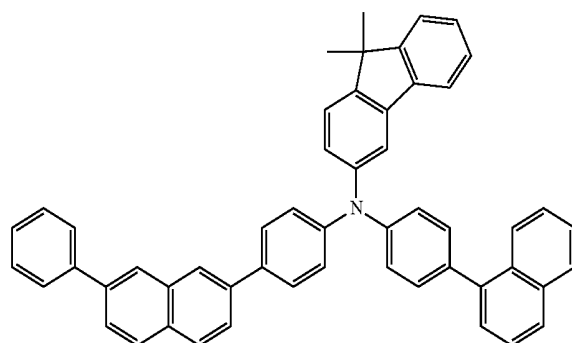
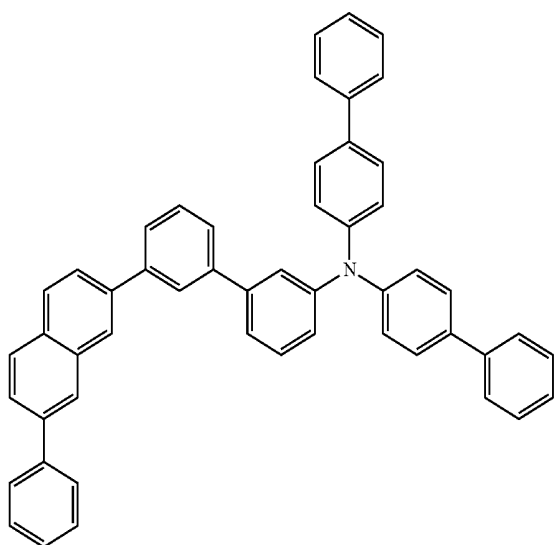
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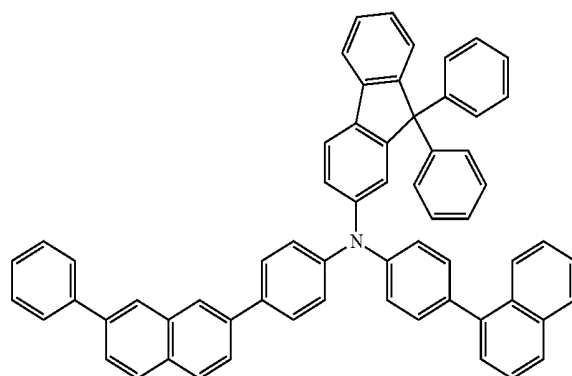
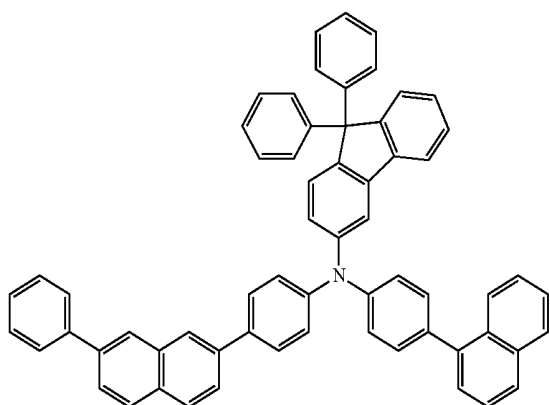
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B36



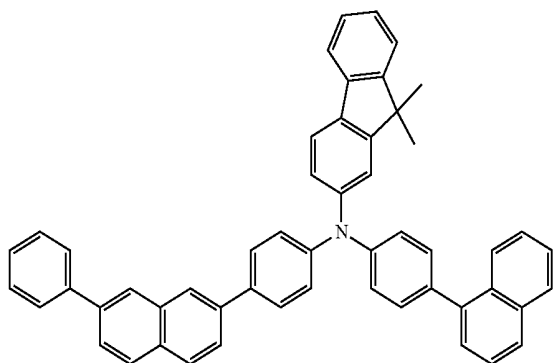
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B38

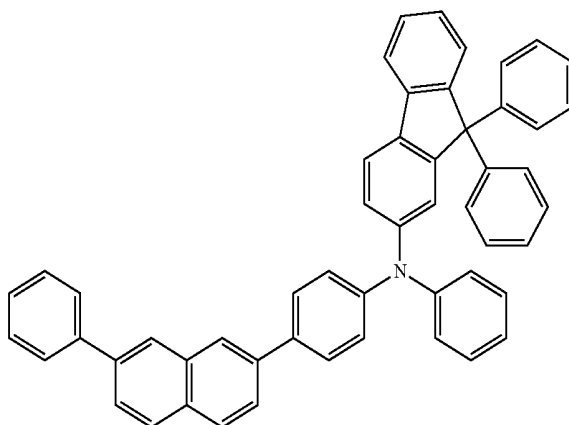


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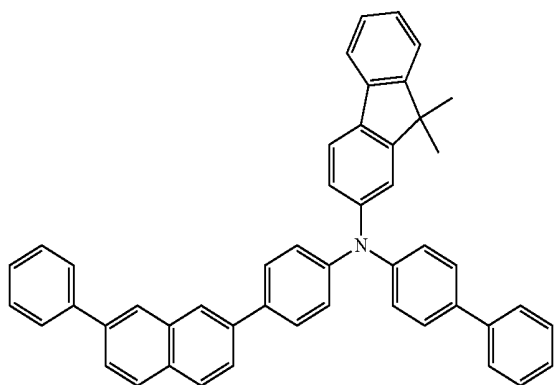
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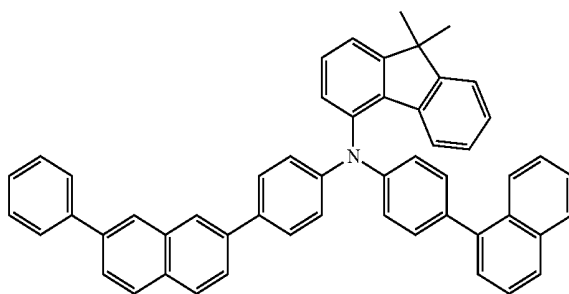
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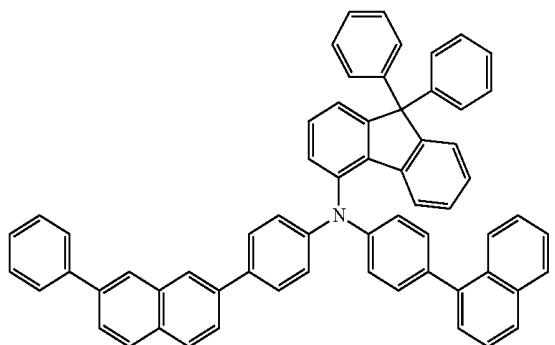
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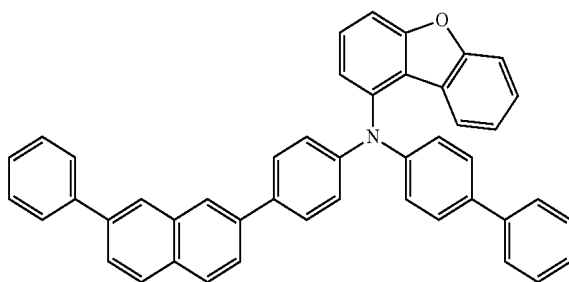
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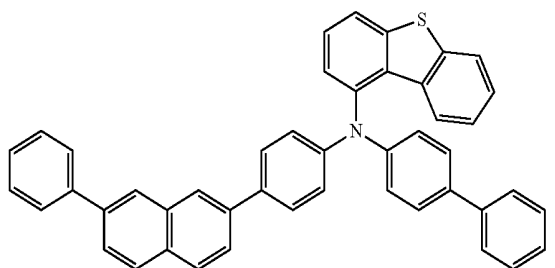
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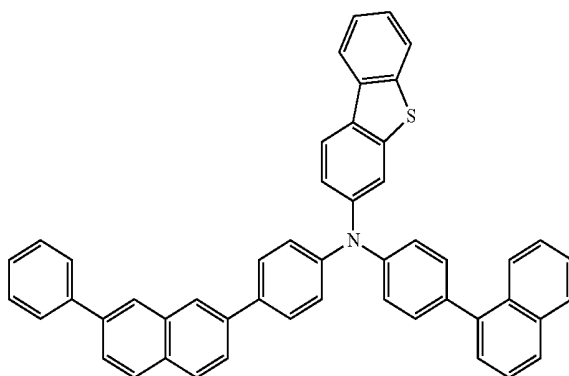
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B45

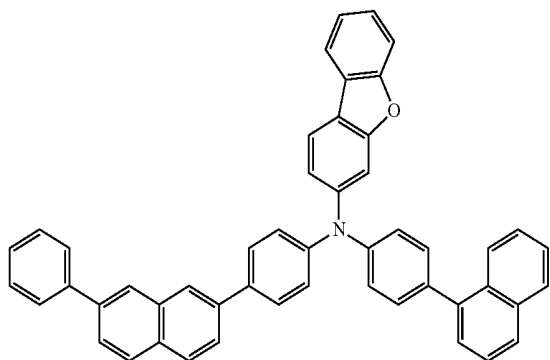


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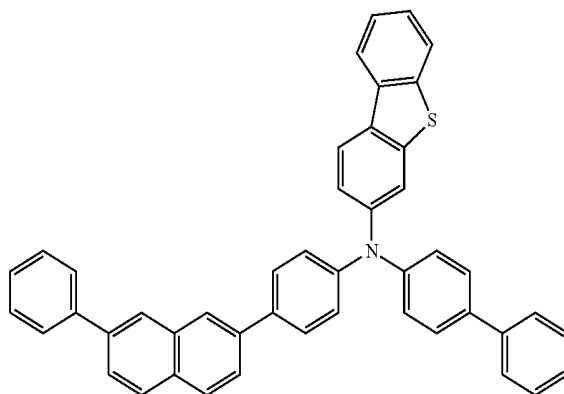


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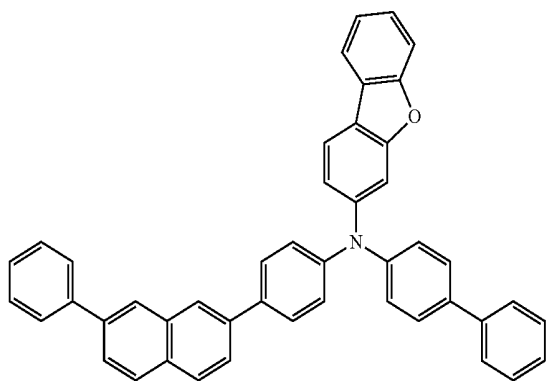
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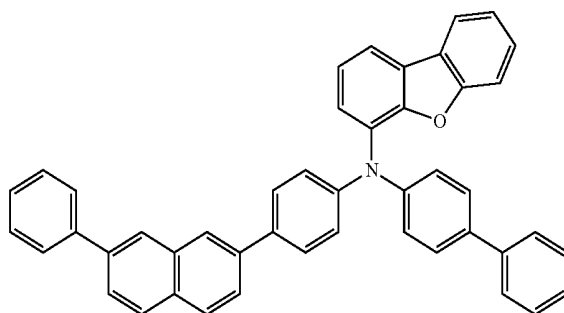
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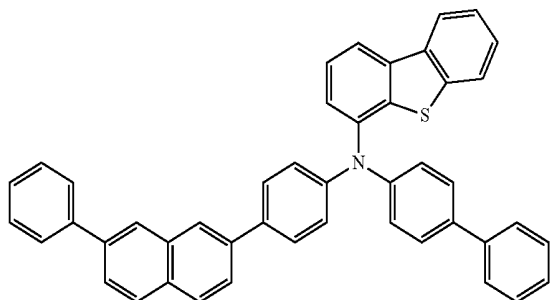
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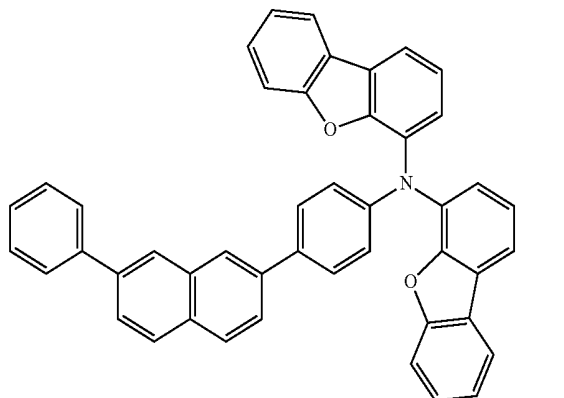
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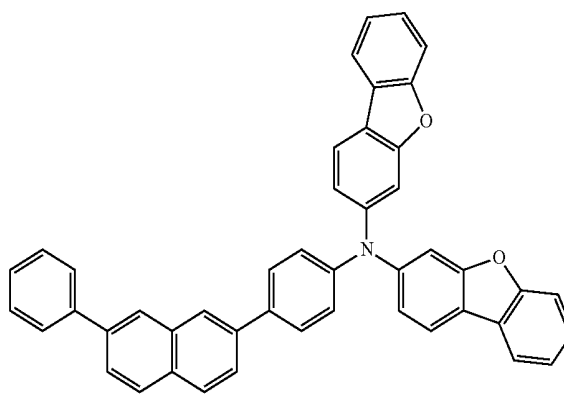
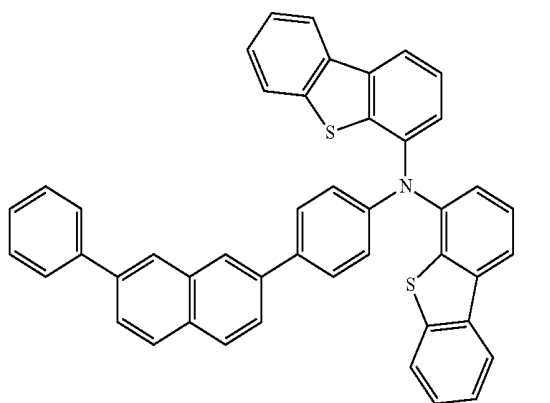
B52



B53

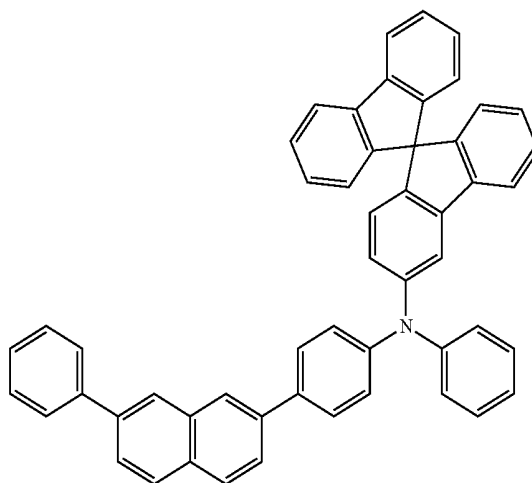
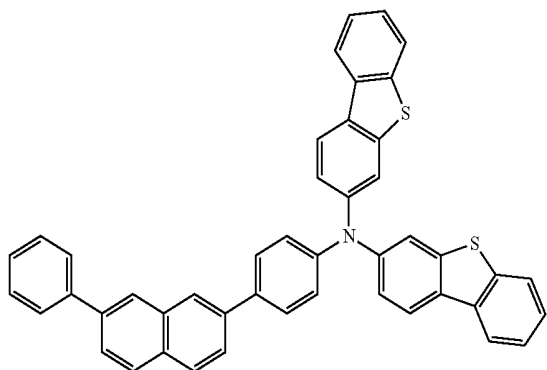


B54



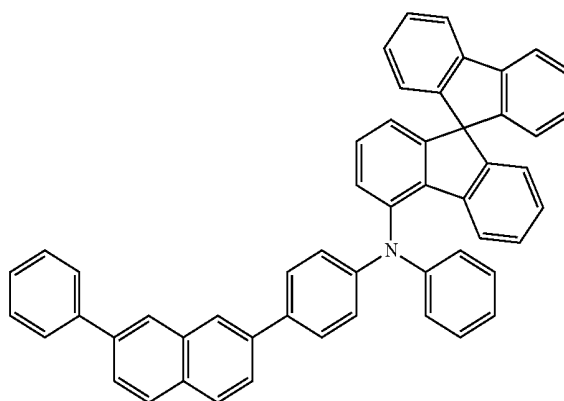
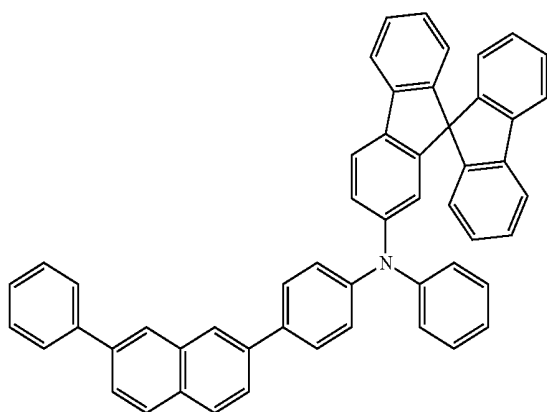
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B55

B56



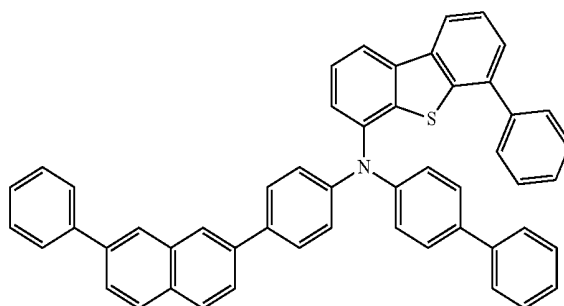
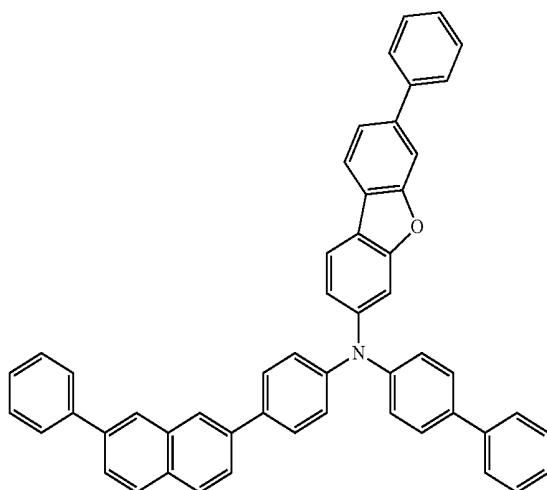
B57

B58



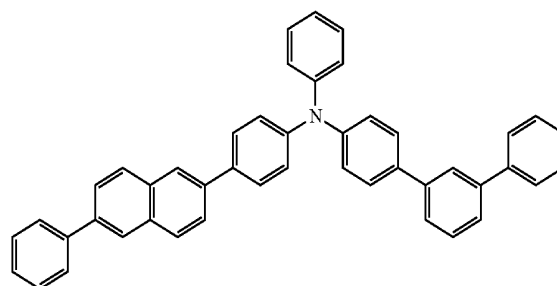
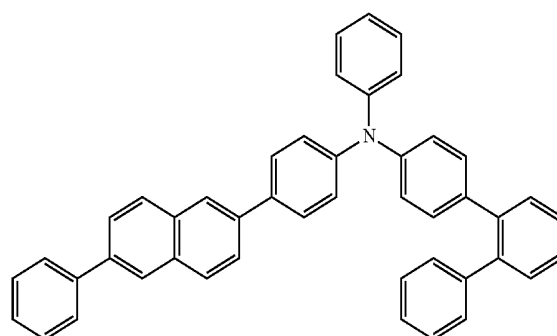
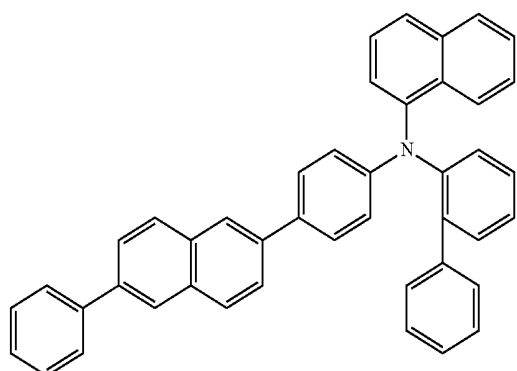
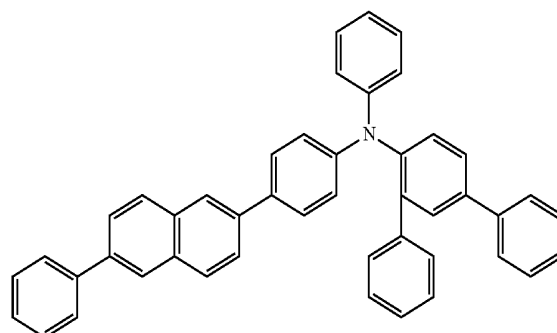
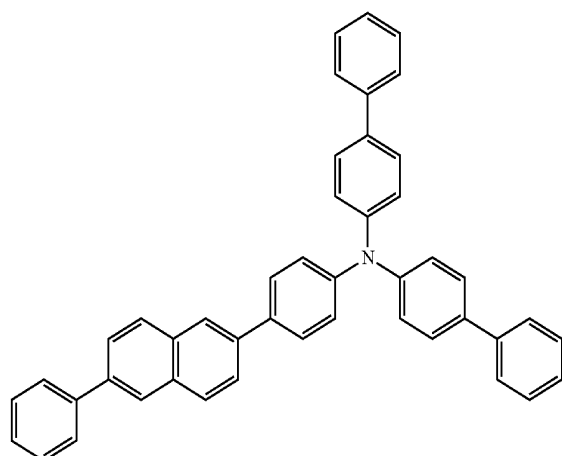
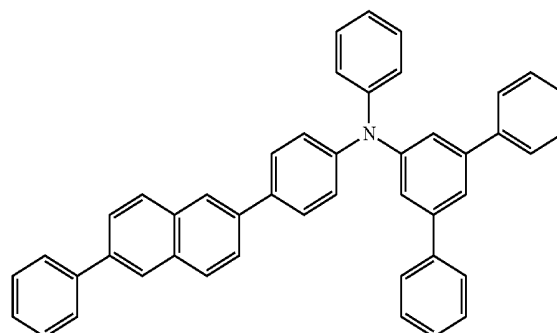
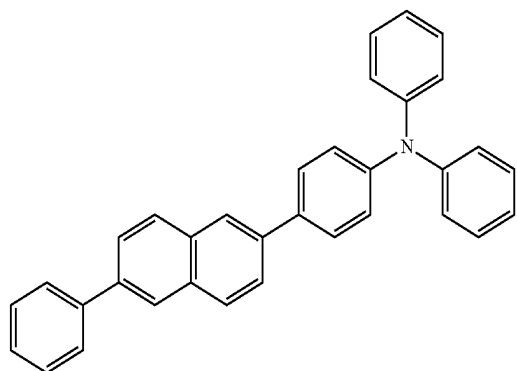
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B60



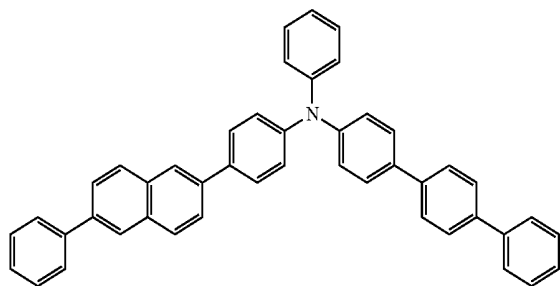
[Compound Group 3]

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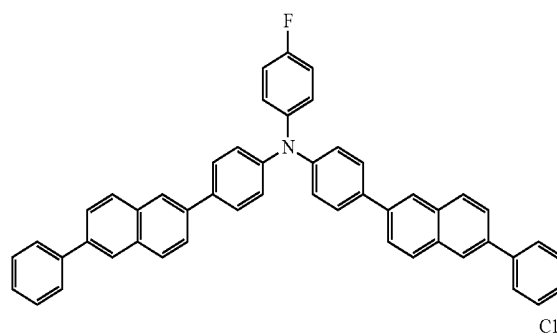
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C8



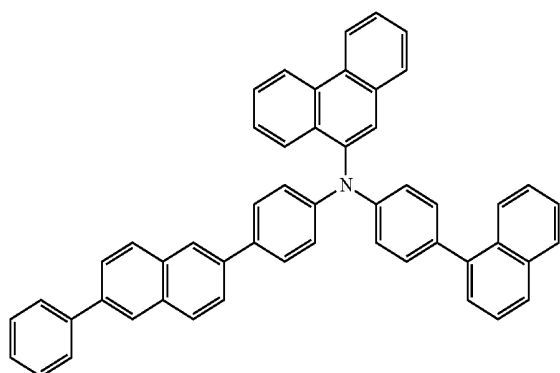
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C12

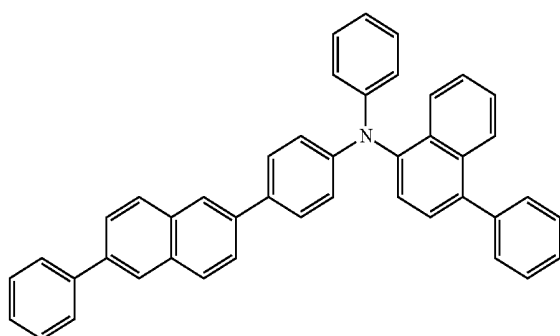


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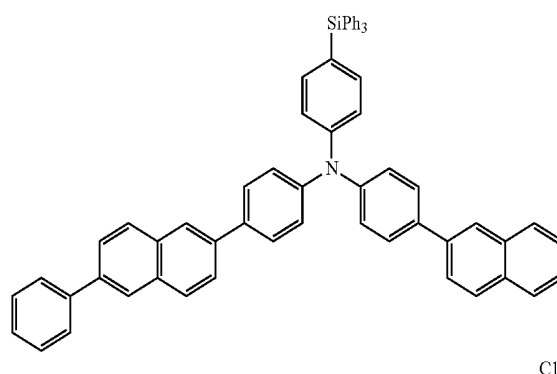
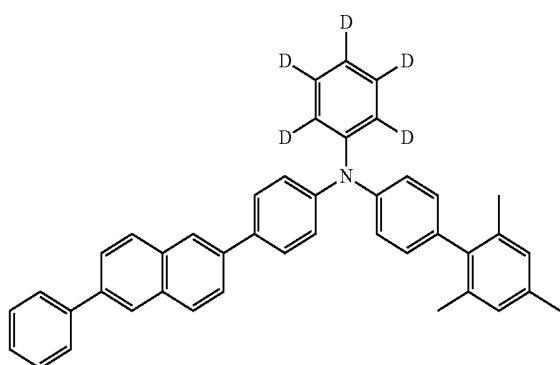
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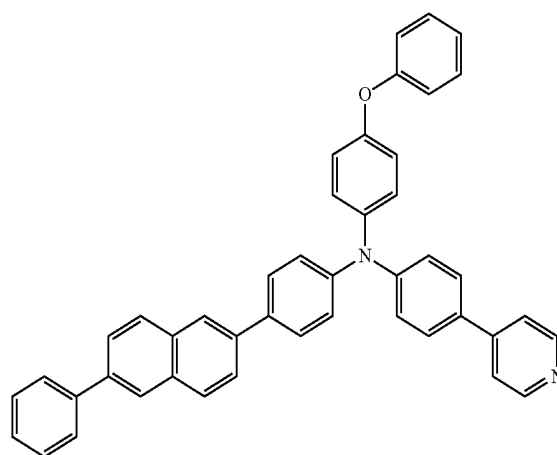
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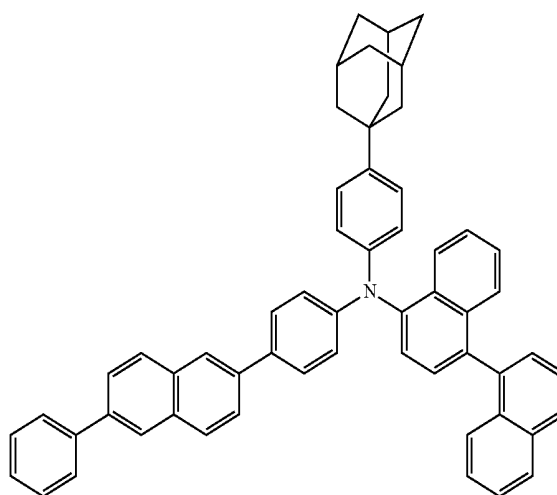
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C14

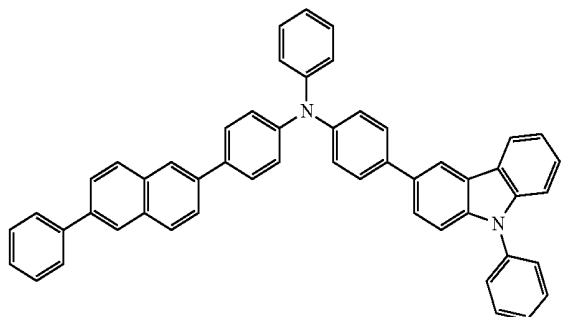


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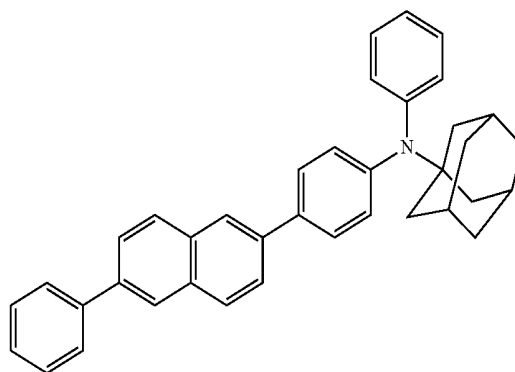
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C16

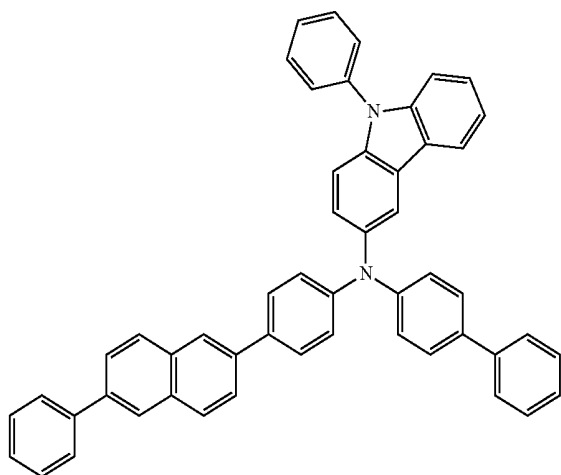


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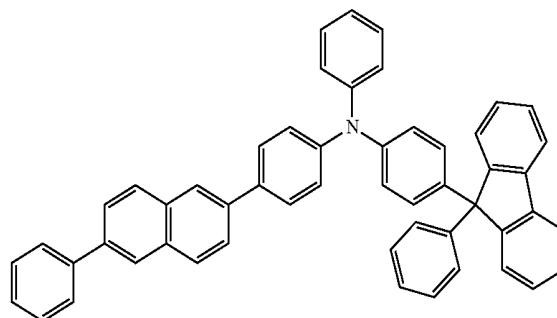
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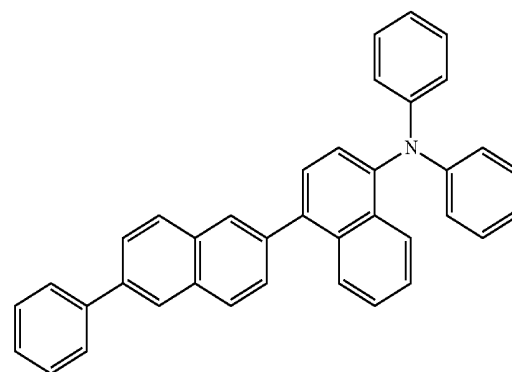
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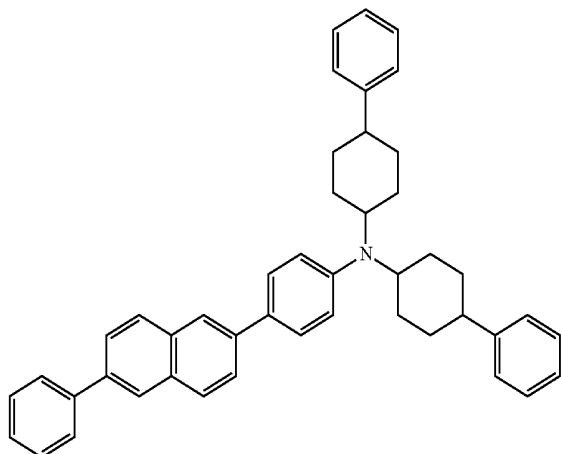
C20



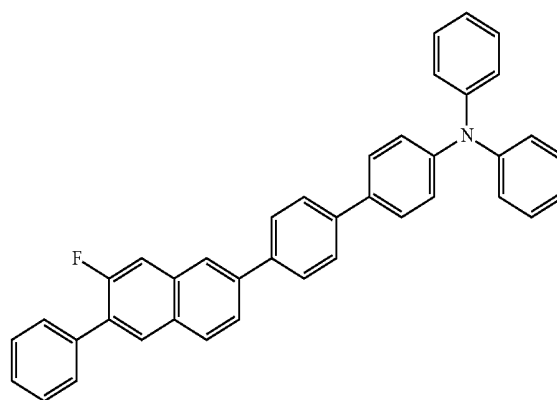
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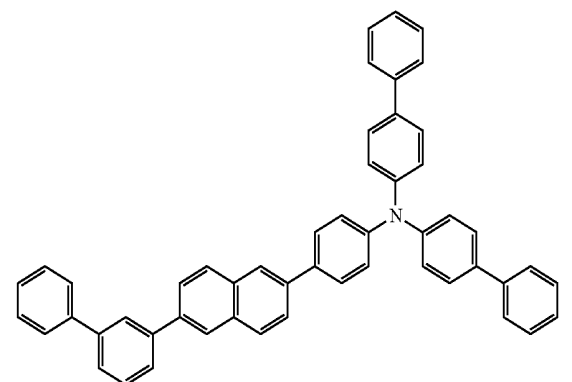
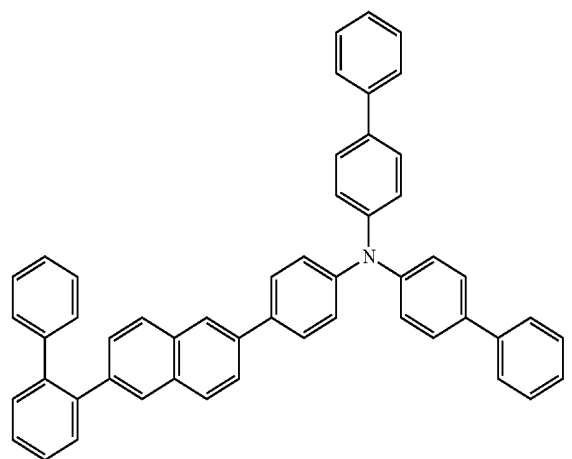
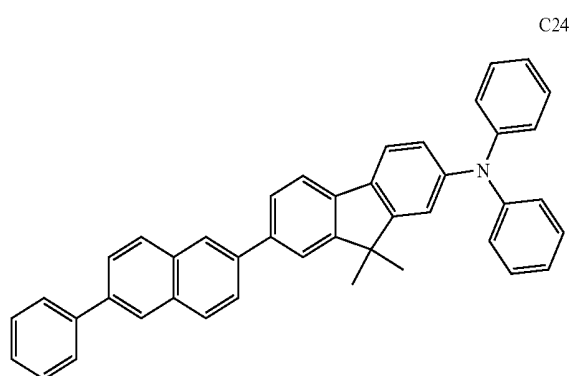
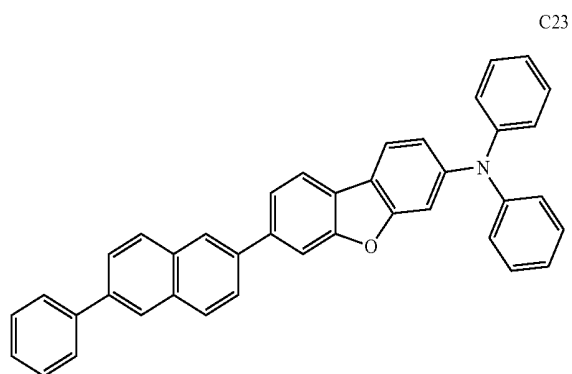
C18



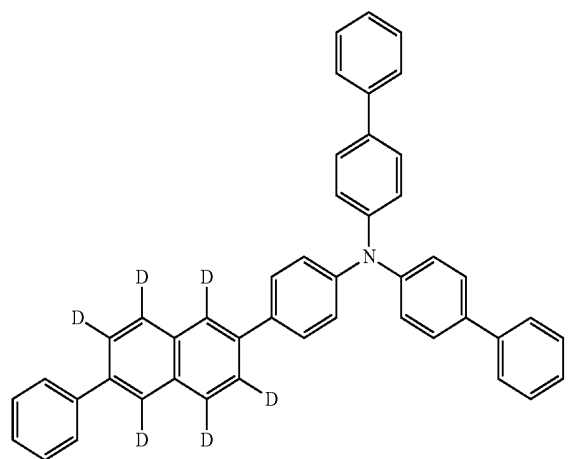
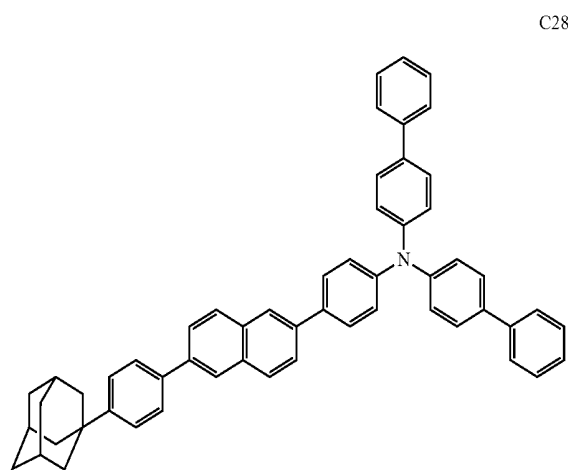
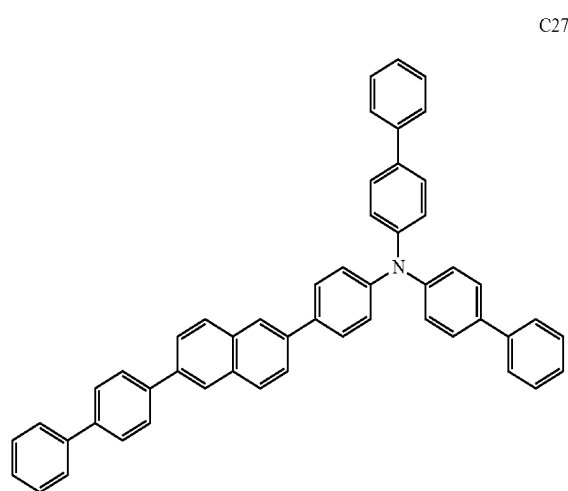
C22



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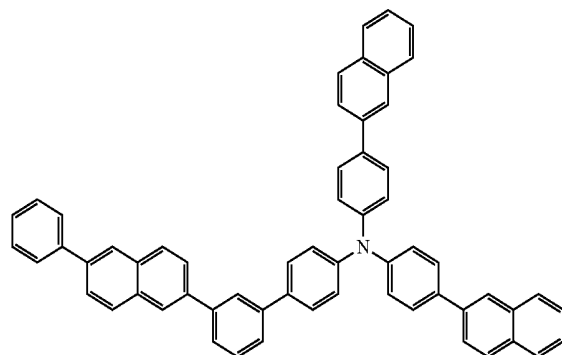
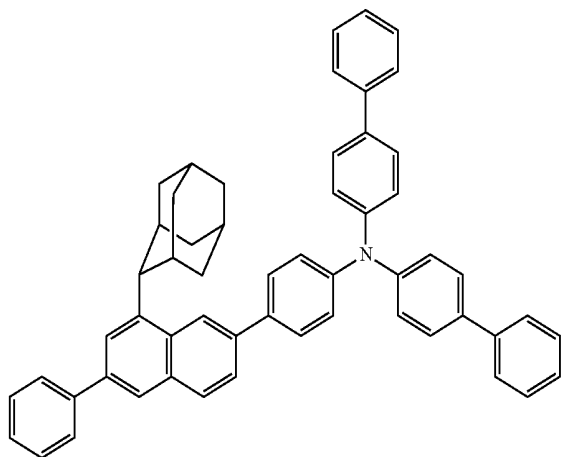


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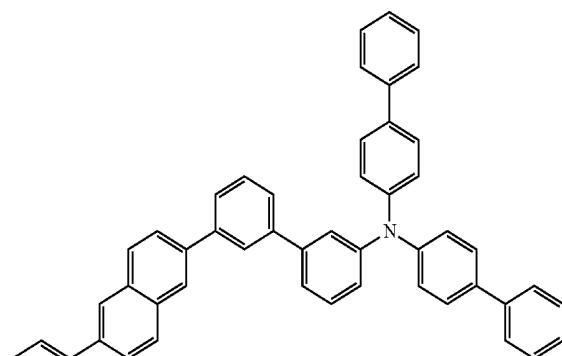
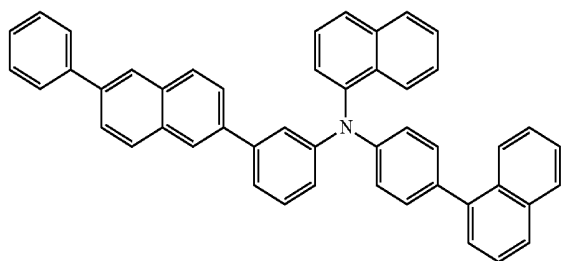
C30

C34



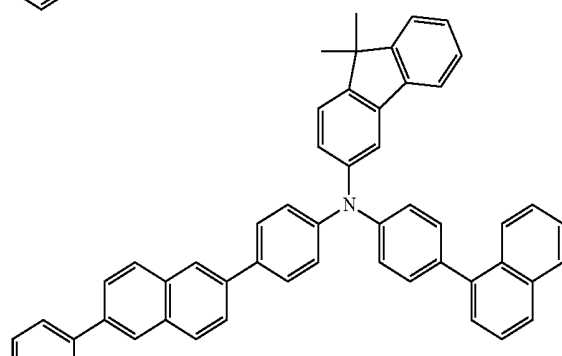
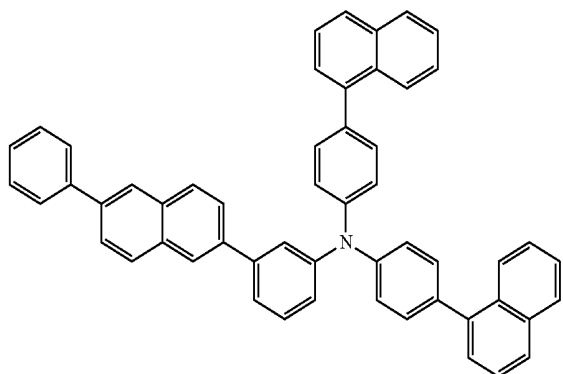
C35

C31



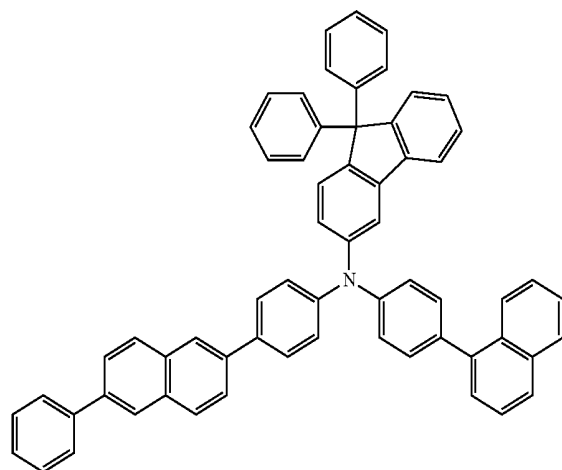
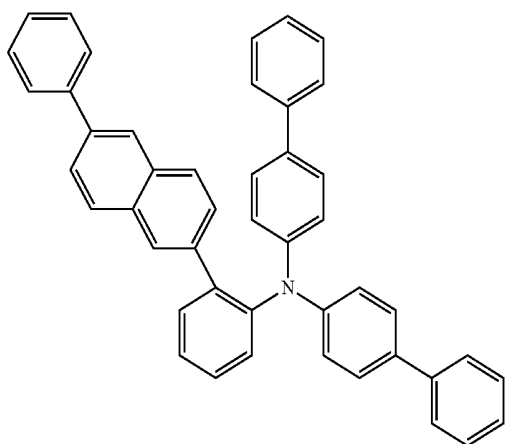
C36

C32



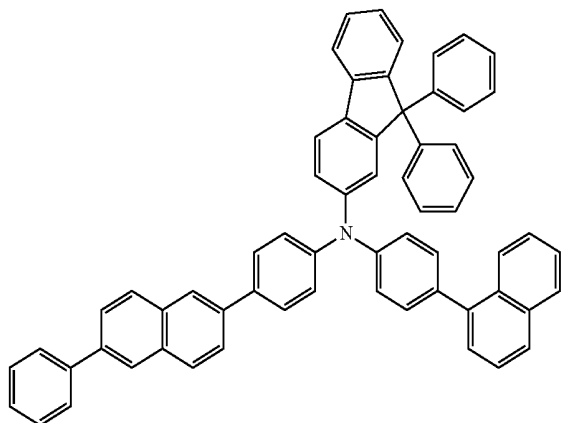
C37

C33



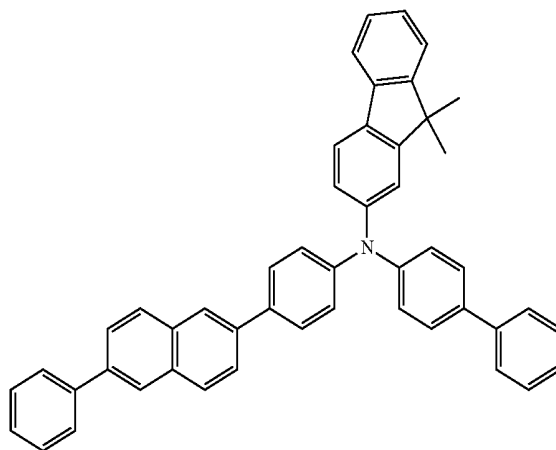
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C38



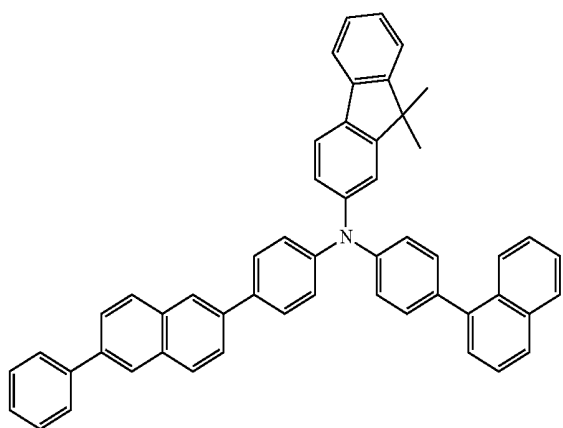
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C41

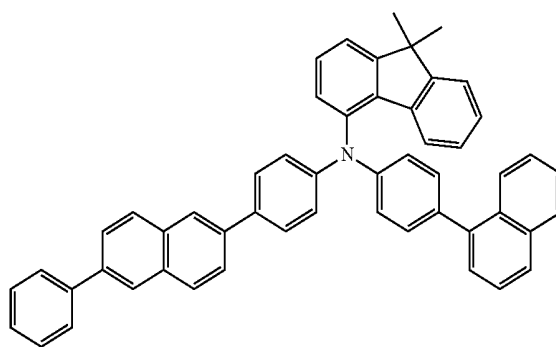


C42

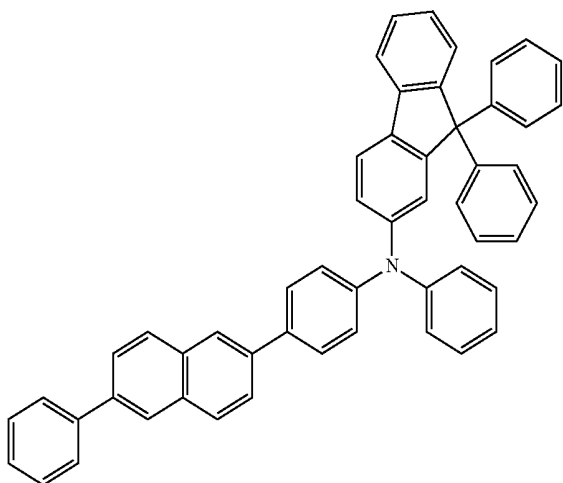
C39



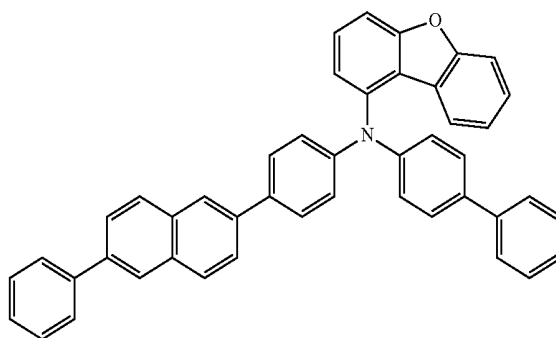
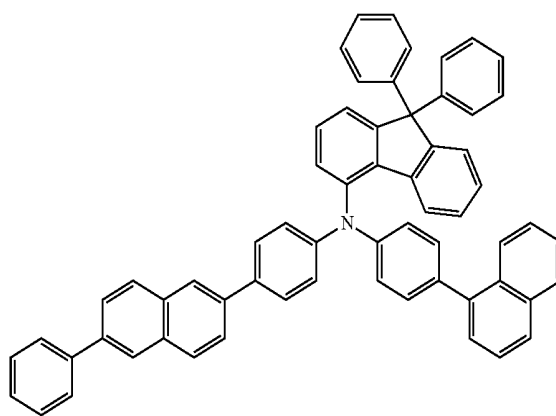
C43



C40

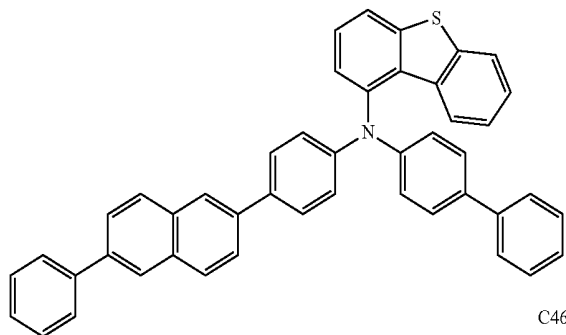


C44

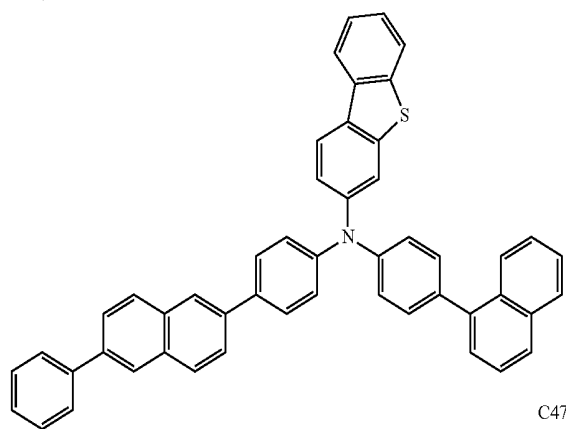


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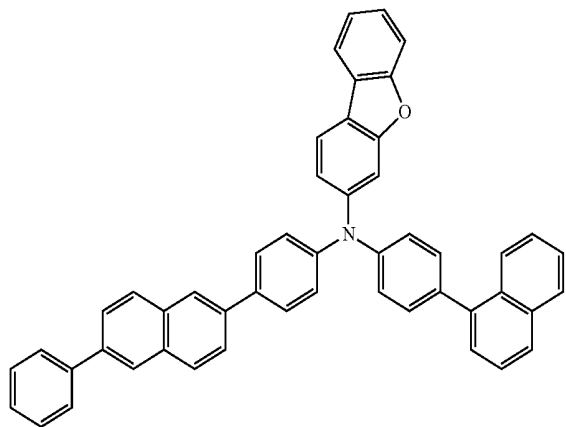
C45



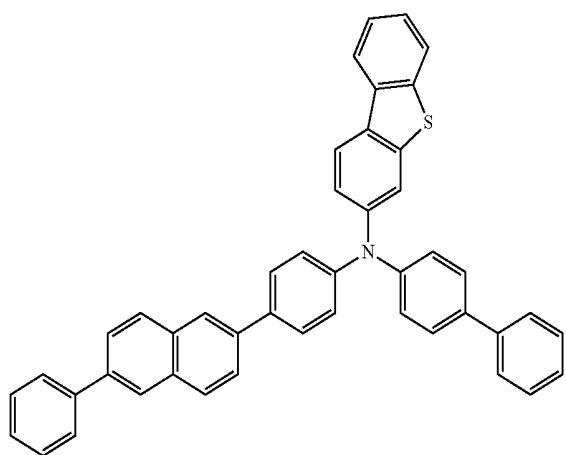
C46



C47

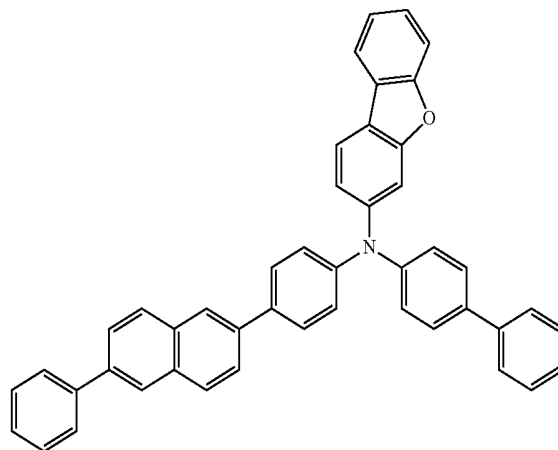


C48

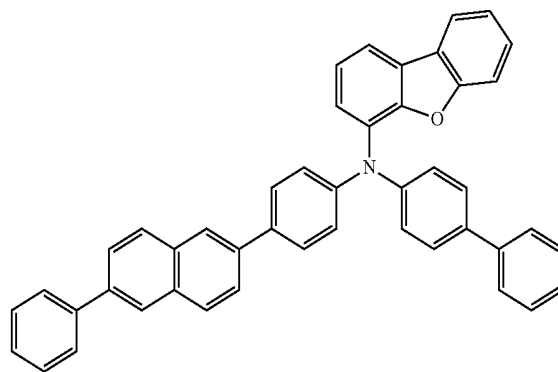


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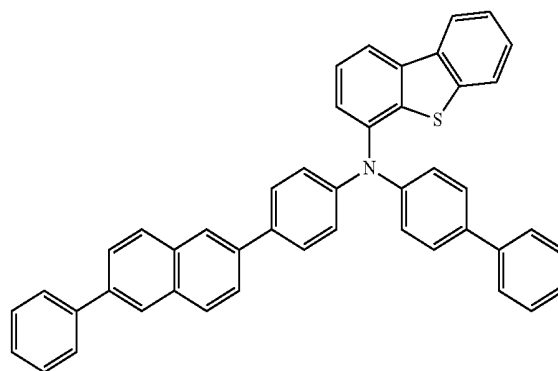
C49



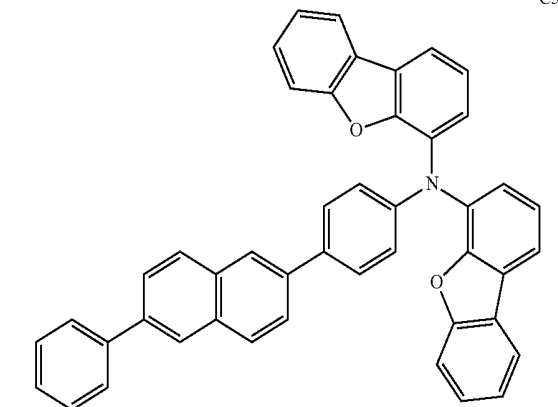
C50



C51

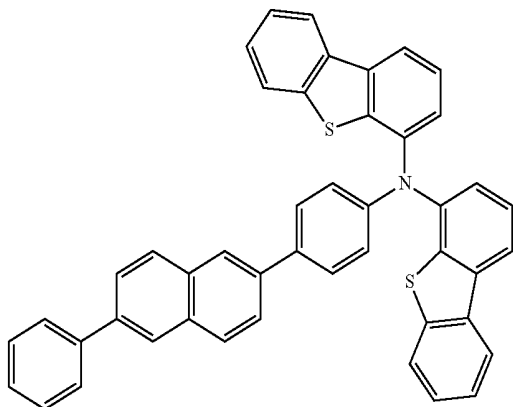


C52



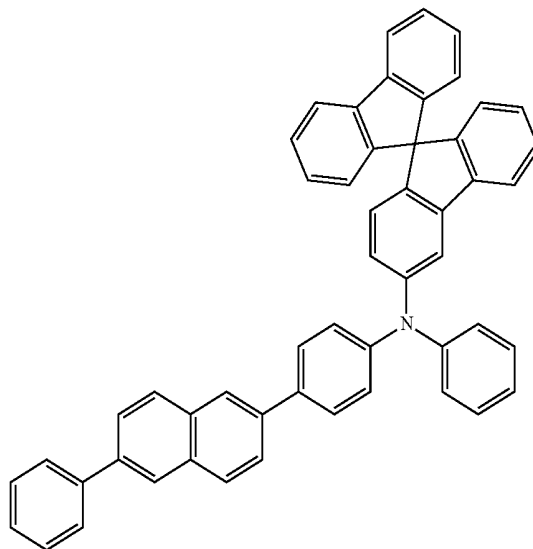
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C53

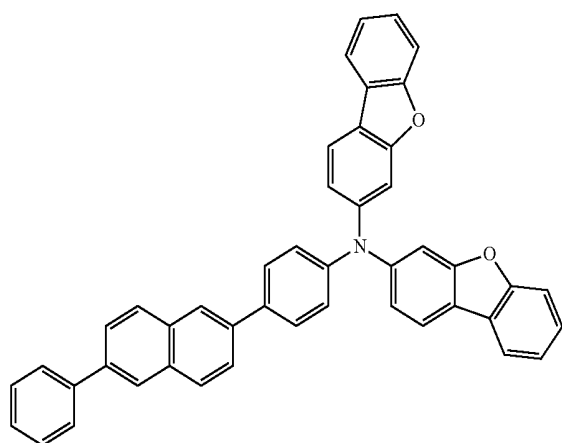


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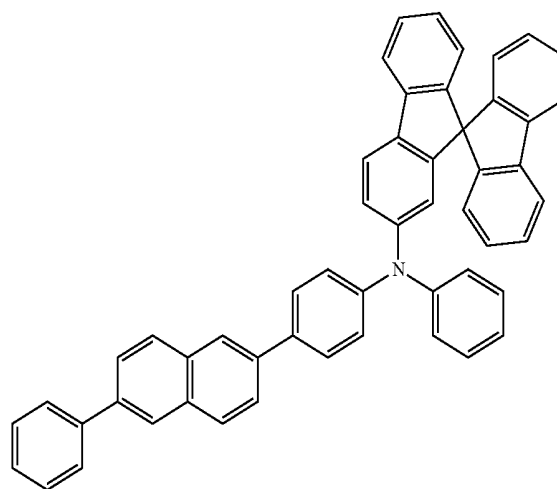
C56



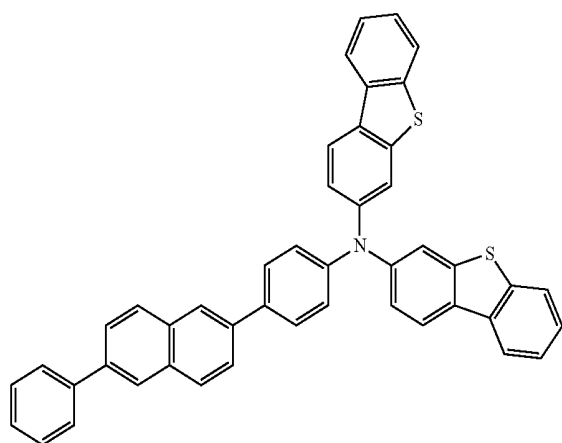
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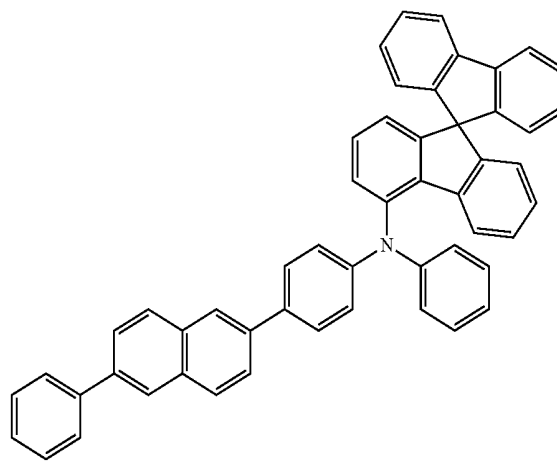
C57



C55

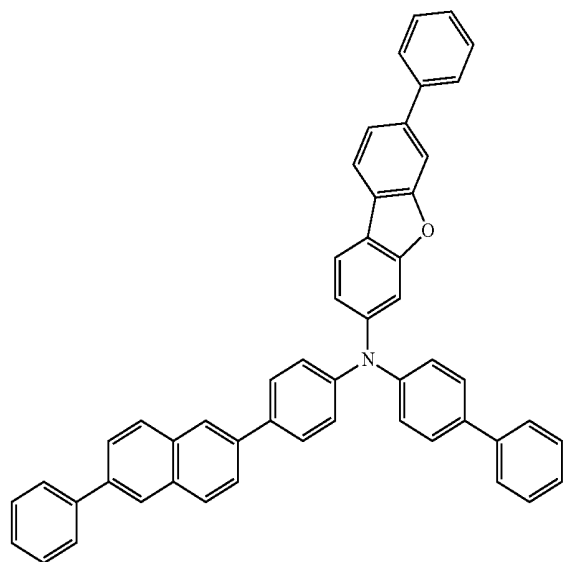


C58



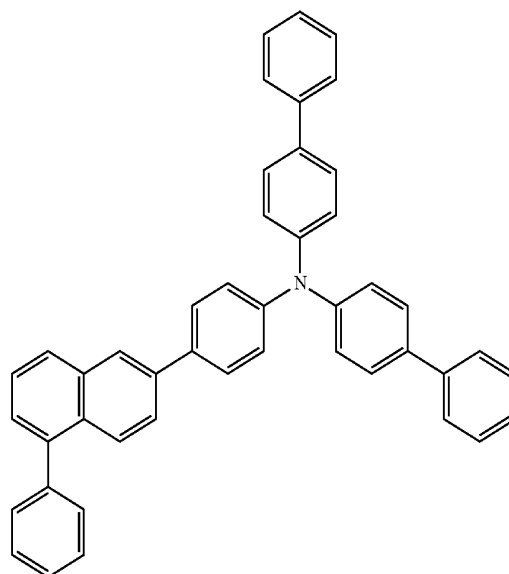
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C59

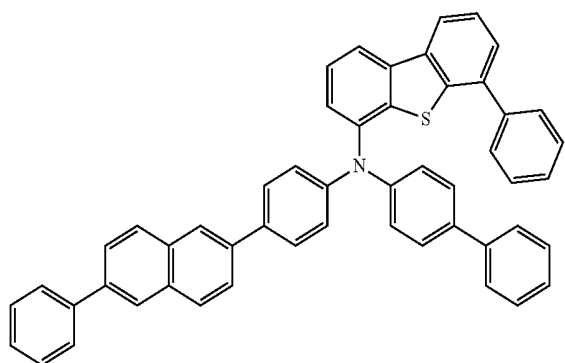


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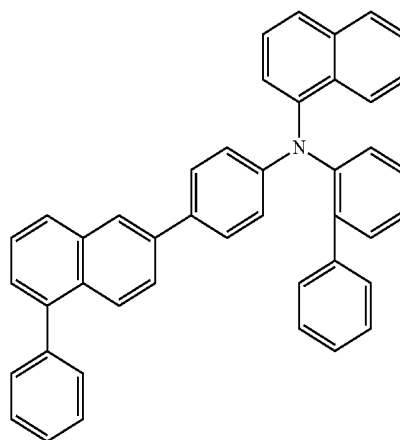
D2



C60

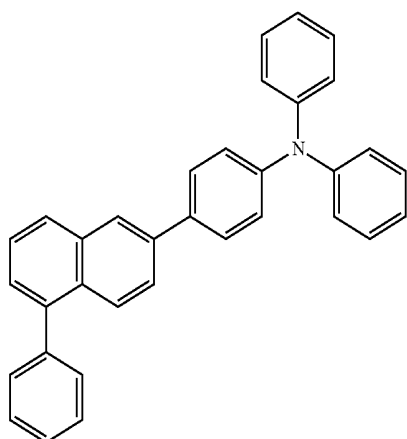


D3

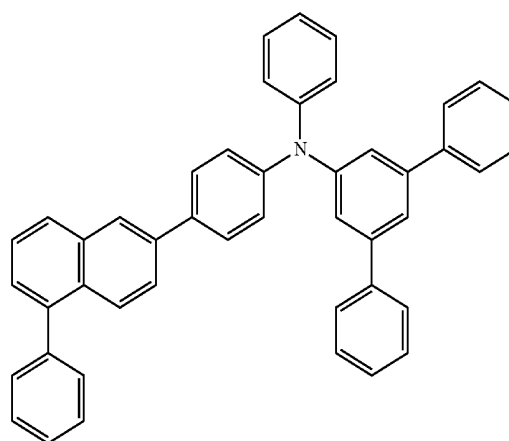


[Compound Group 4]

D1

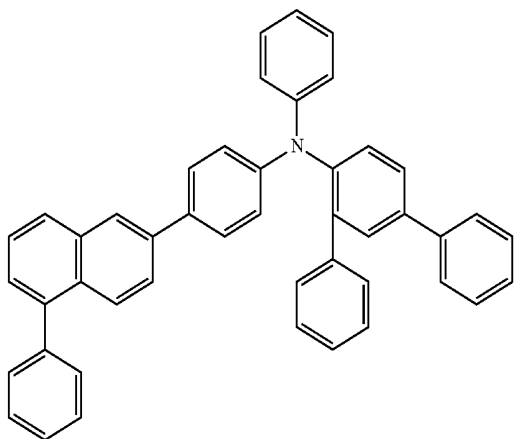


D4

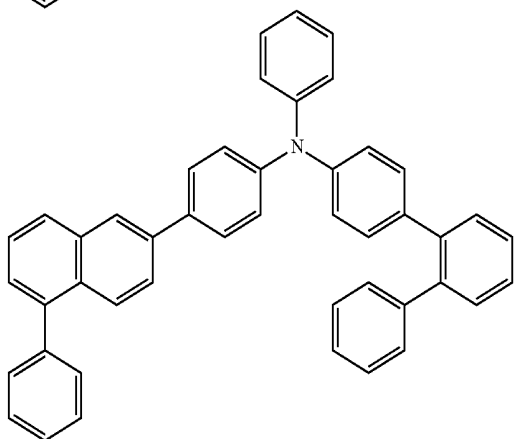


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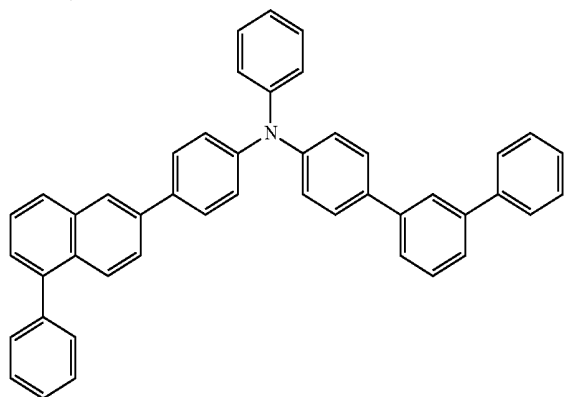
D5



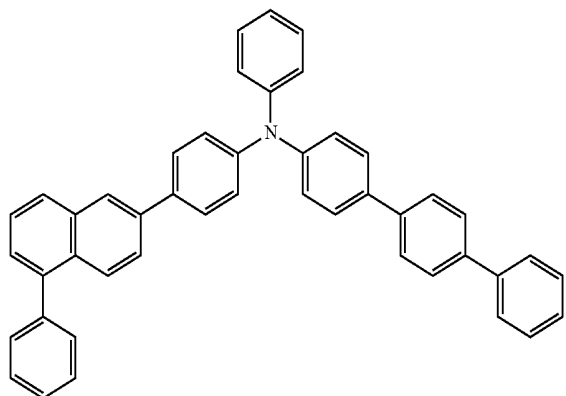
D6



D7

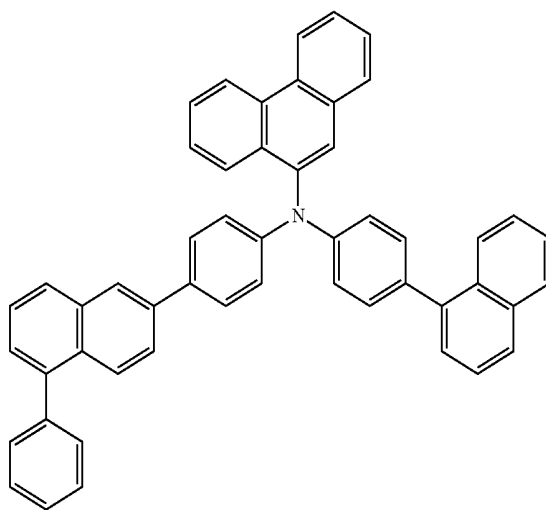


D8

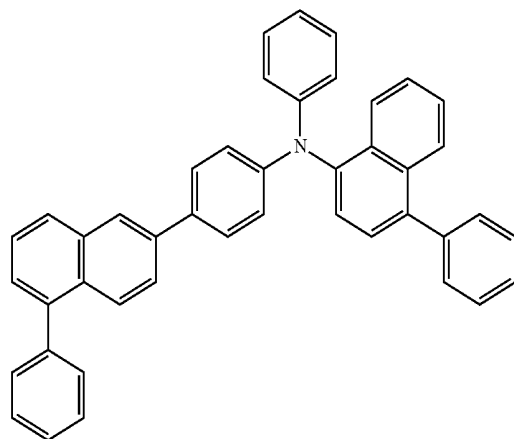


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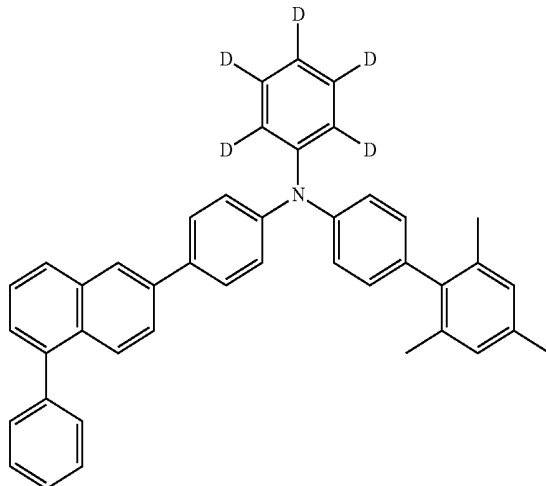
D9



D10

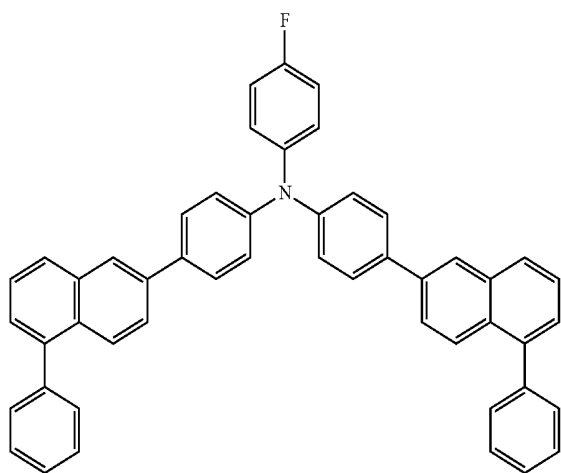


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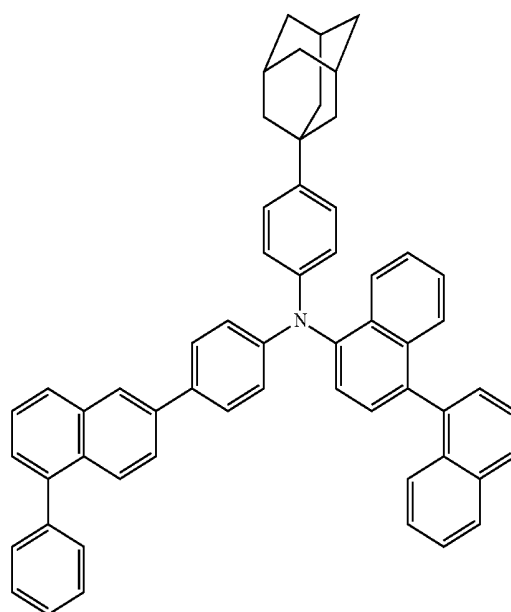
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D12



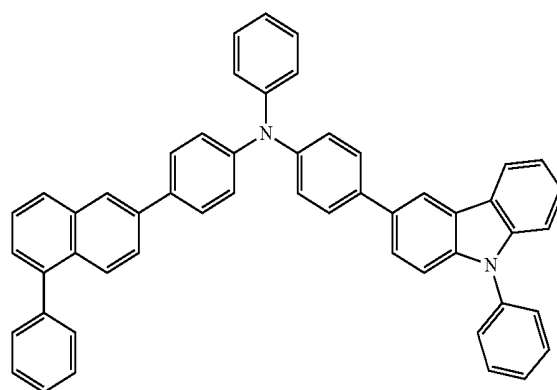
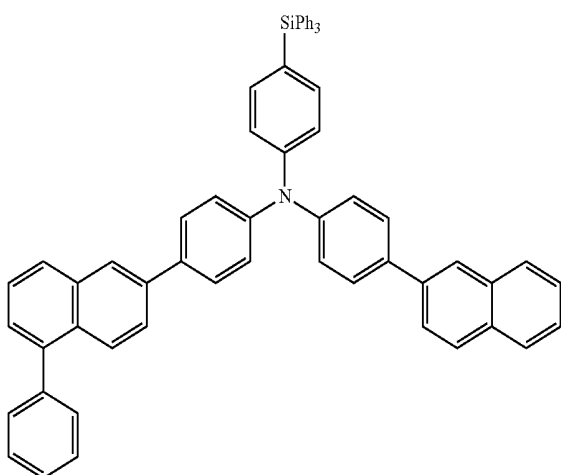
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D15



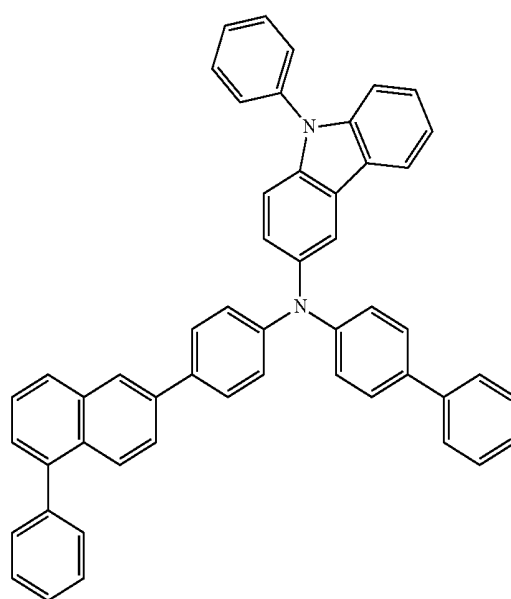
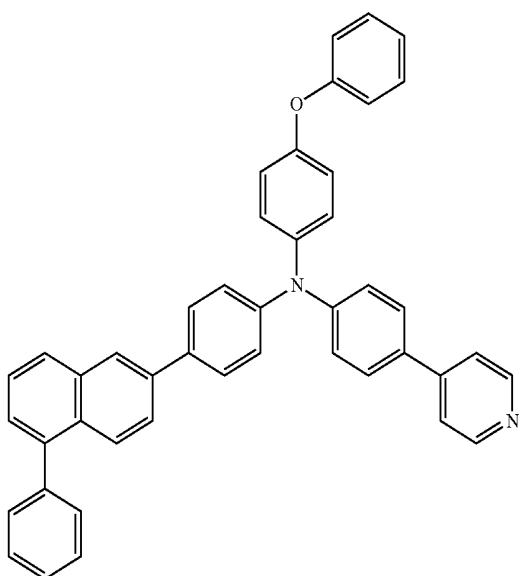
D13

D16



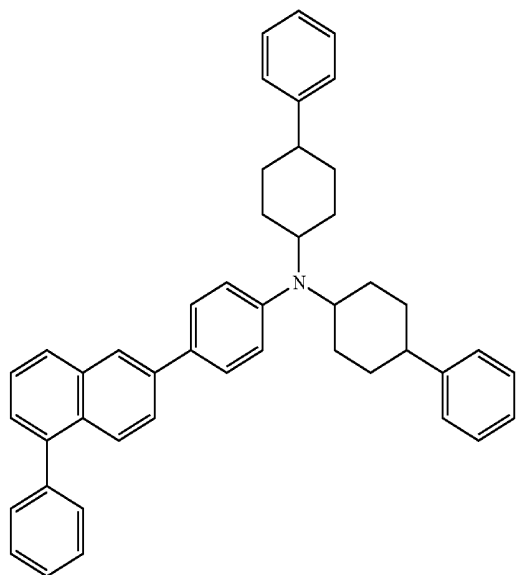
D14

D17



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D18



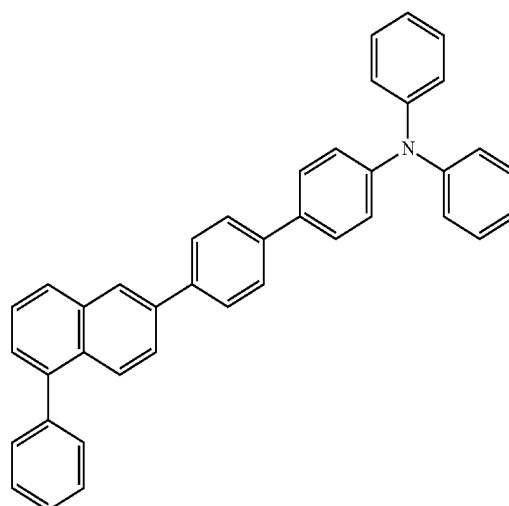
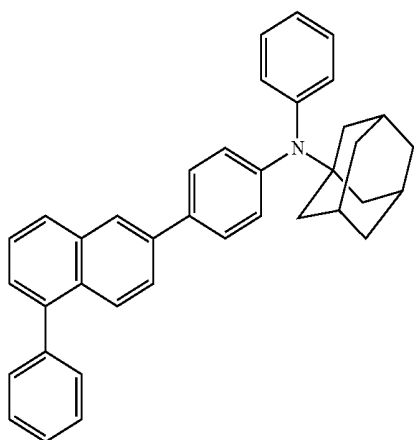
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D21

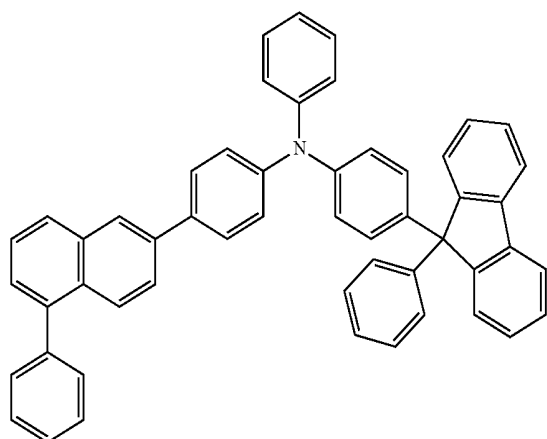


D22

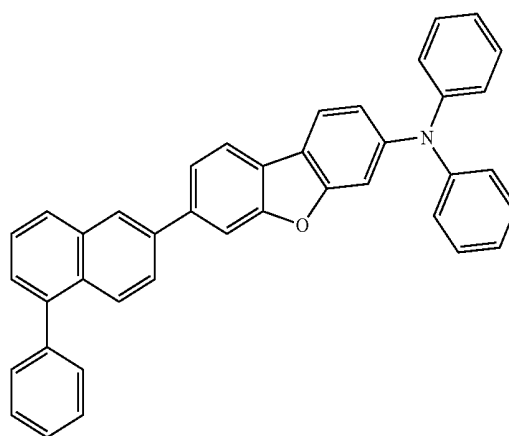
D19



D20

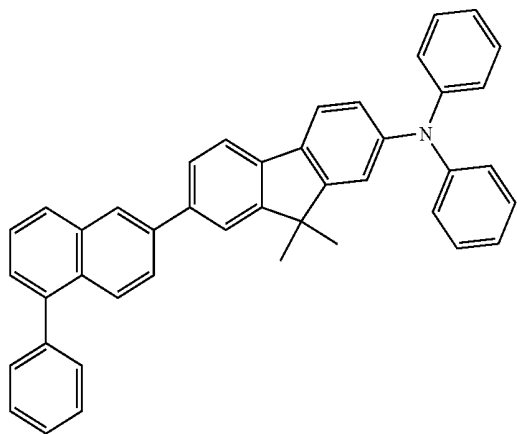


D23



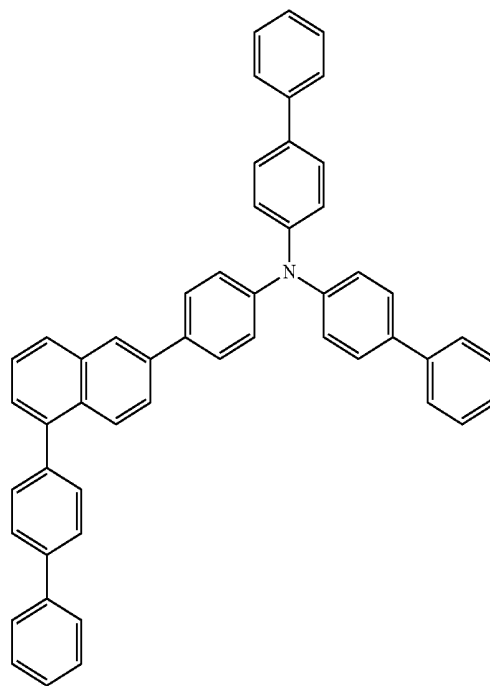
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D24

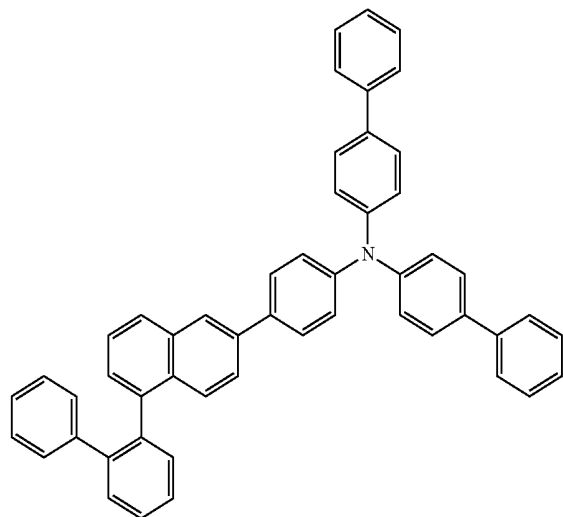


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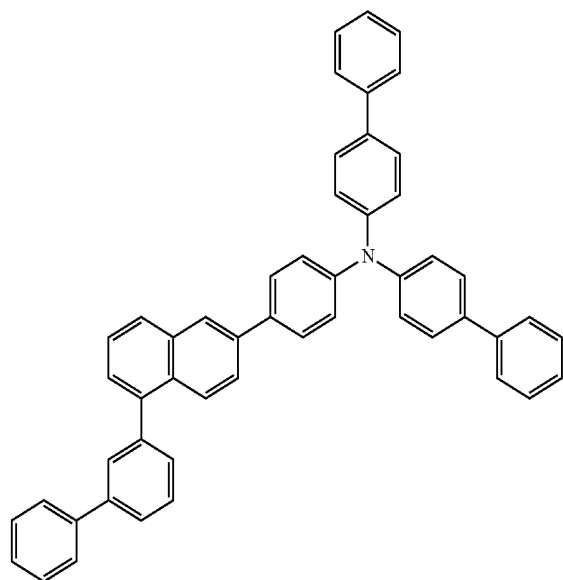
D27



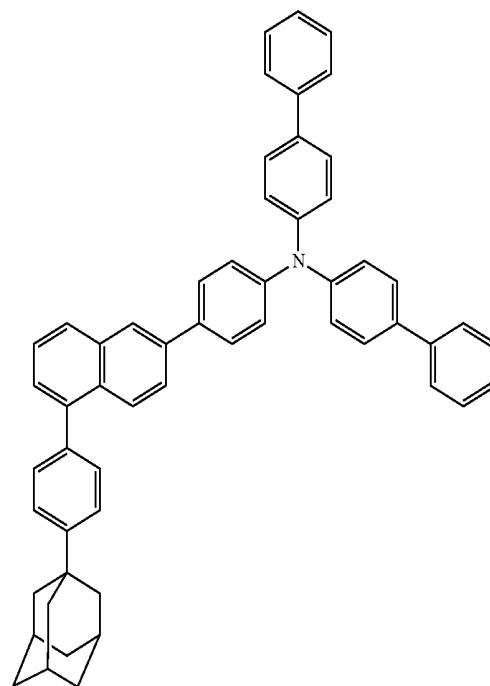
D25



D26

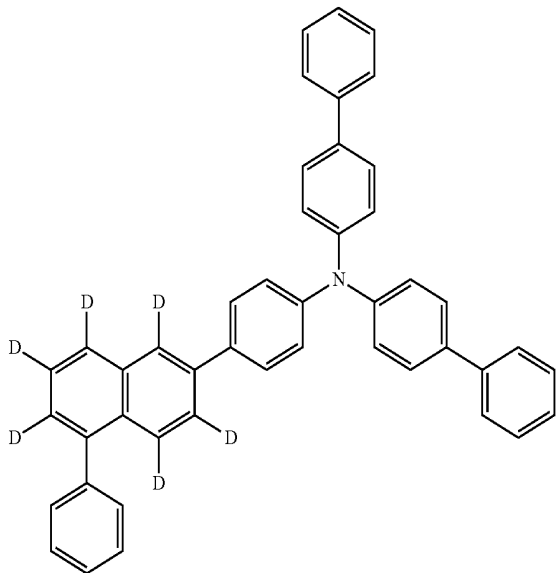


D28



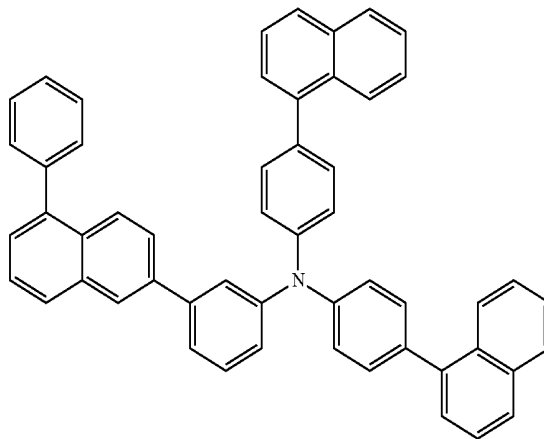
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D29

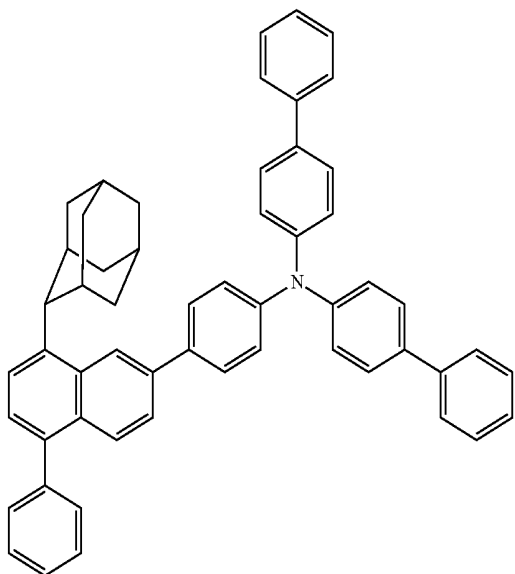


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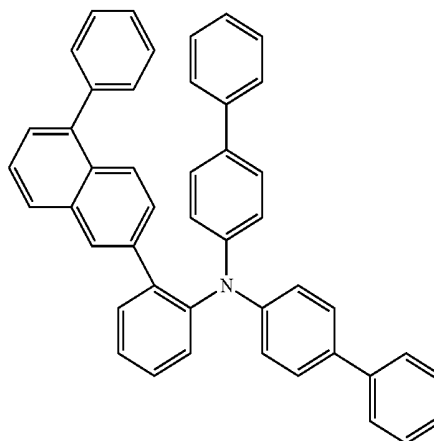
D32



D30

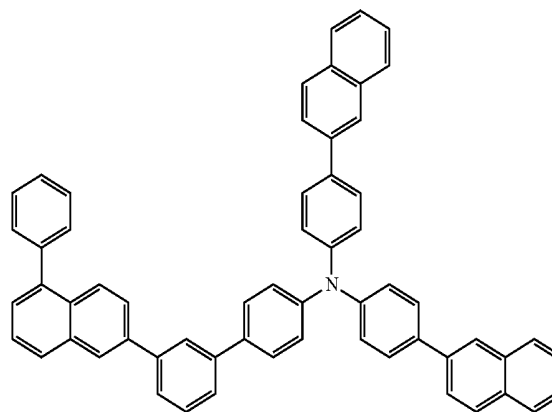
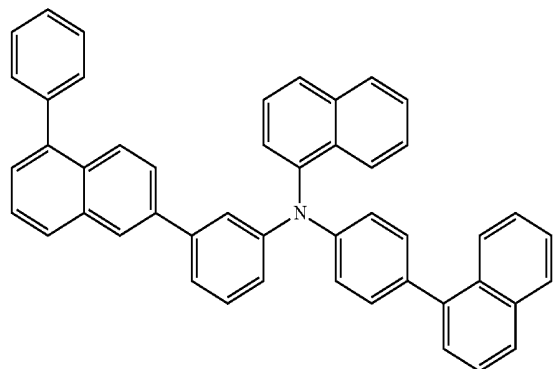


D33



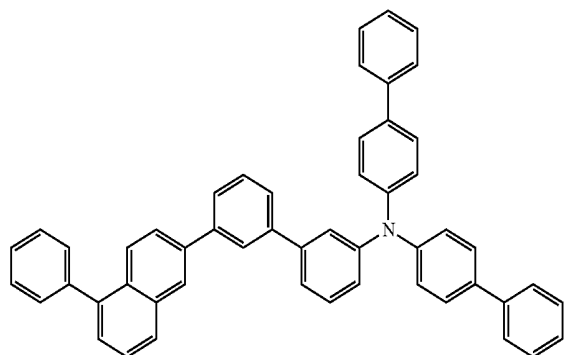
D34

D31



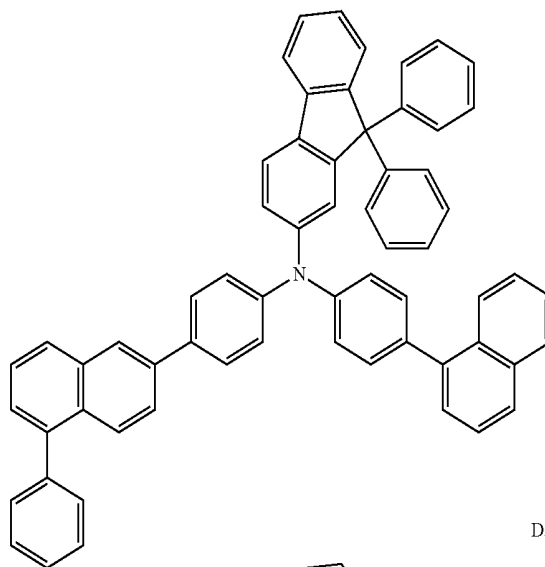
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D35

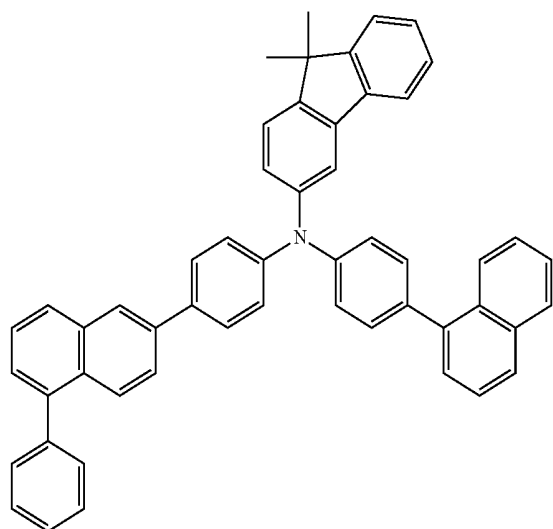


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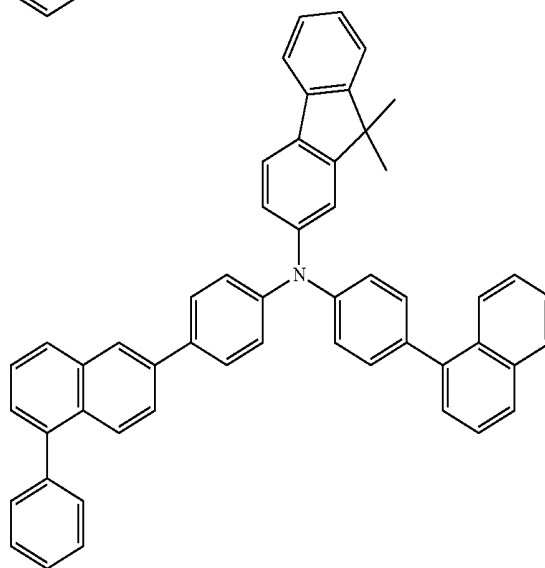
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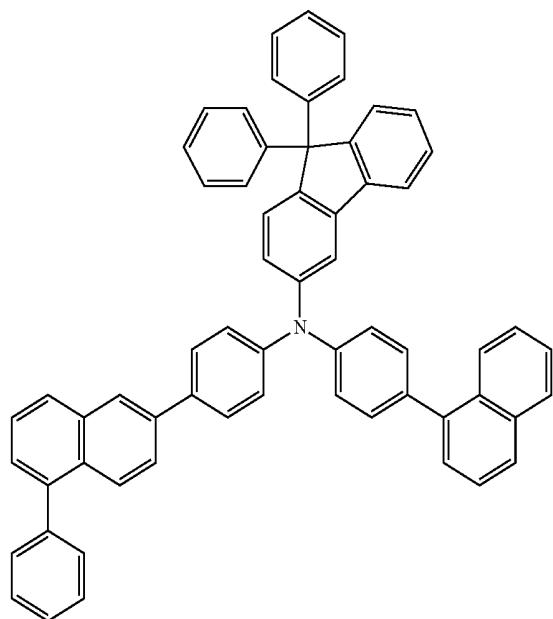
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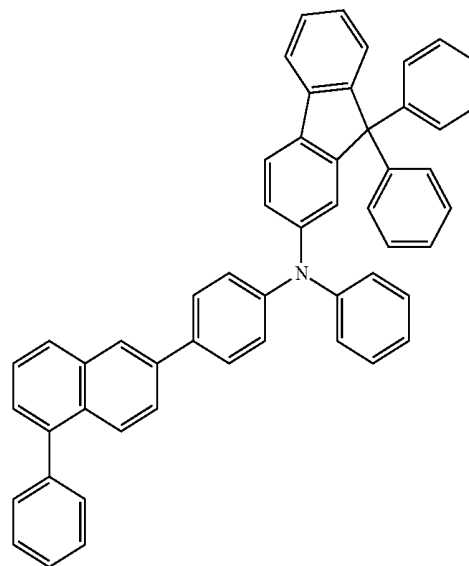
D39



D37

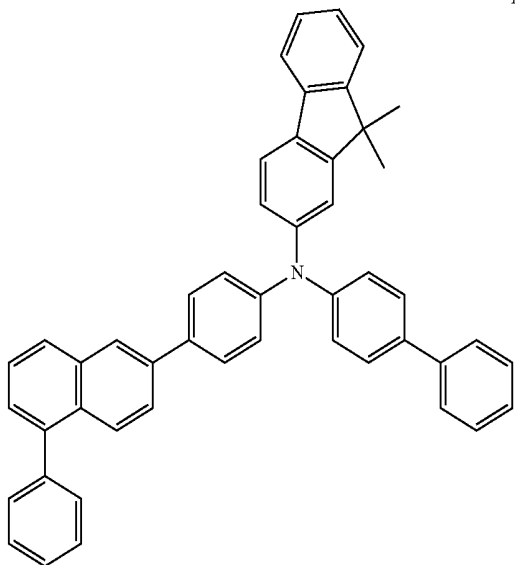


D40



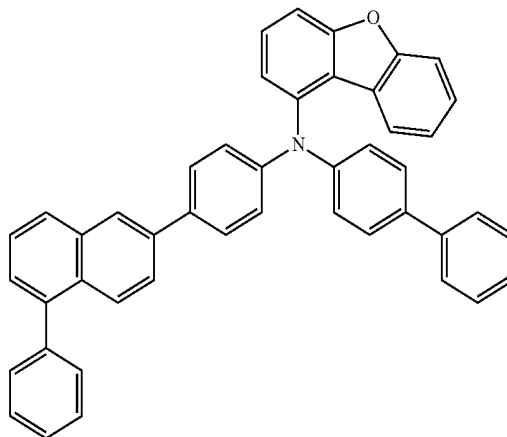
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D41

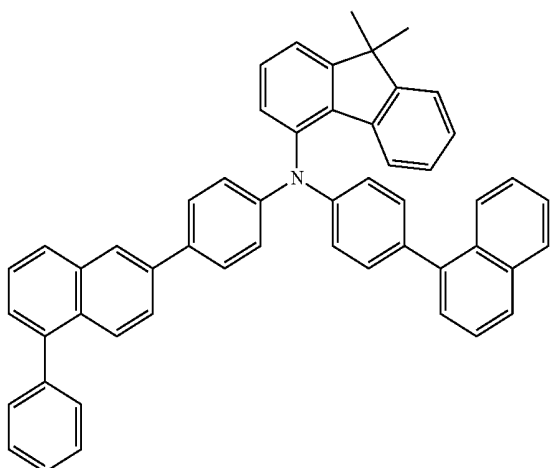


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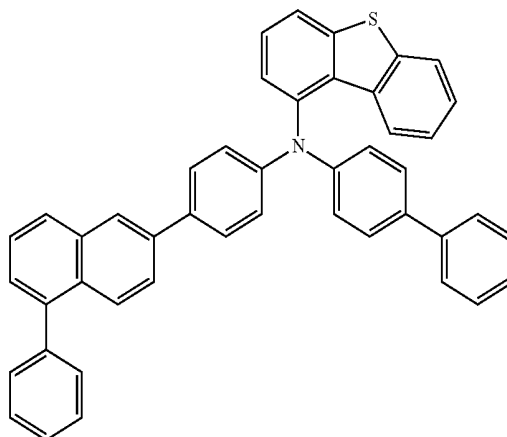
D44



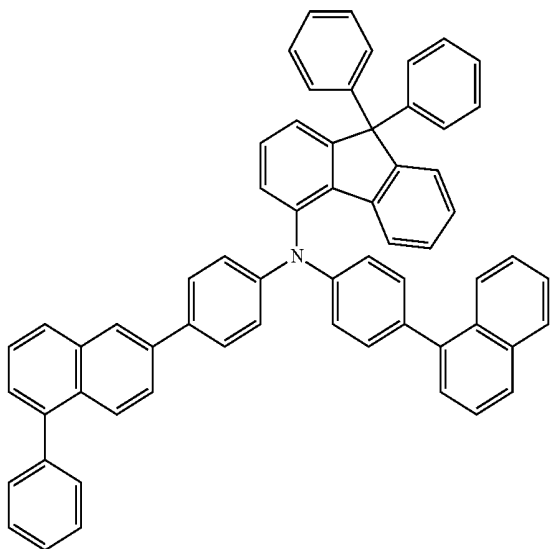
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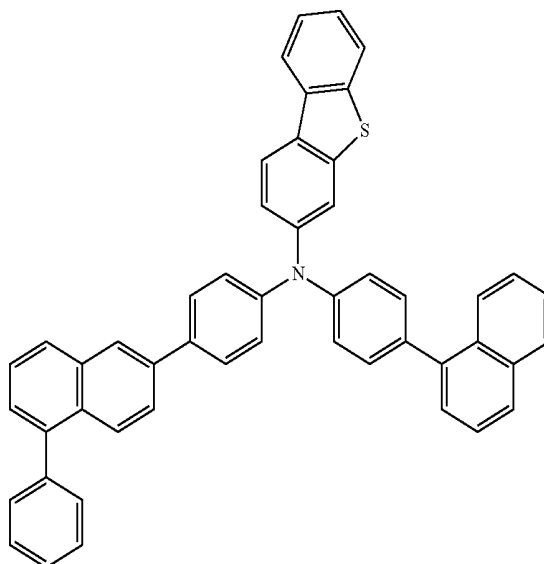
D45



D43

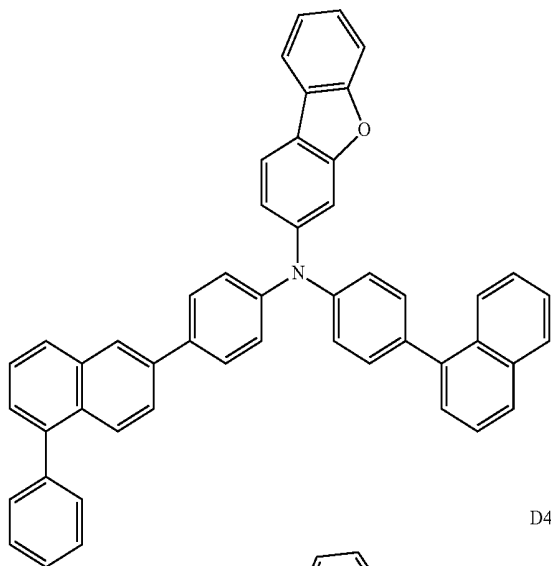


D46

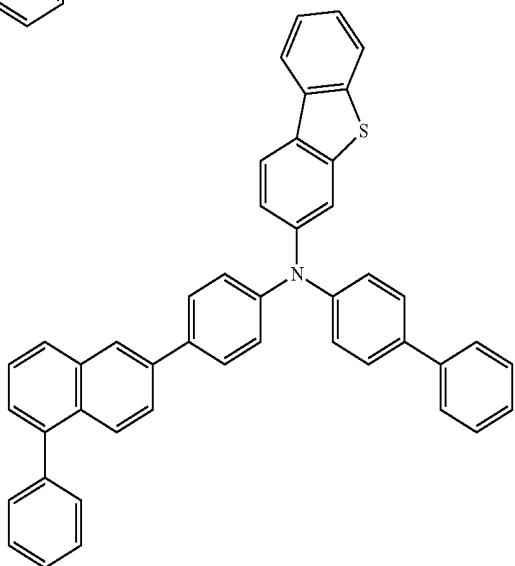


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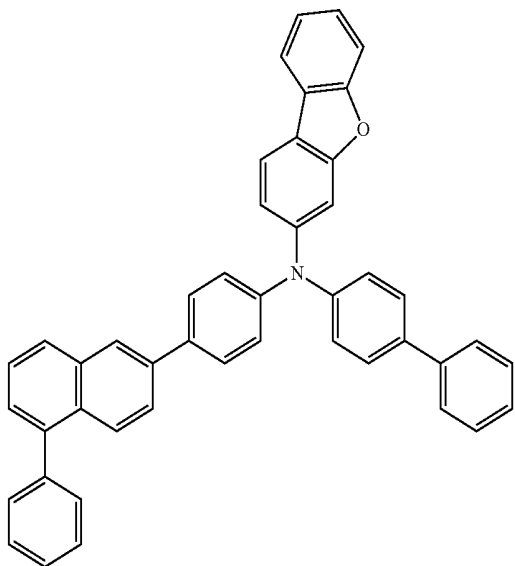
D47



D48

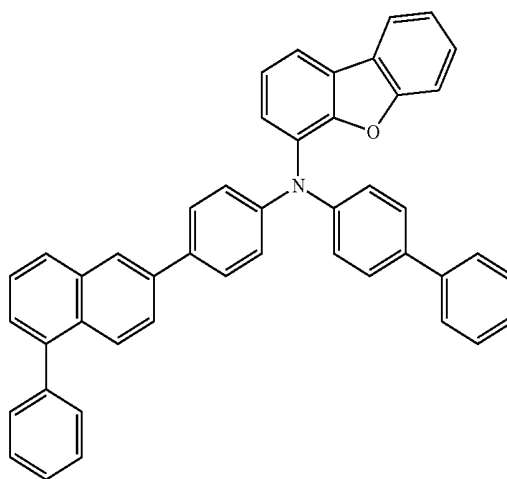


D49

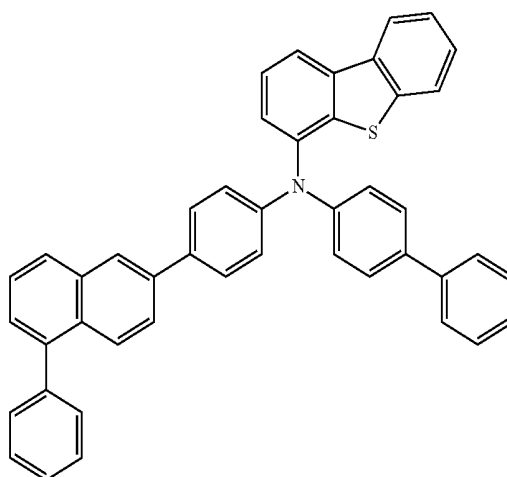


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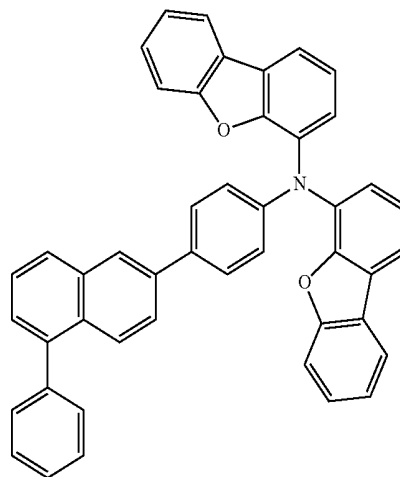
D50



D51

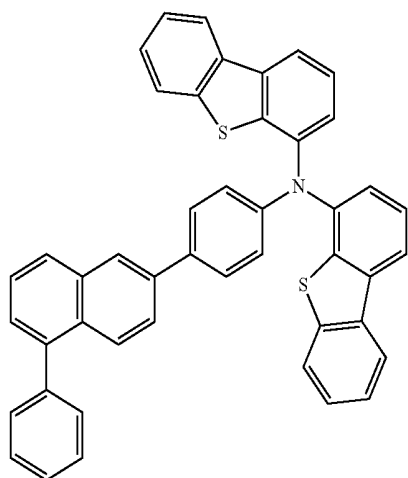


D52



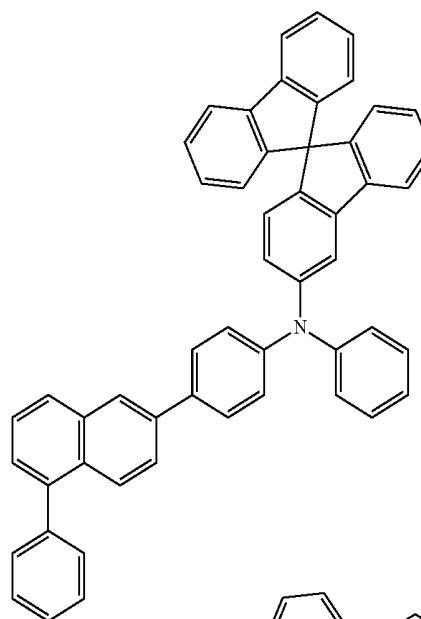
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D53

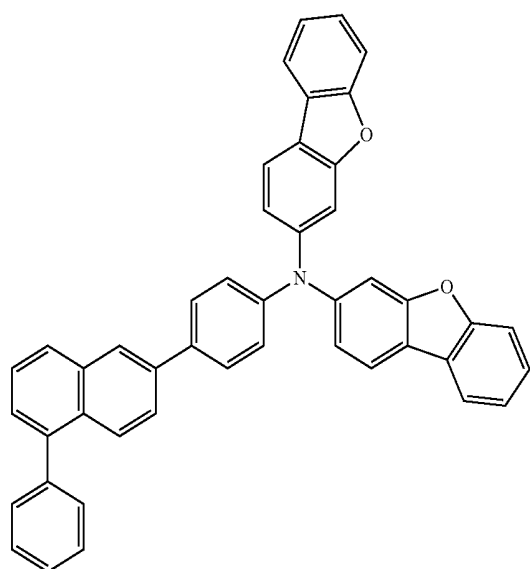


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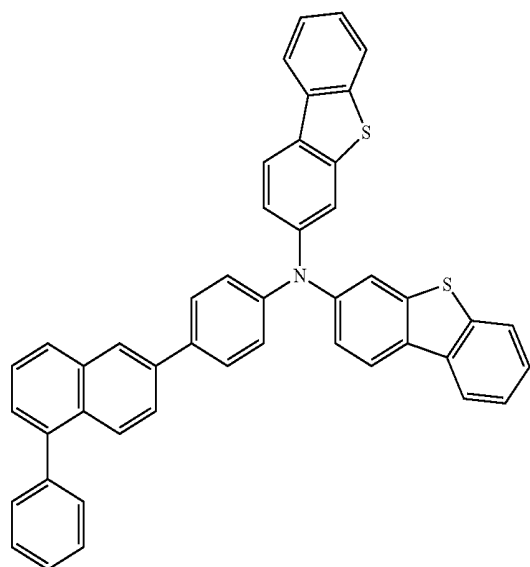
D56



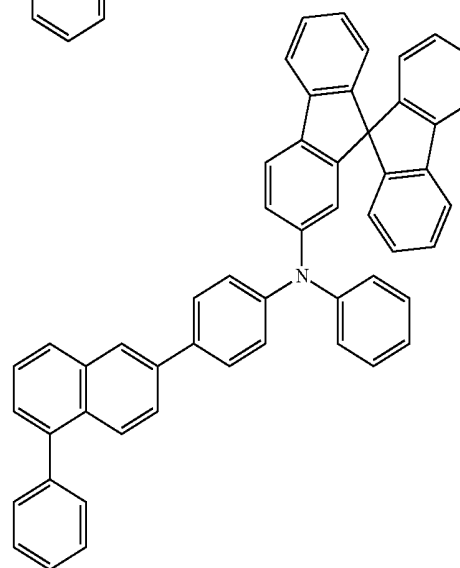
D54



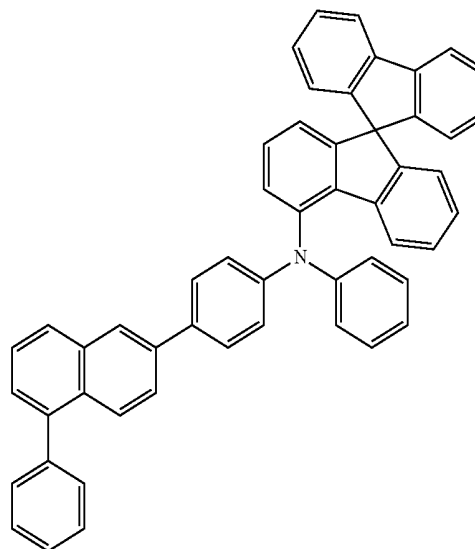
D55



D57

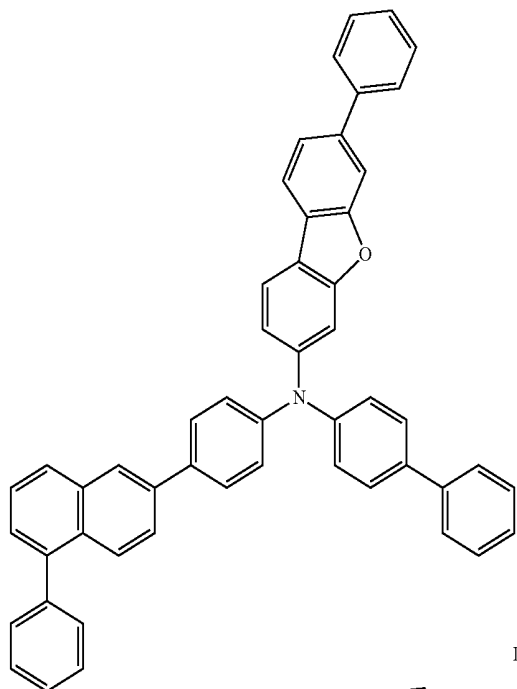


D58



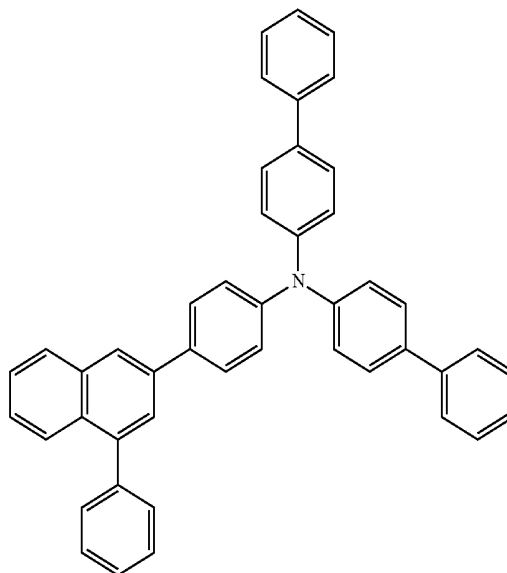
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D59

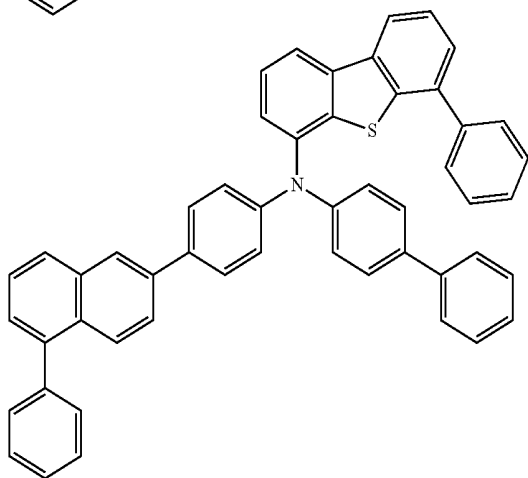


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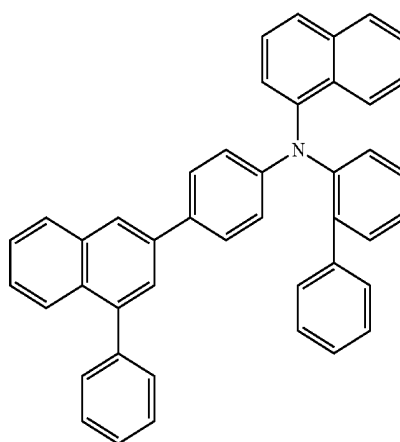
E2



D60

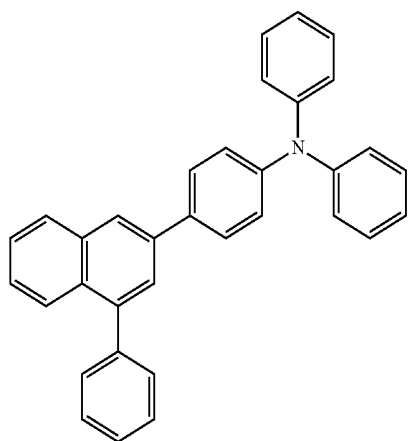


E3

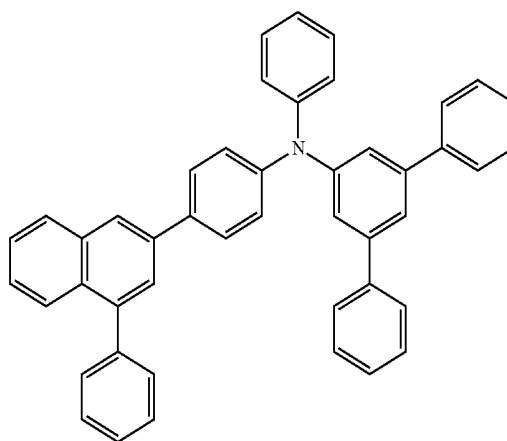


[Compound Group 5]

E1

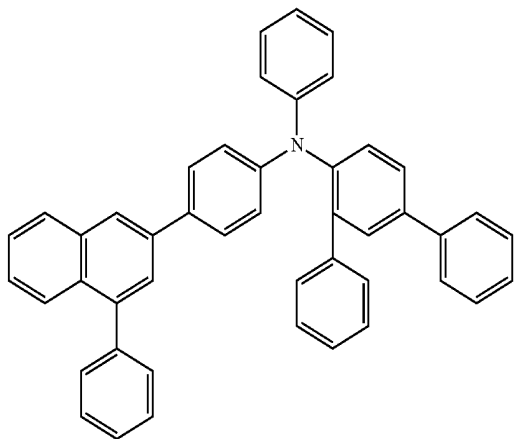


E4



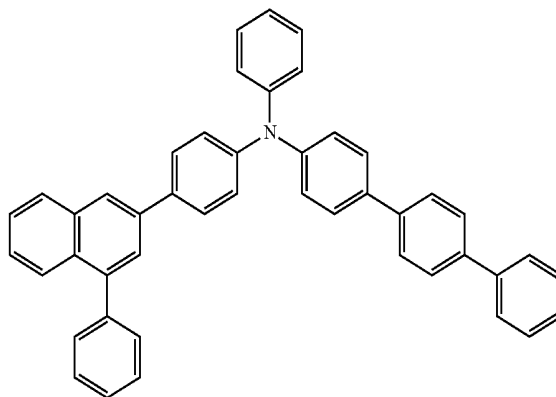
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E5



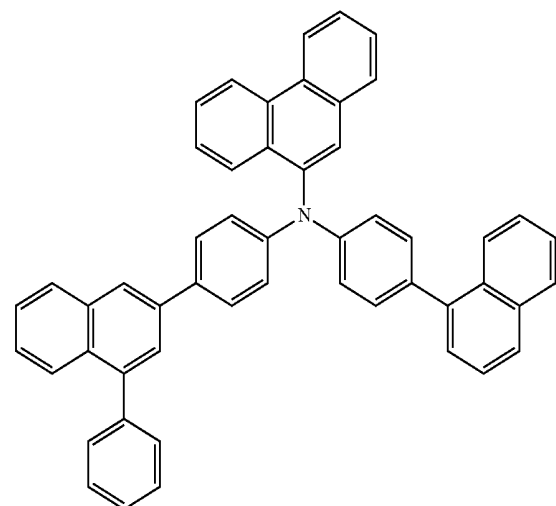
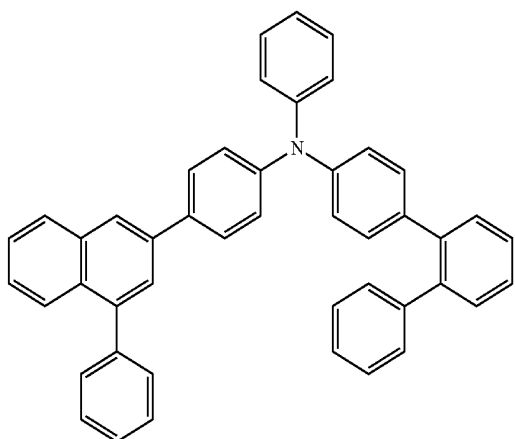
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E8



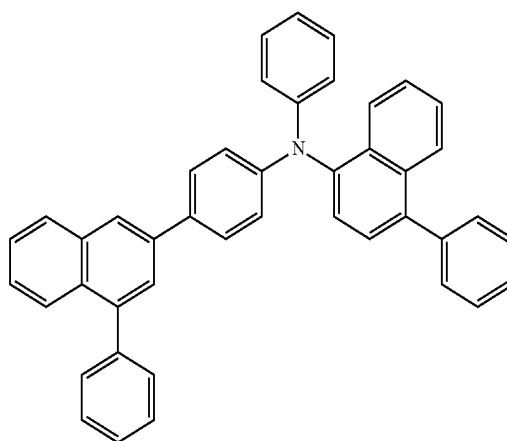
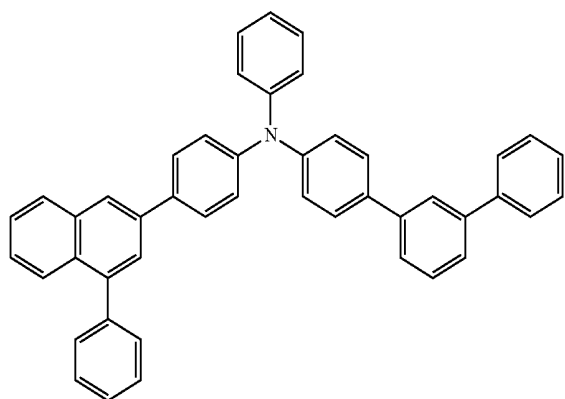
E9

E6



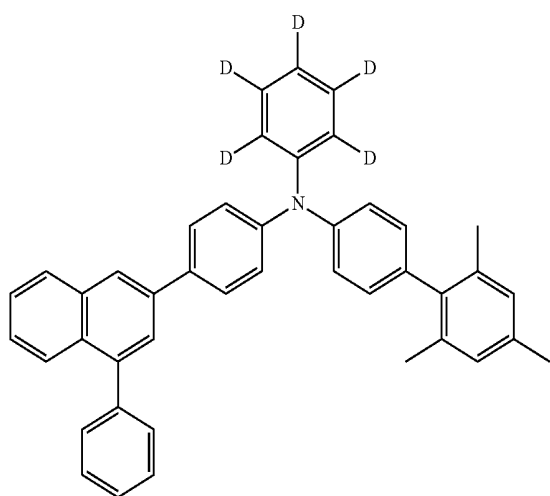
E7

E10



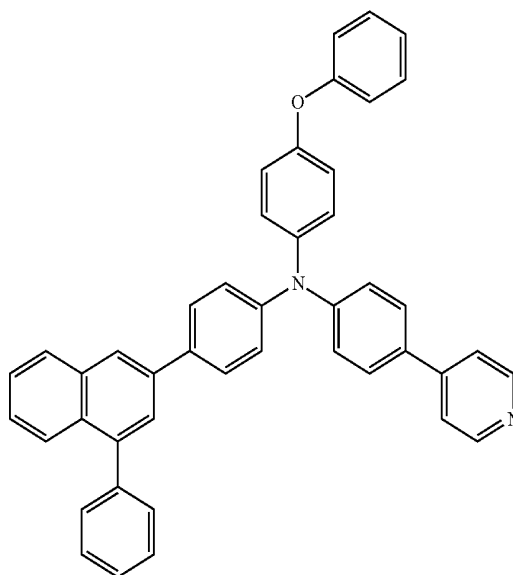
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E11

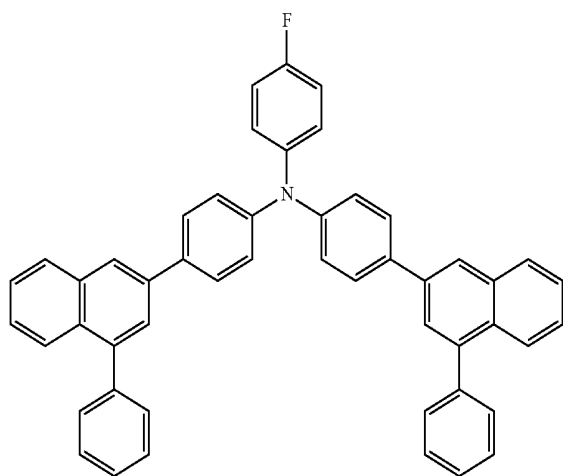


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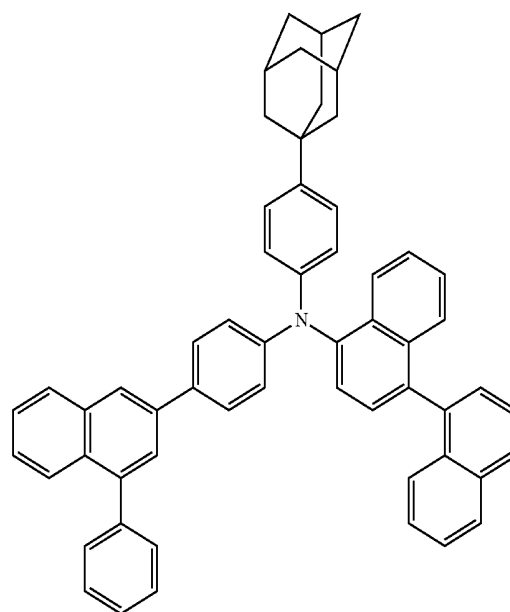
E14



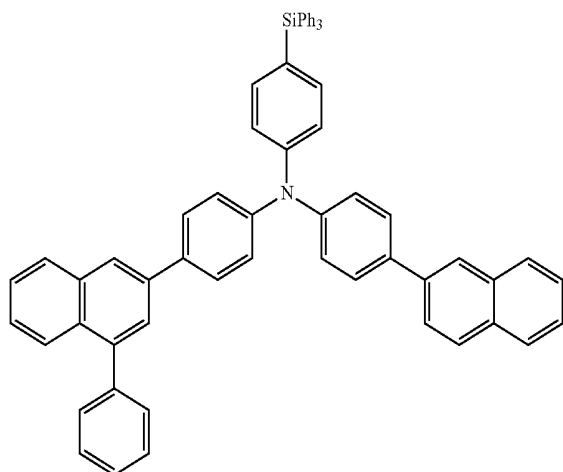
E12



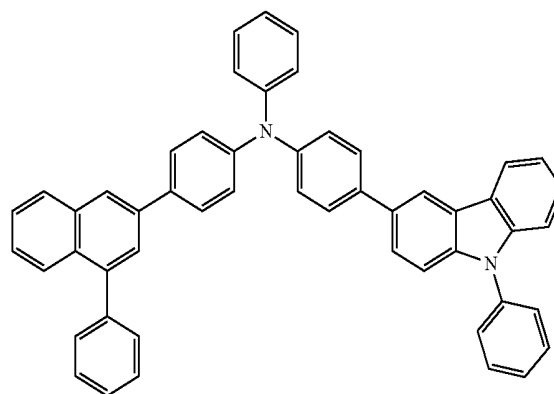
E15



E13

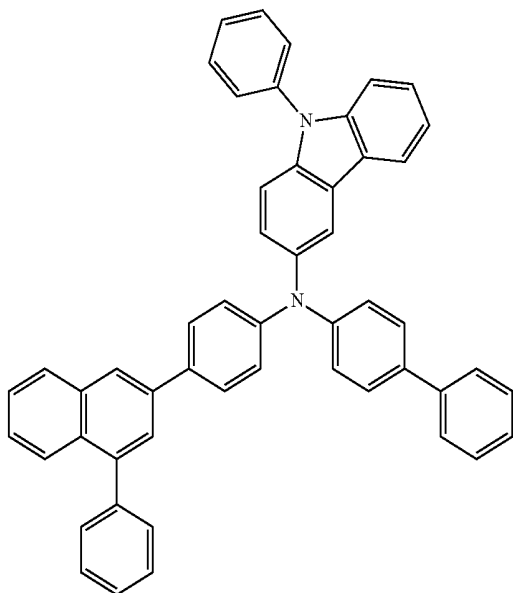


E16



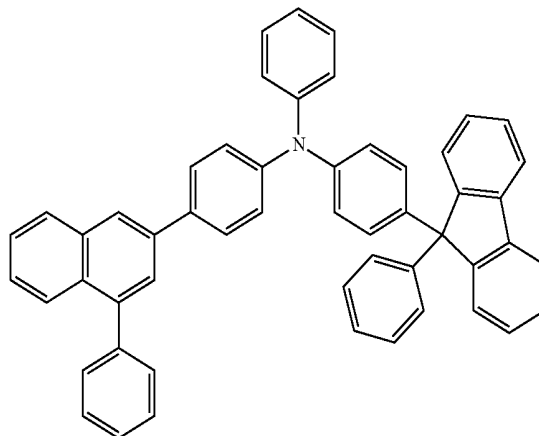
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E17

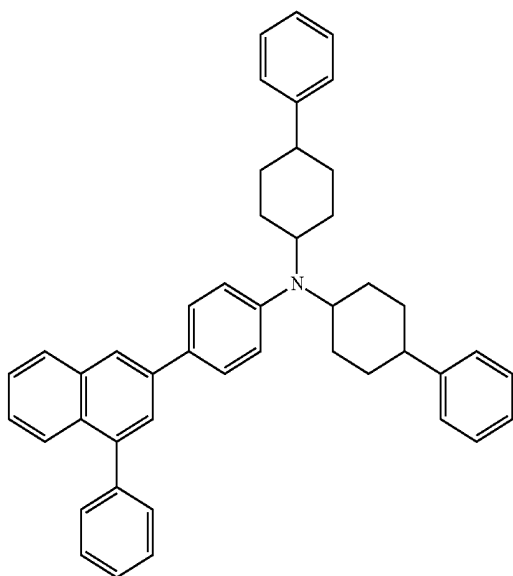


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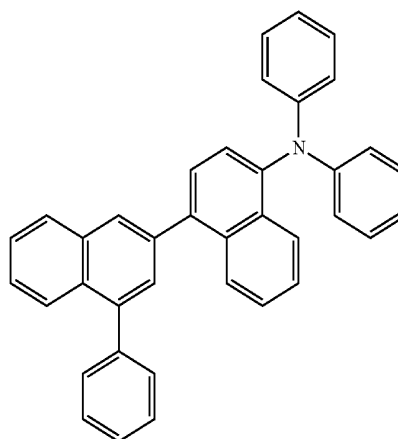
E20



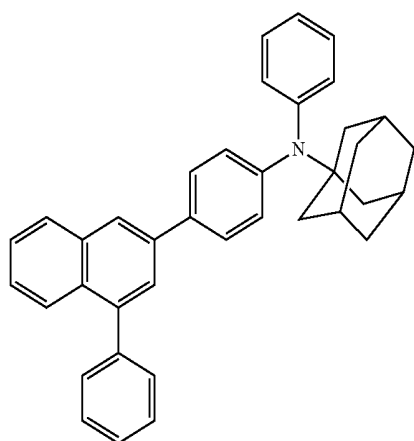
E18



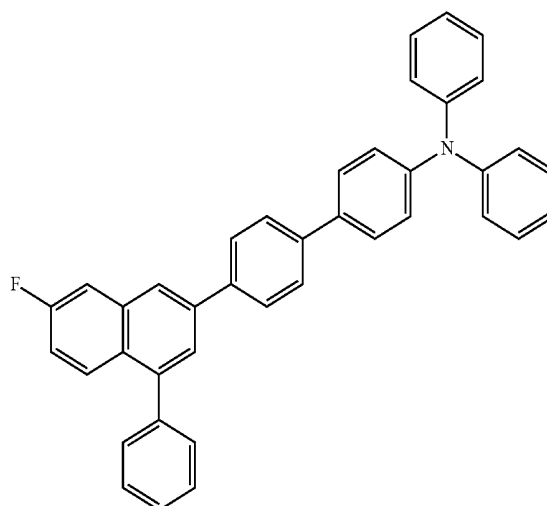
E21



E19

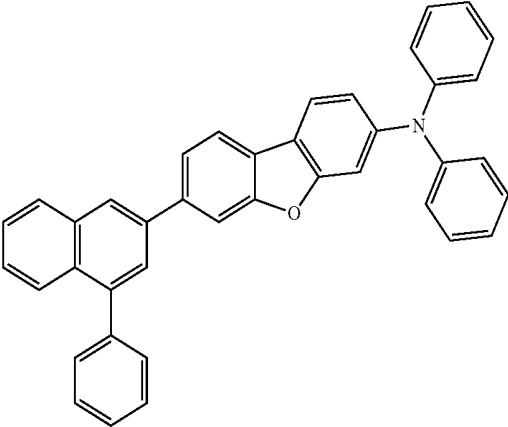


E22



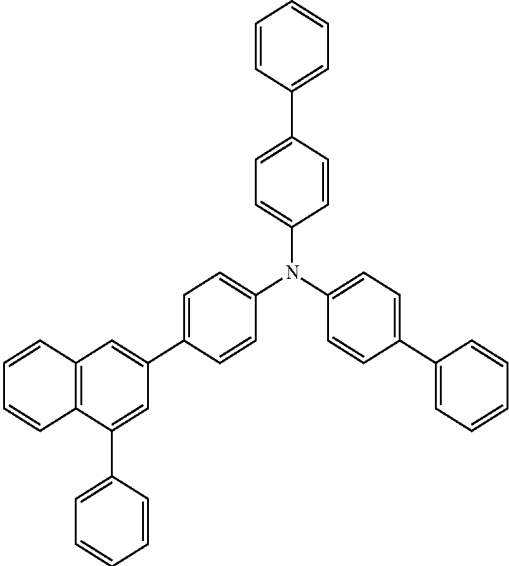
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E23

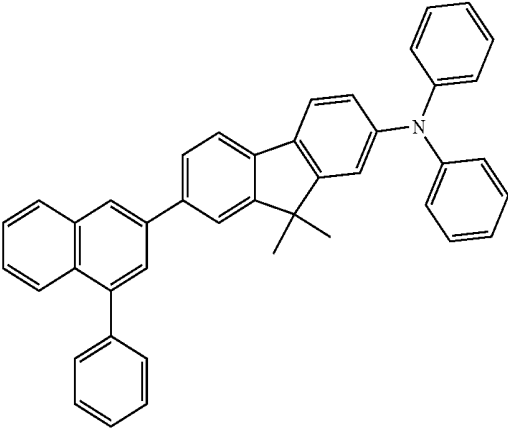


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E26

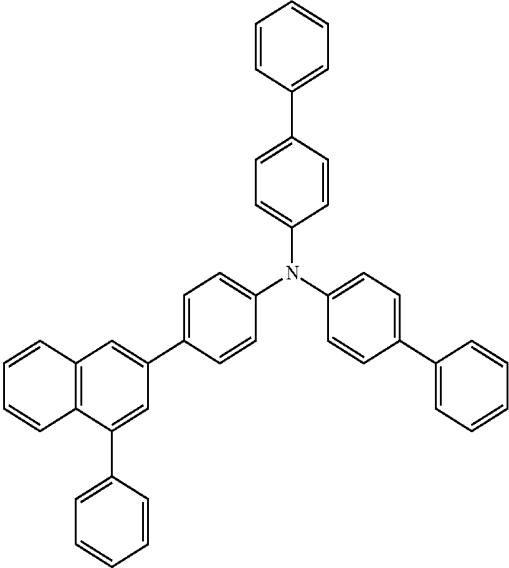
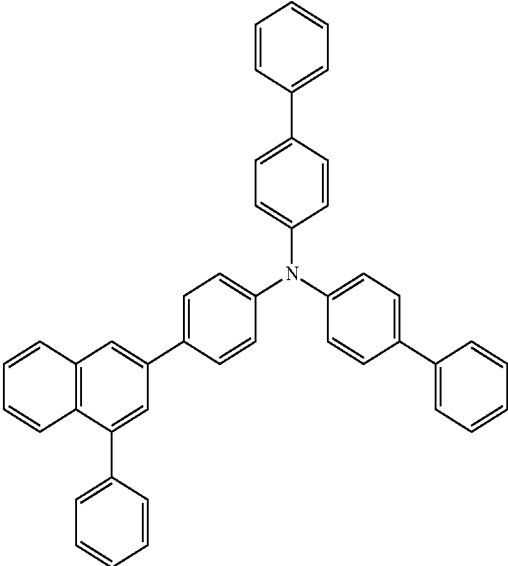


E24



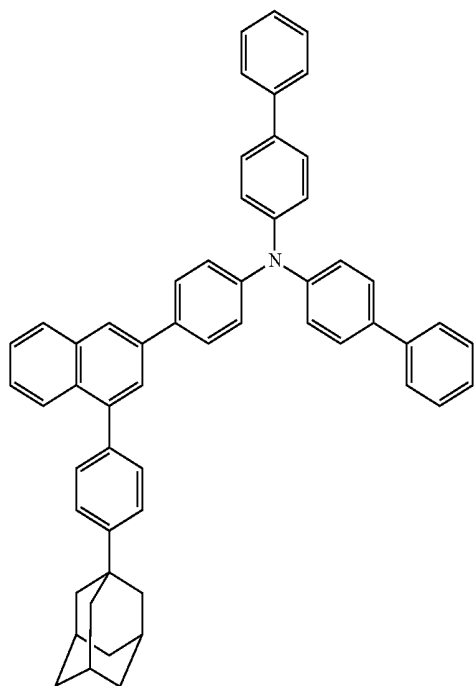
E27

E25



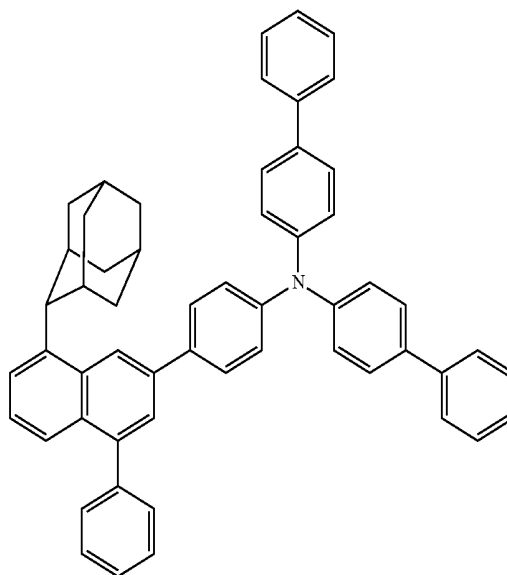
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E28

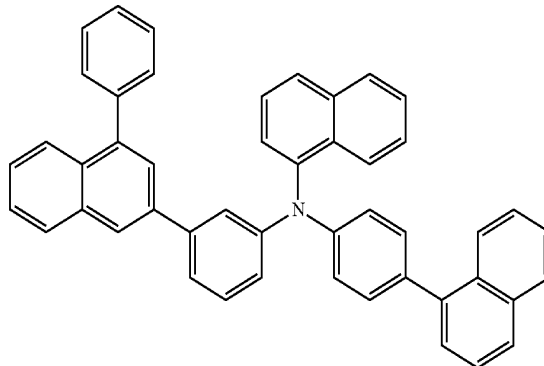


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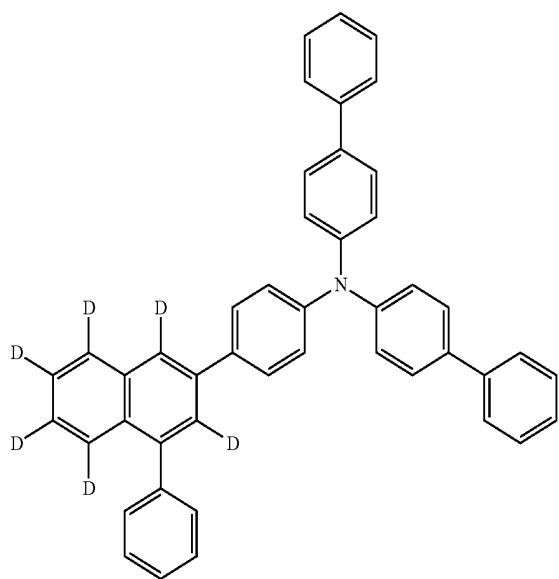
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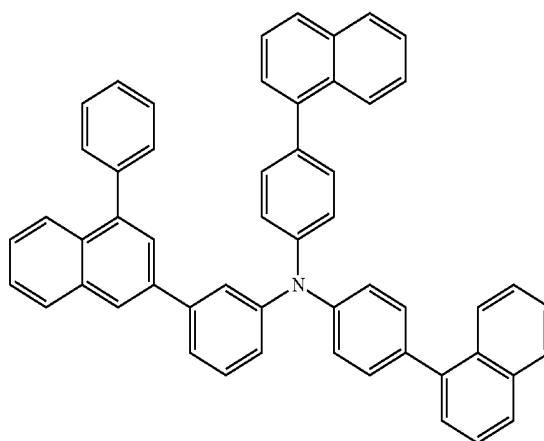
E31



E29

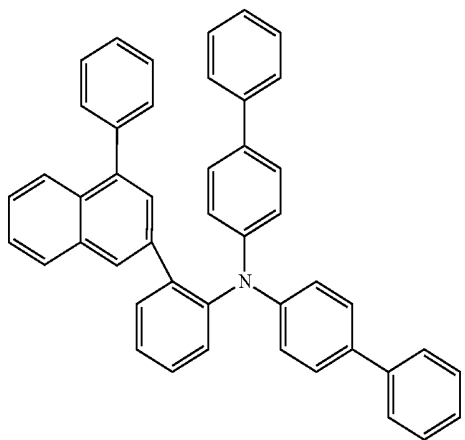


E32



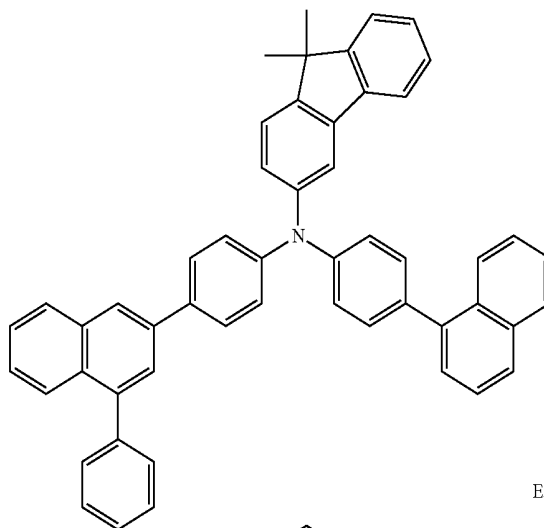
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E33



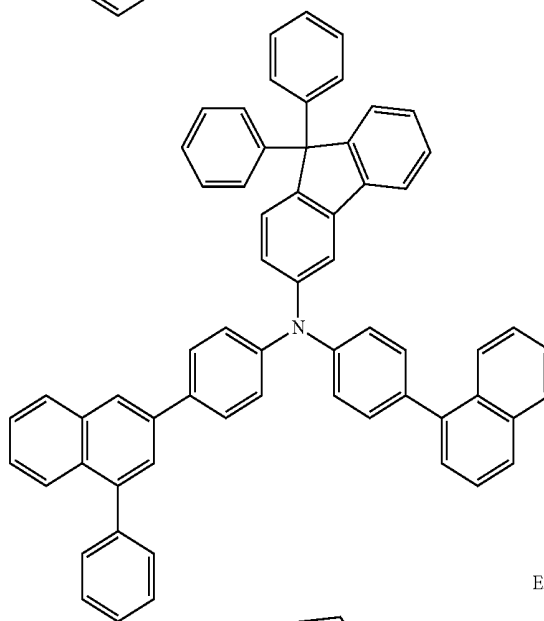
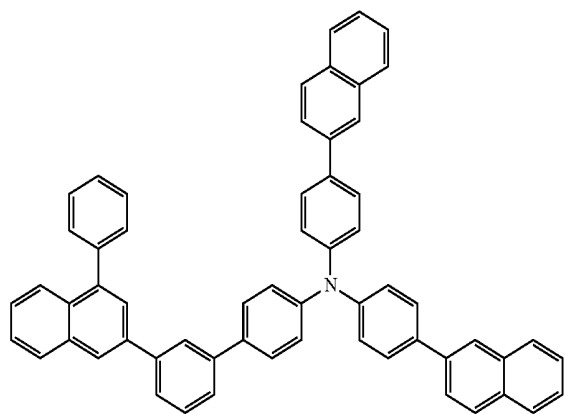
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E36



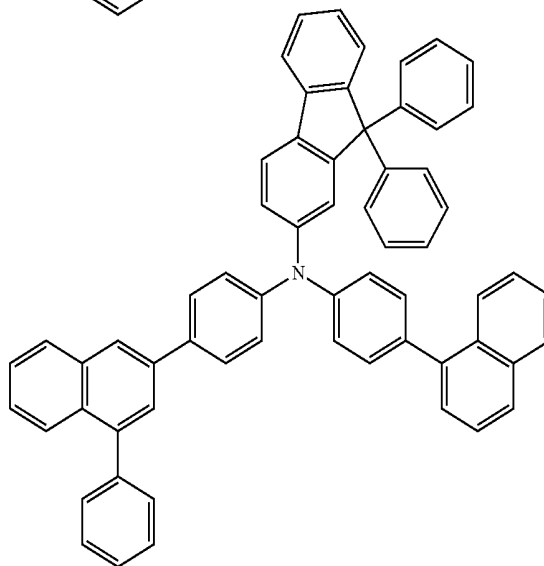
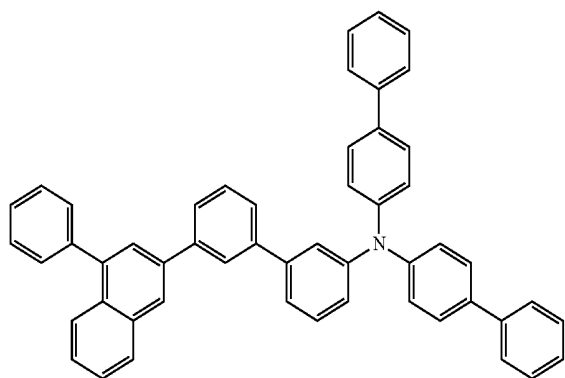
E37

E34



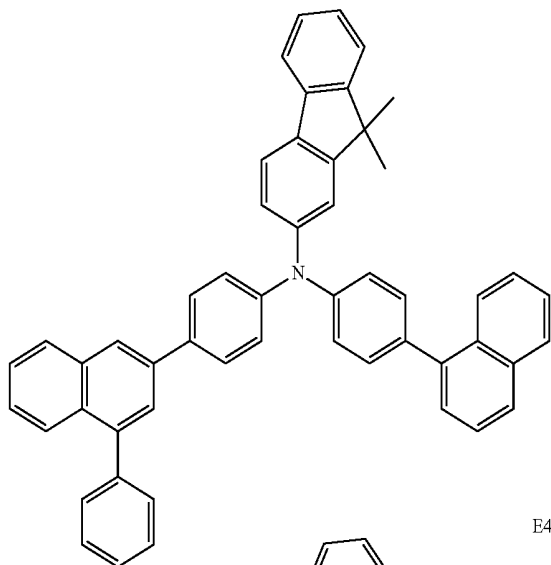
E38

E35



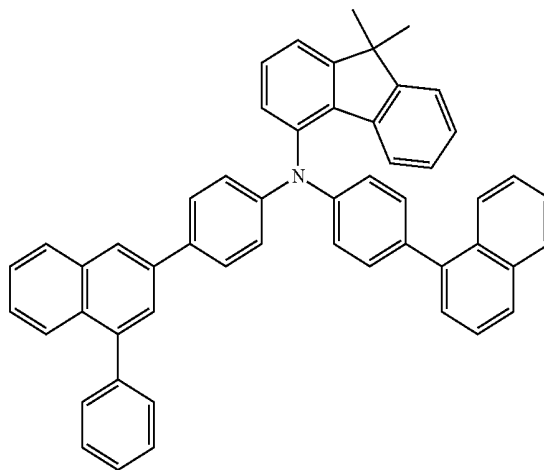
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E39

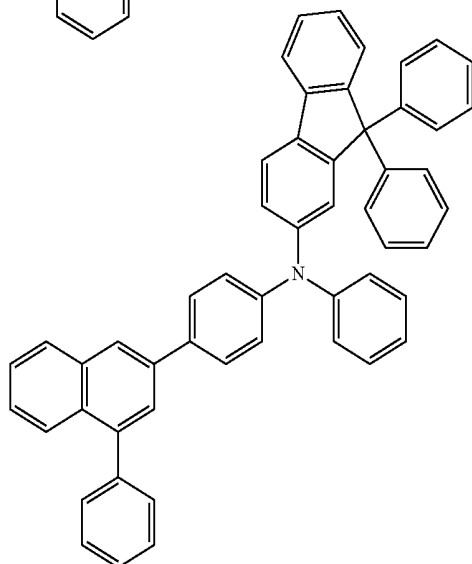


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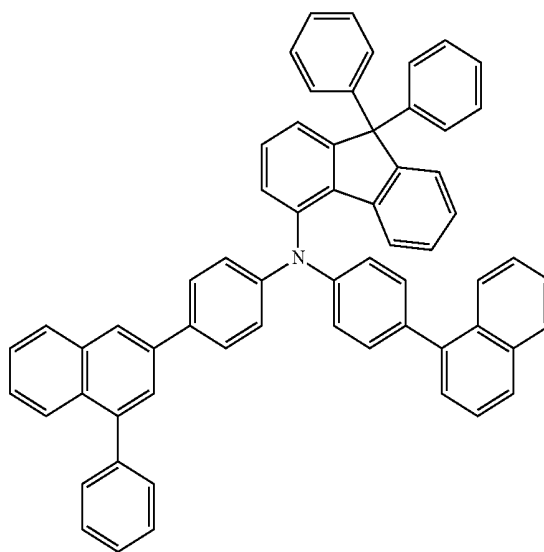
E42



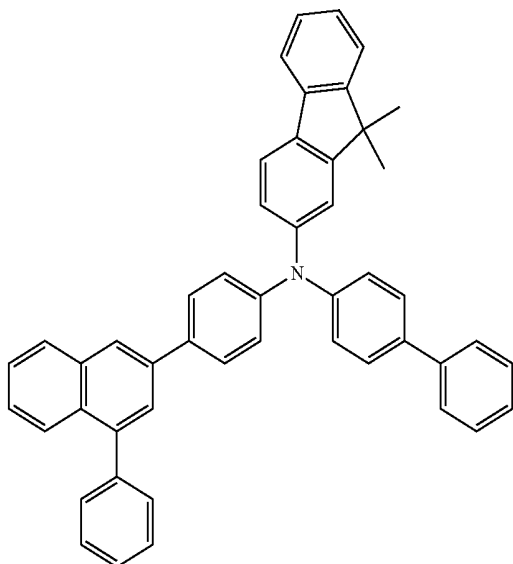
E40



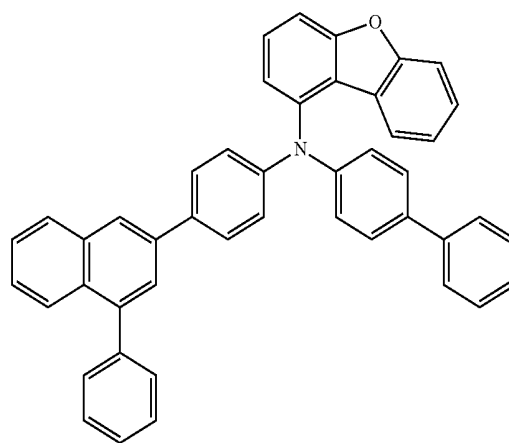
E43



E41

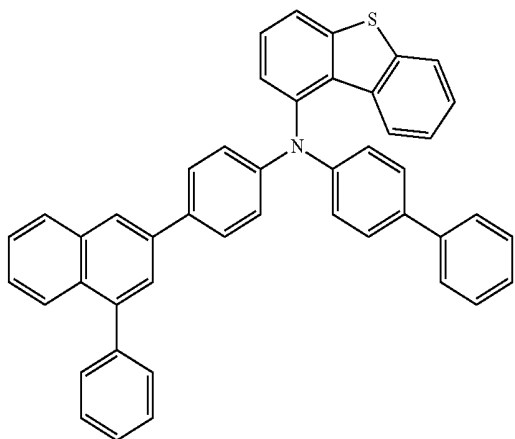


E44

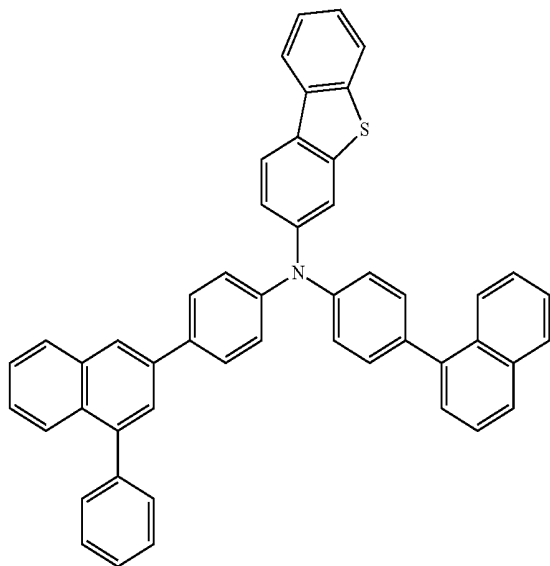


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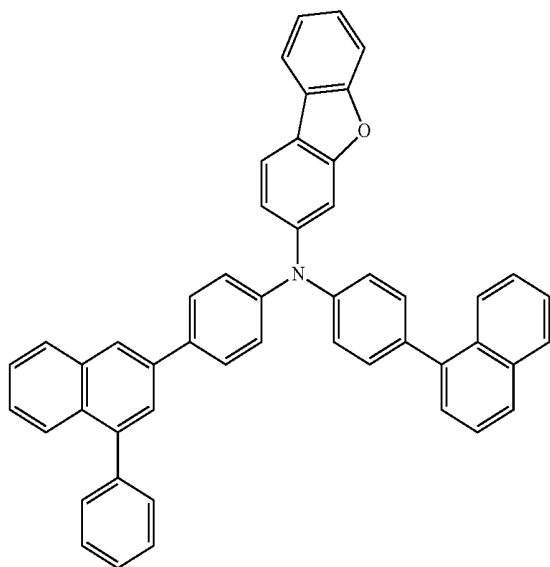
E45



E46

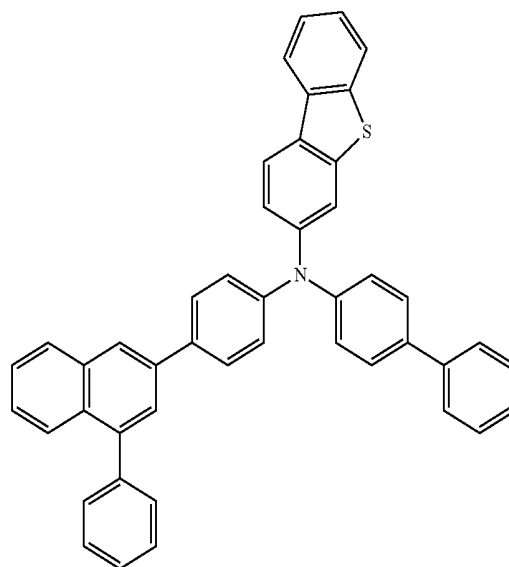


E47

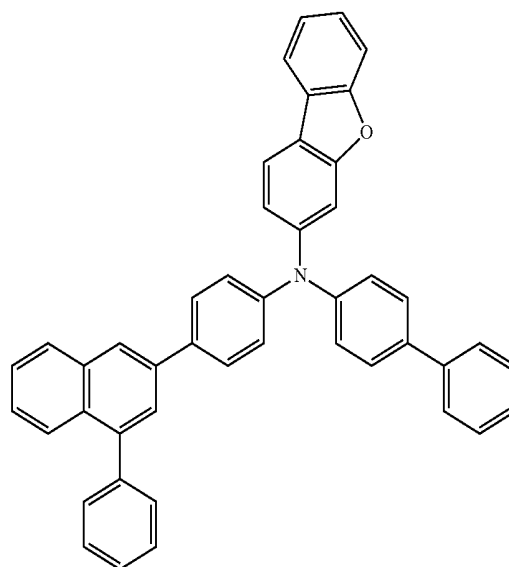


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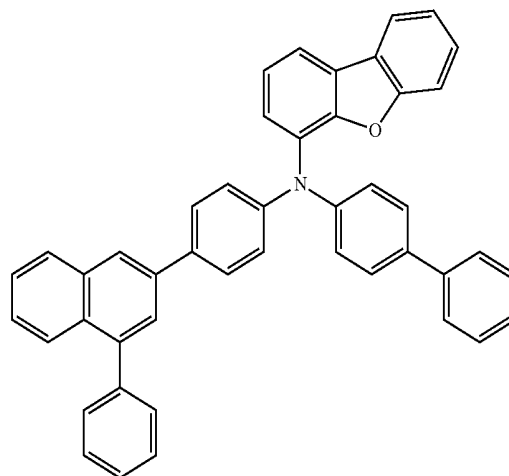
E48



E49

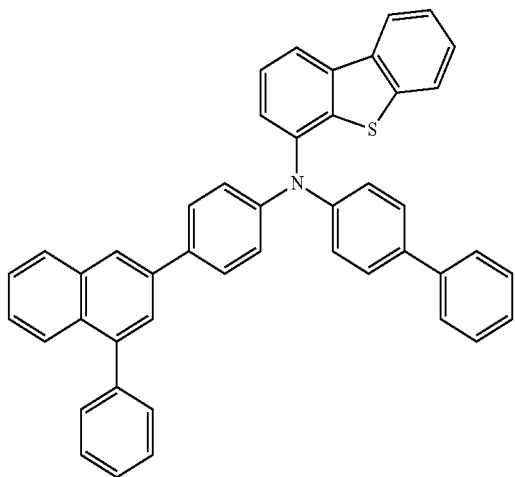


E50



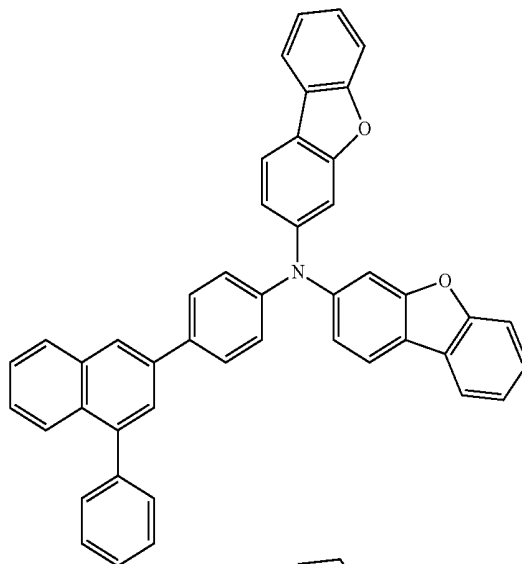
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E51



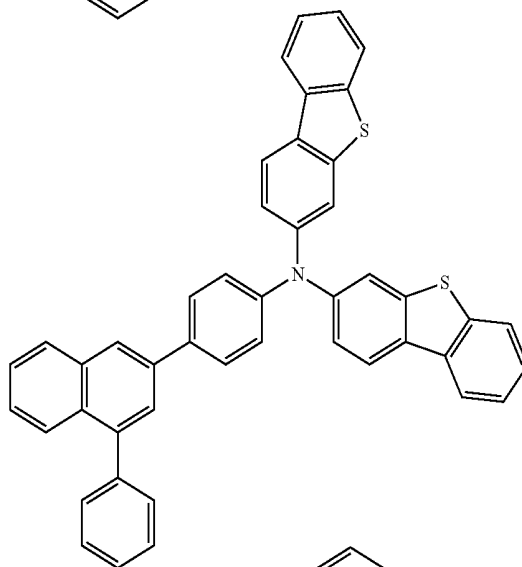
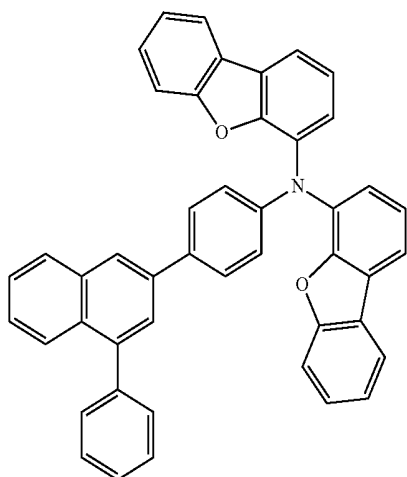
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E54



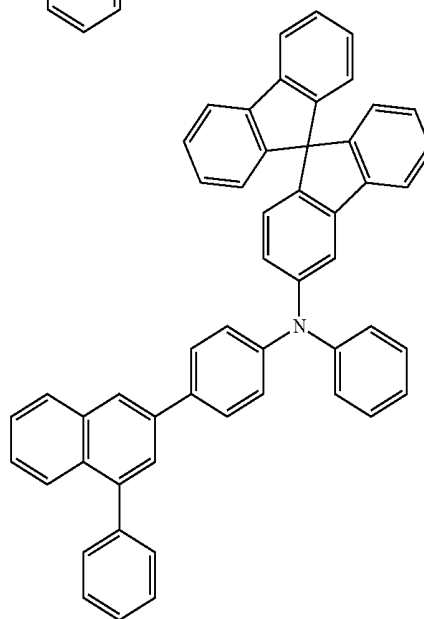
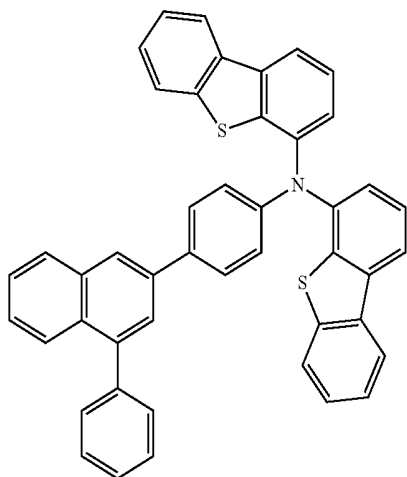
E55

E52



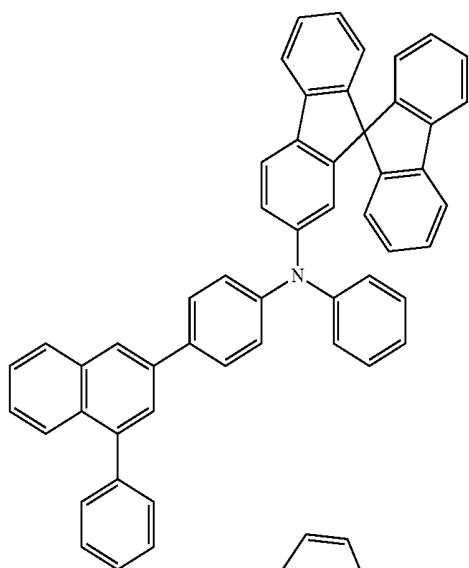
E56

E53



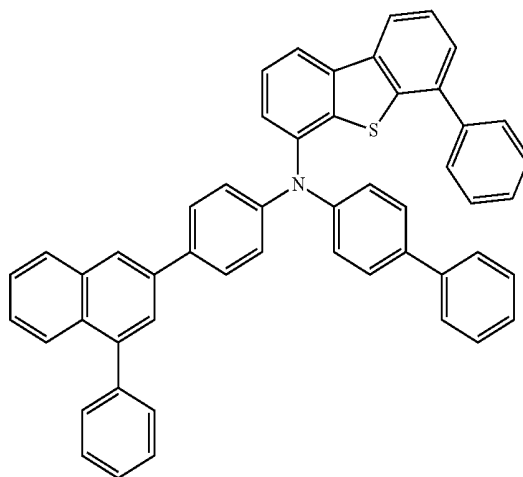
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E57

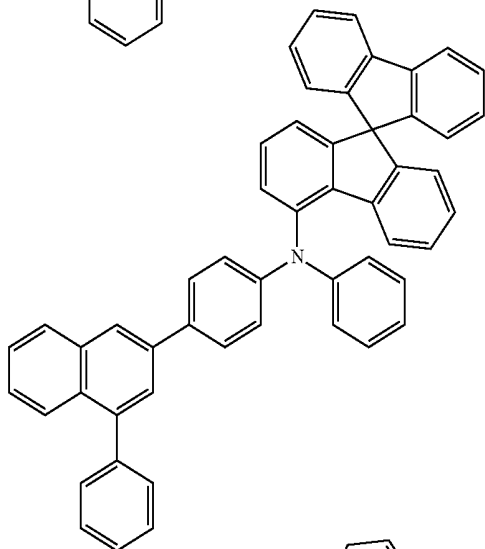


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E60

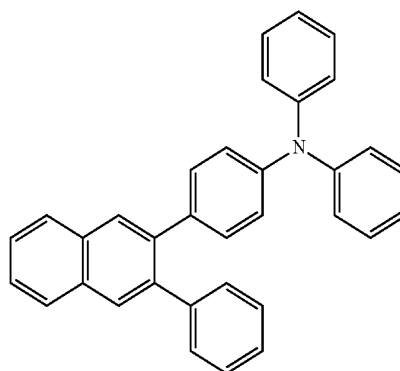


E58

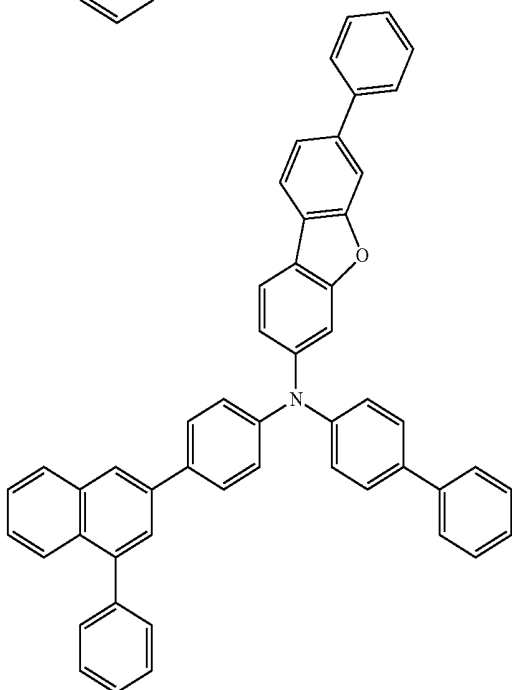


[Compound Group 6]

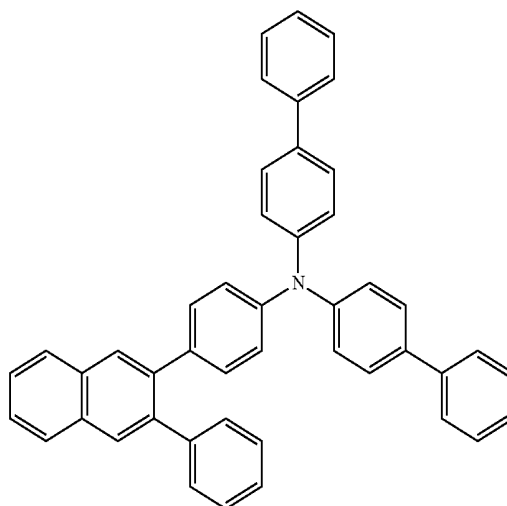
F1



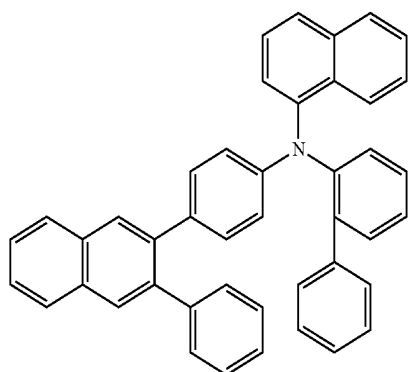
E59



F2

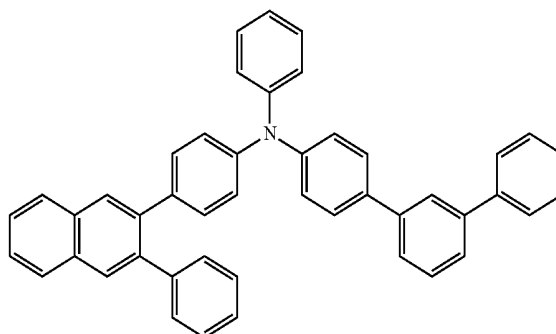


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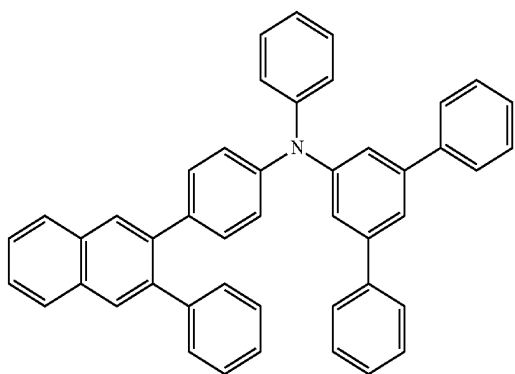


F3

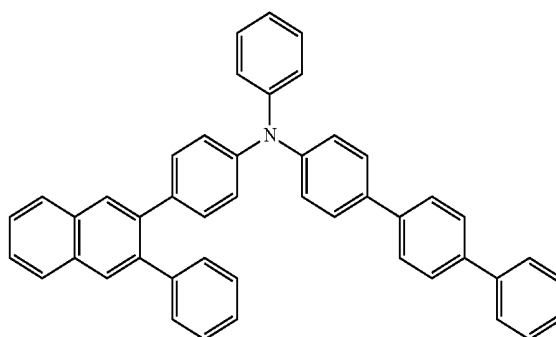
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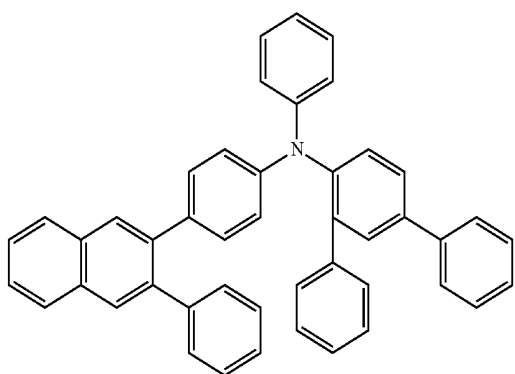
F7



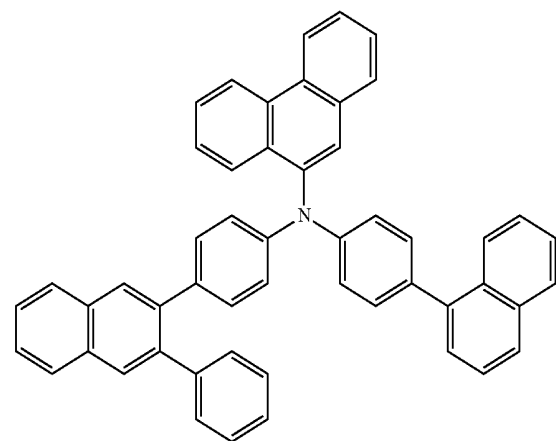
F4



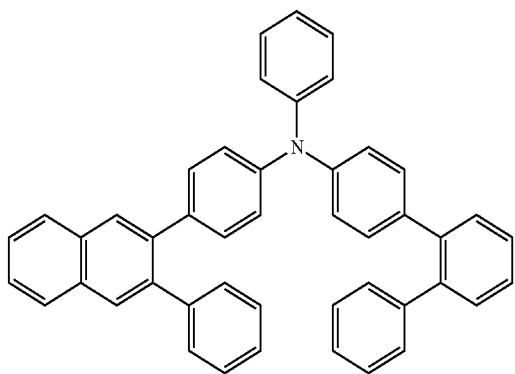
F8



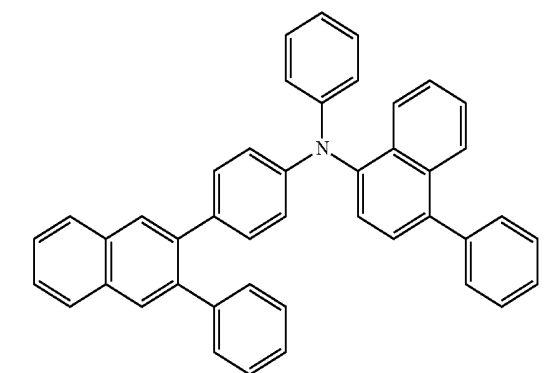
F5



F9



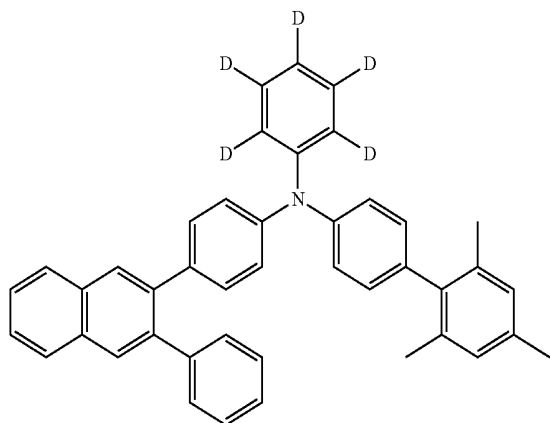
F6



F10

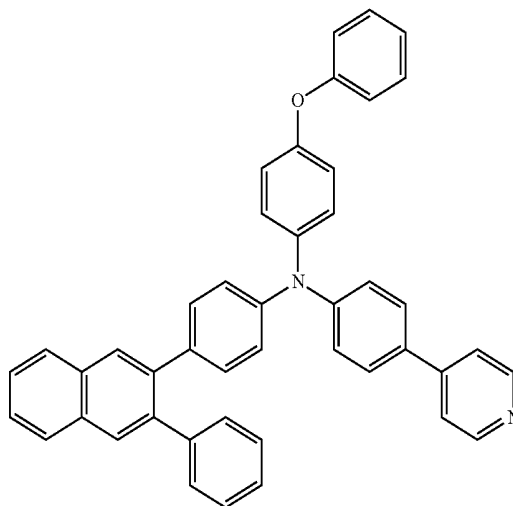
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F11

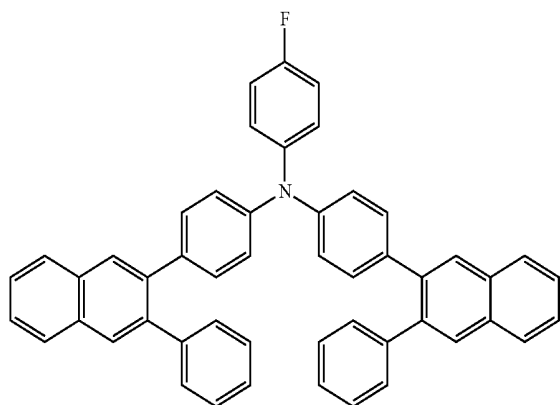


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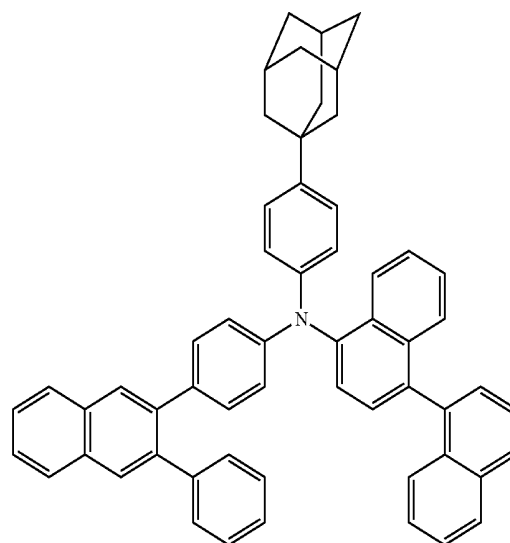
F14



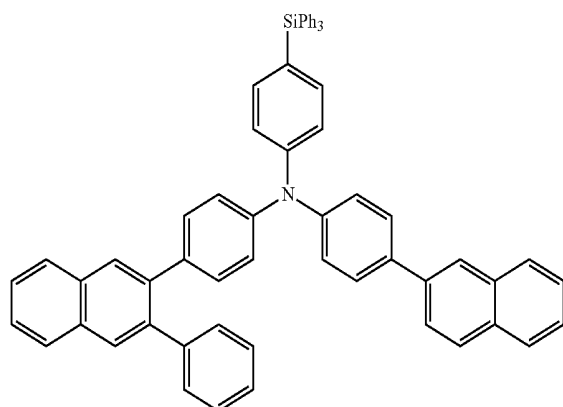
F12



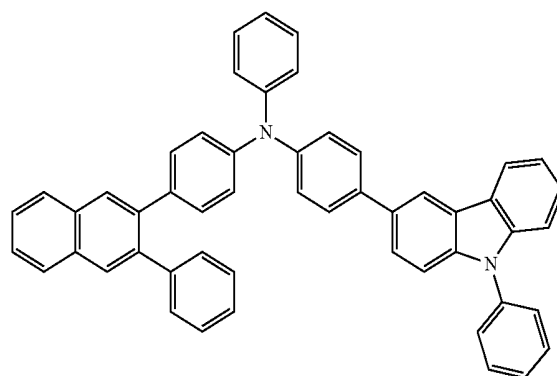
F15



F13

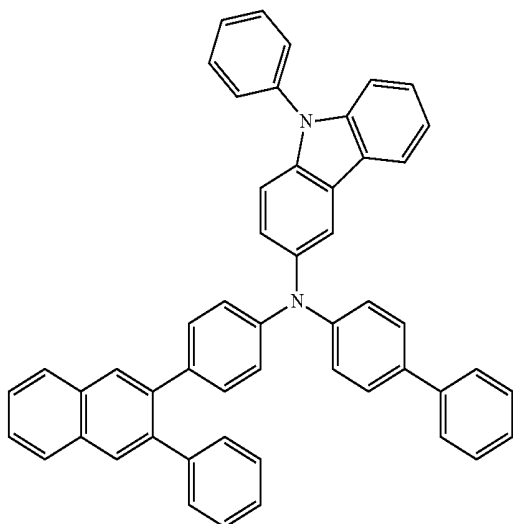


F16



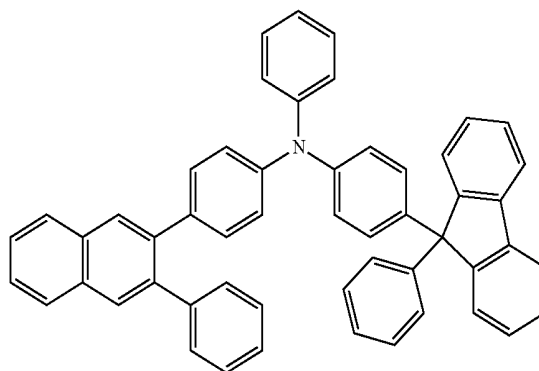
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F17

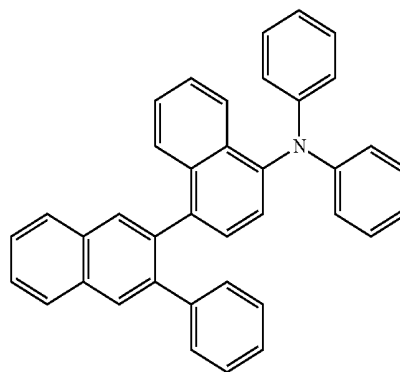


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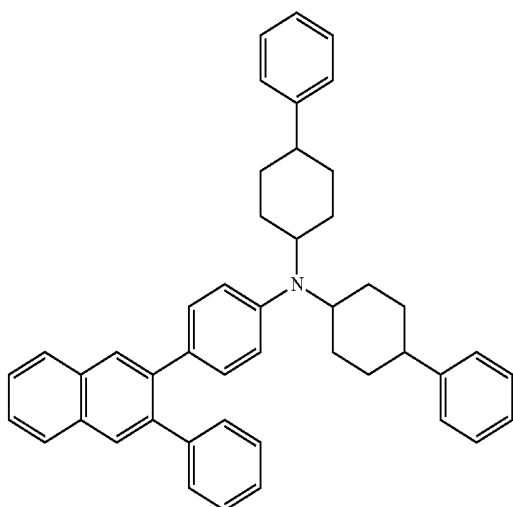
F20



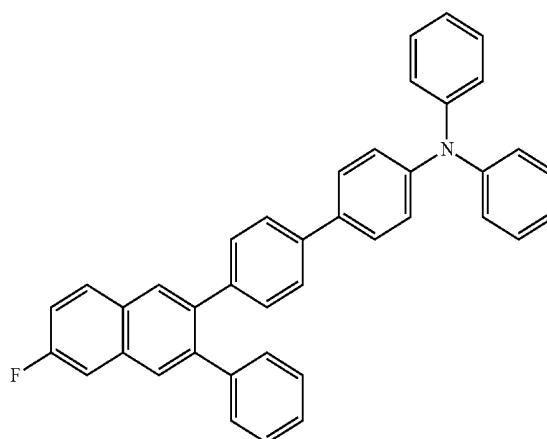
F21



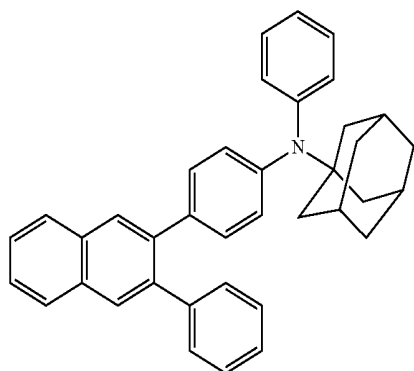
F18



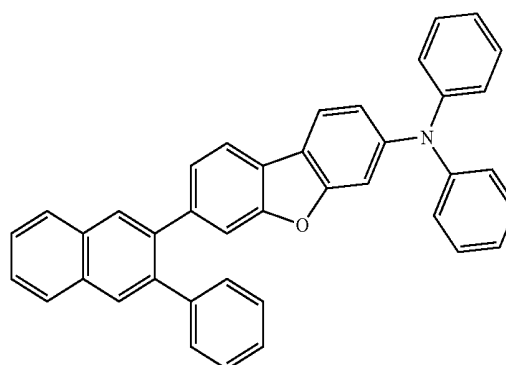
F22



F19

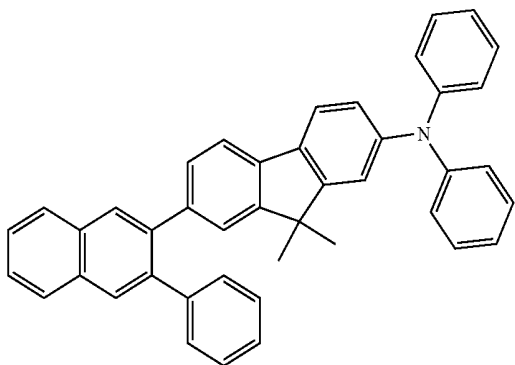


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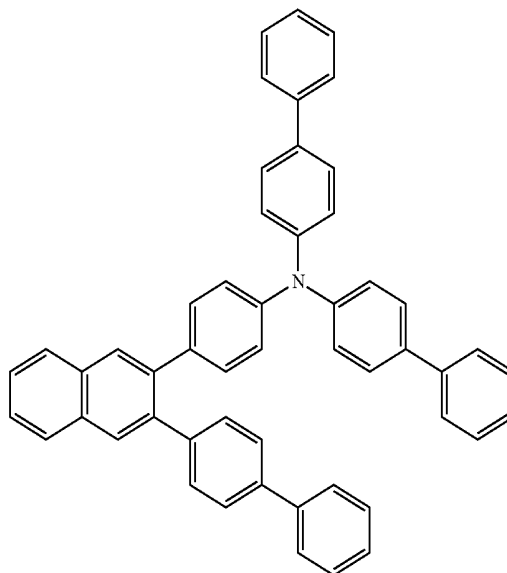
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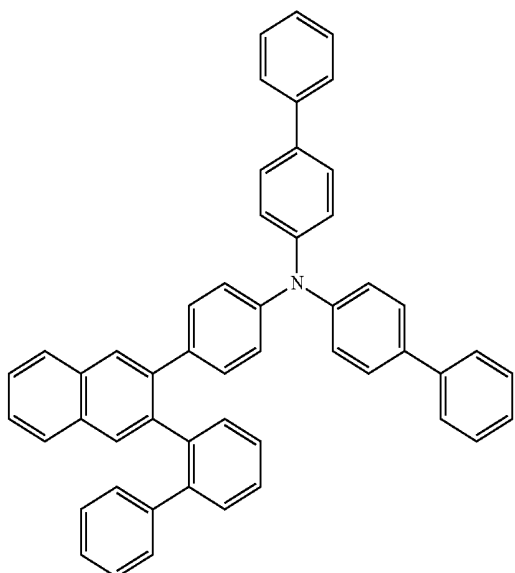


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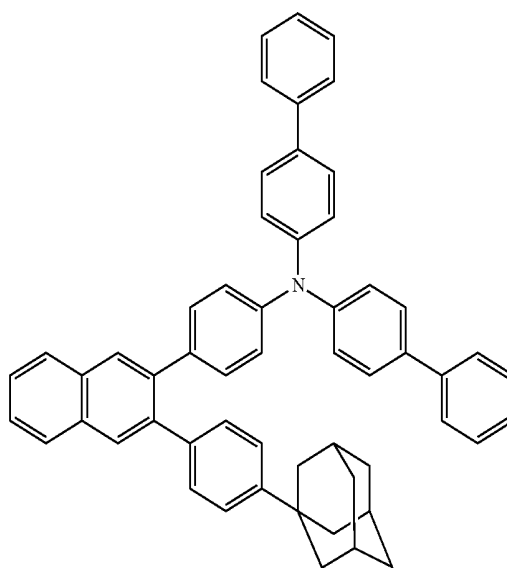
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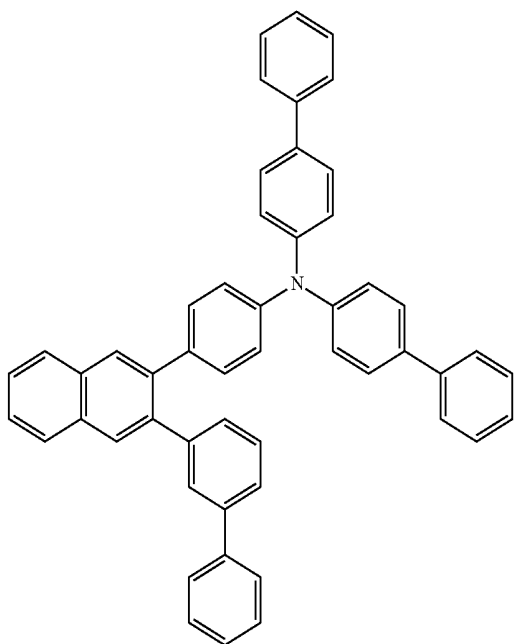
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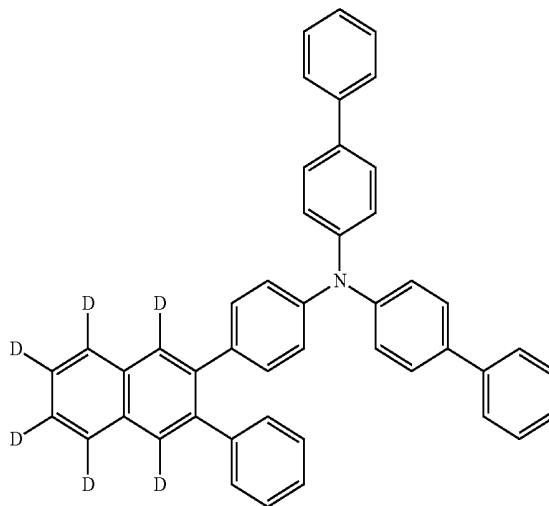
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F26

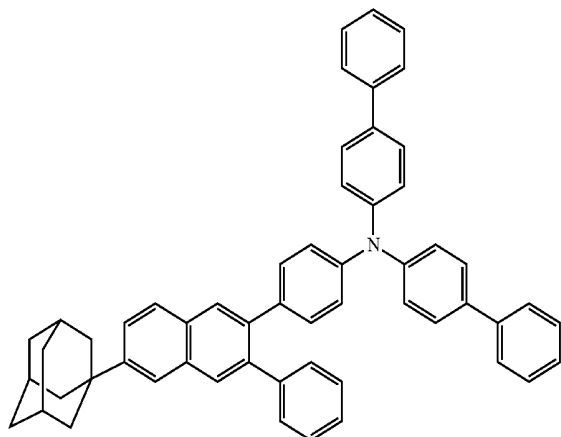


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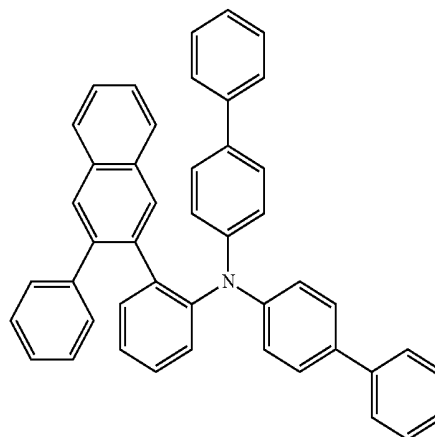
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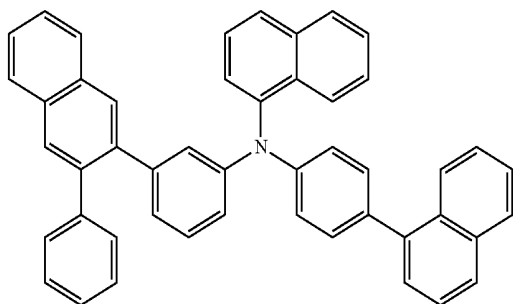


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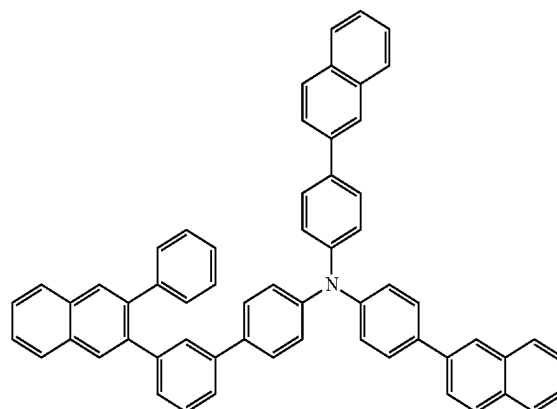
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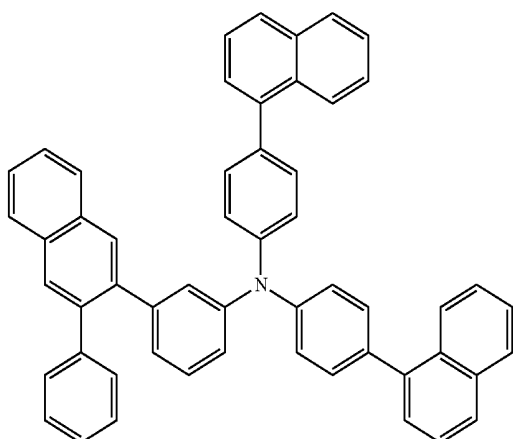
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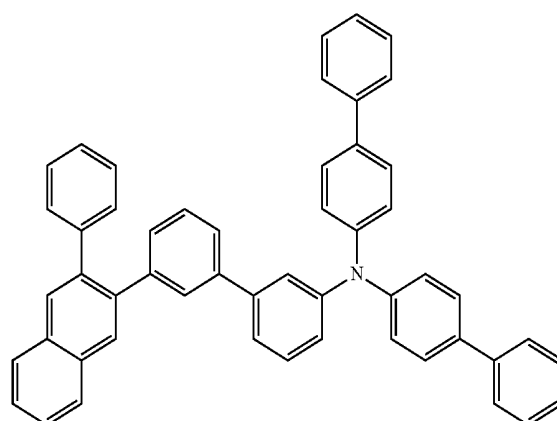
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F32

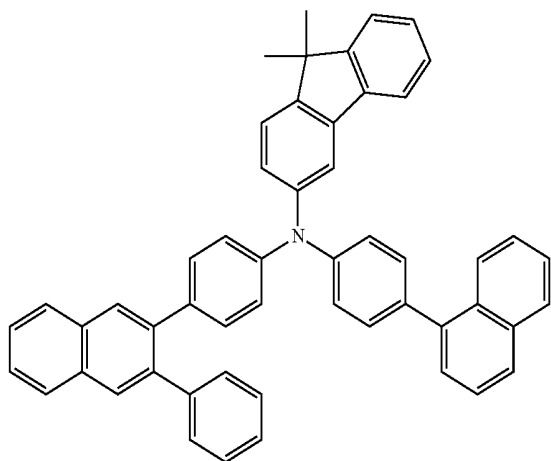


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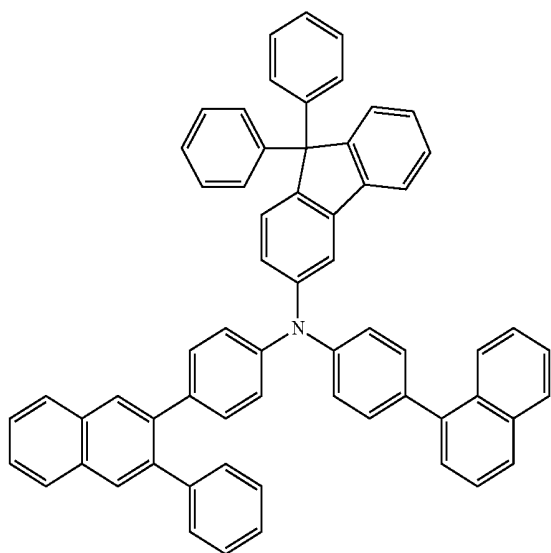


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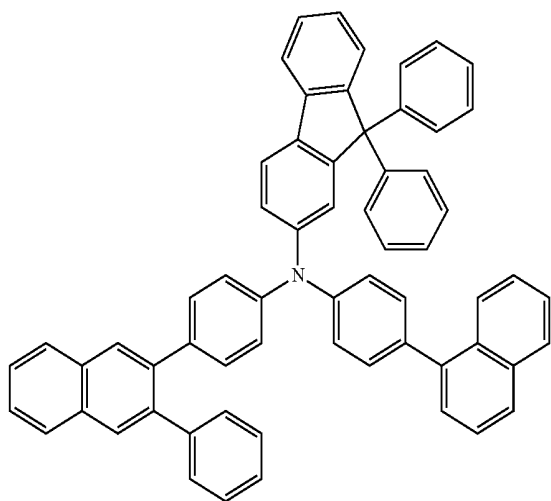
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F37

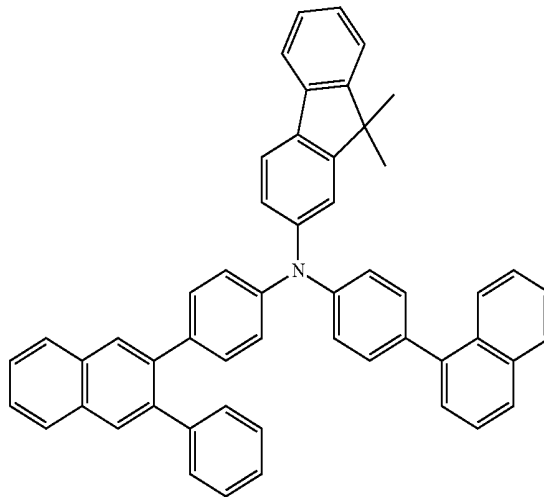


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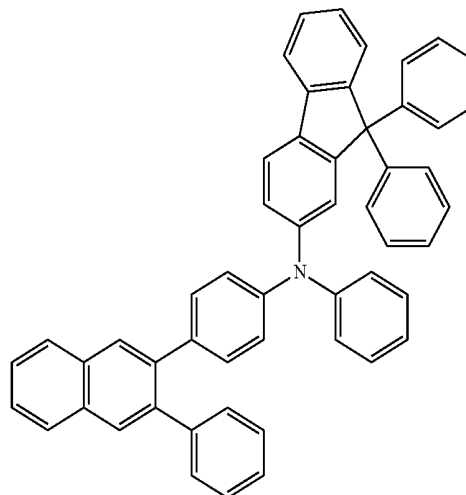


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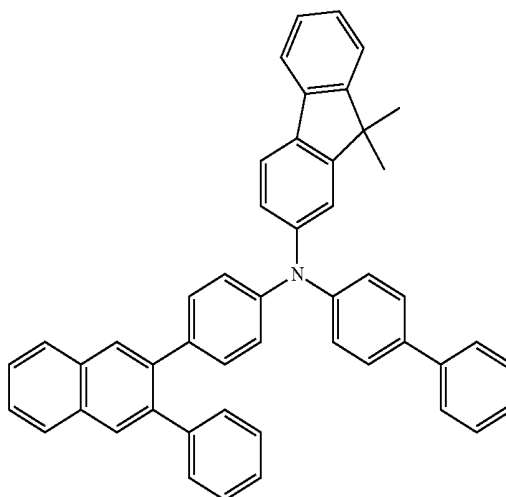
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F40

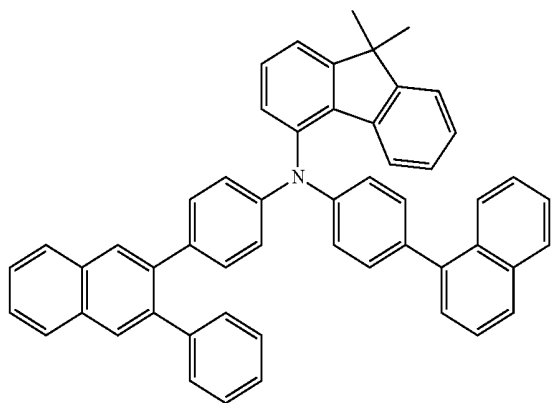


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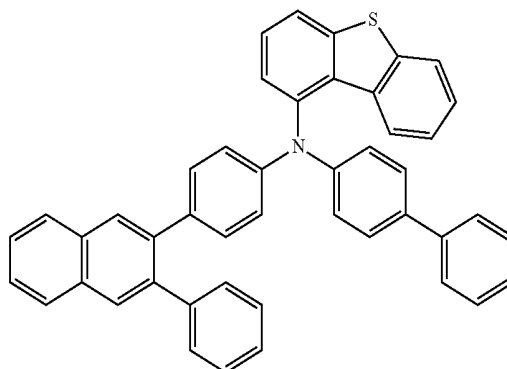
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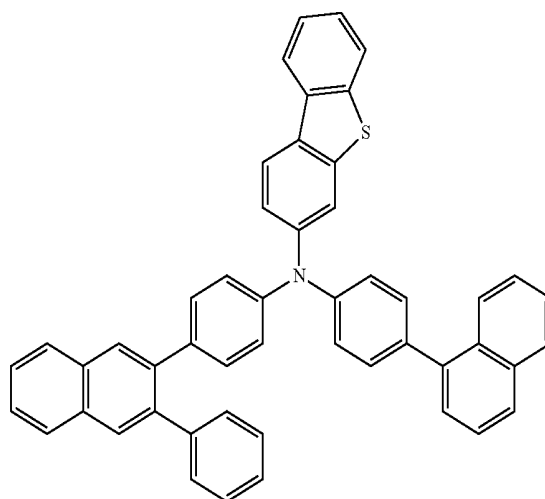
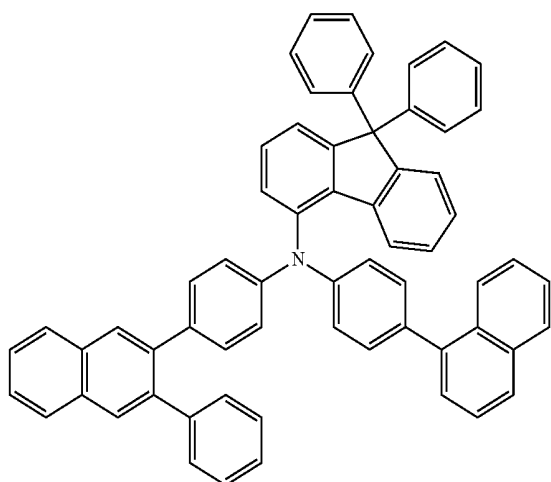
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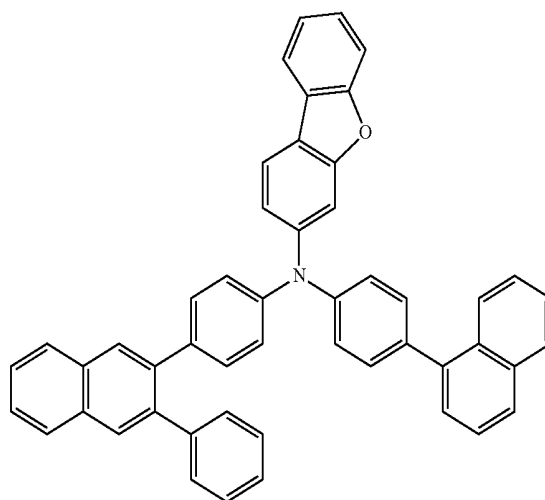
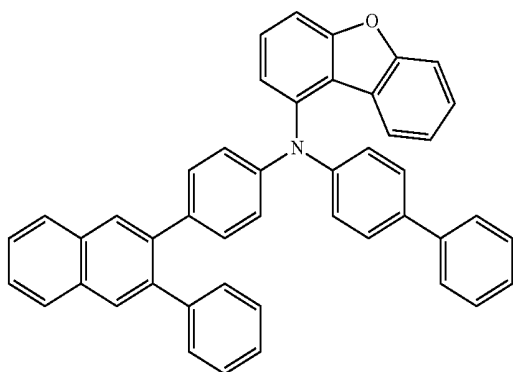
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F43



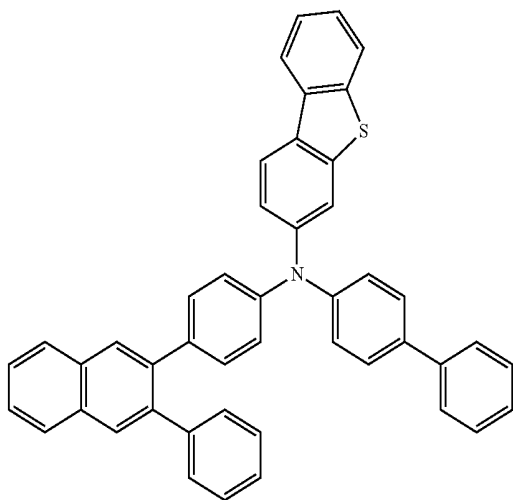
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F44



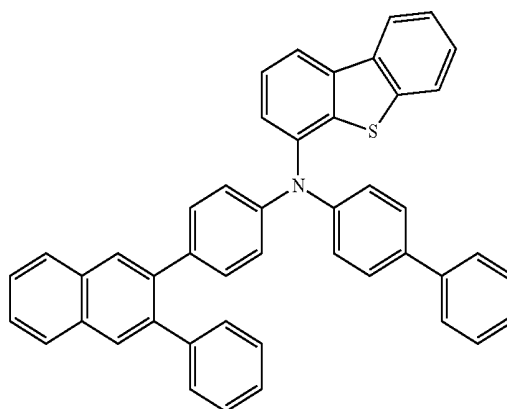
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F48

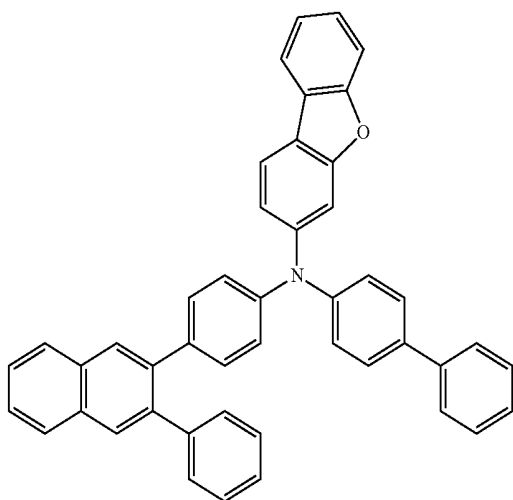


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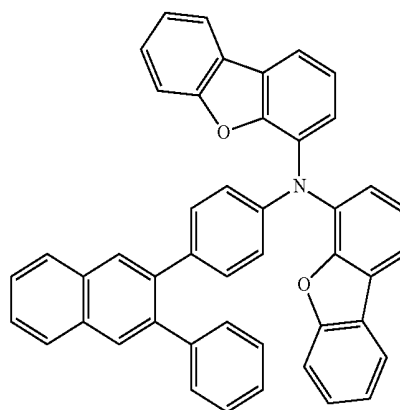
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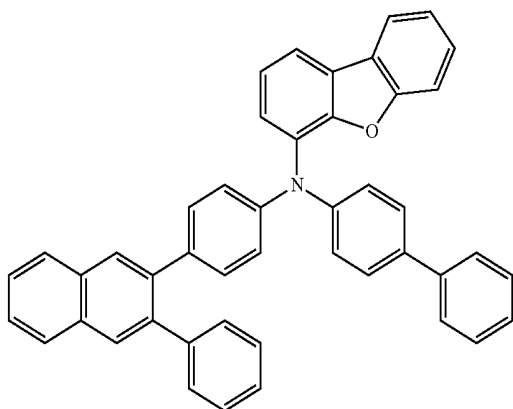
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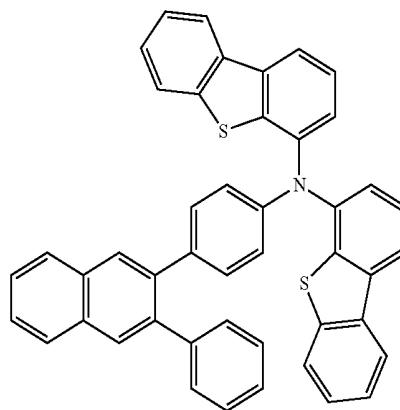
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F50

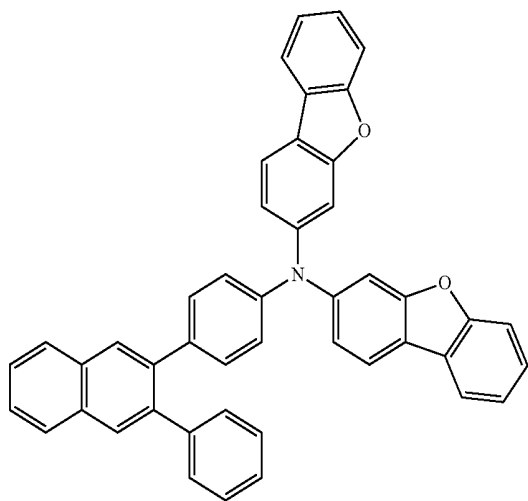


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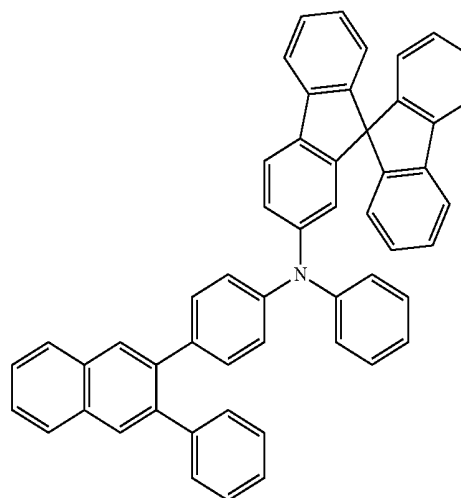
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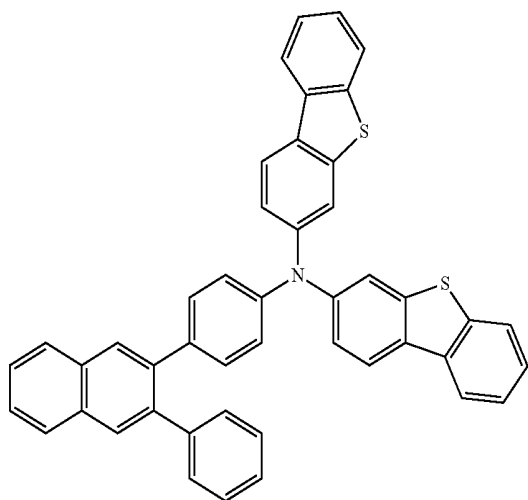


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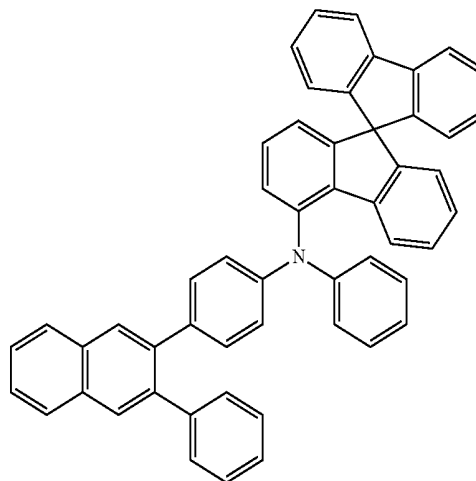
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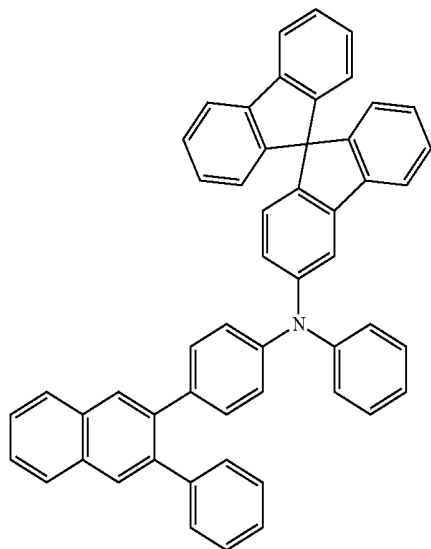
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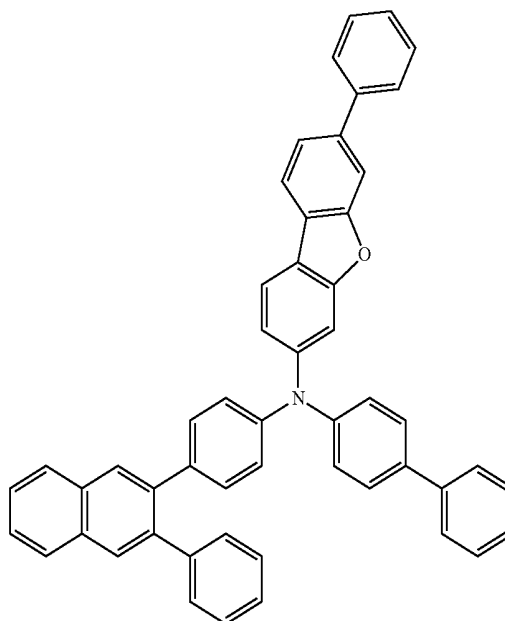
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F56

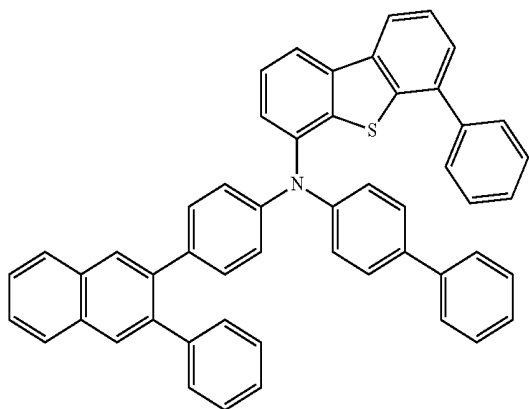


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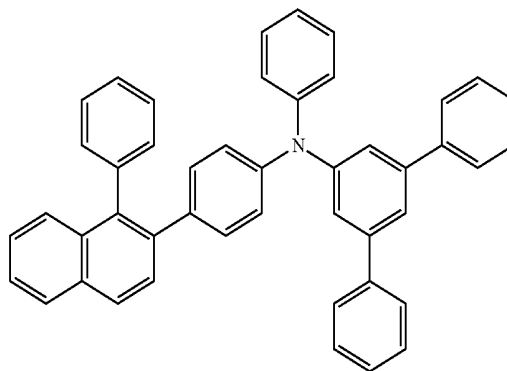
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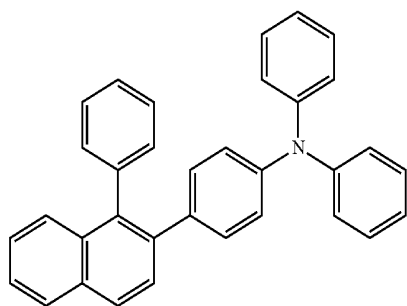
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G4

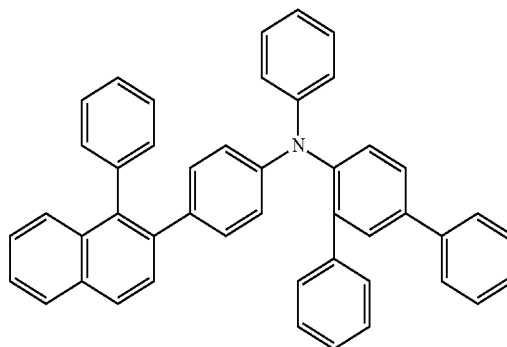


[Compound Group 7]

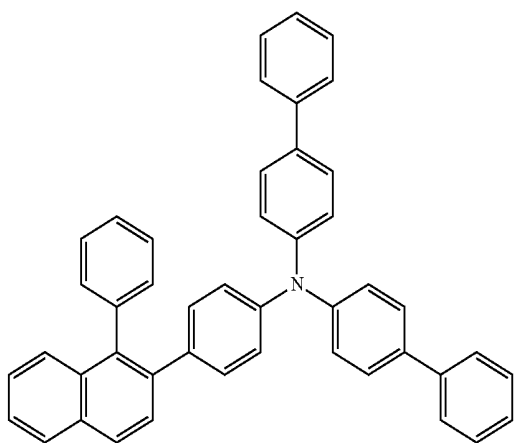
G5



G1

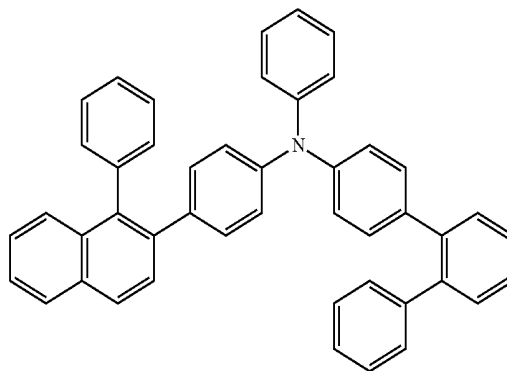


G2

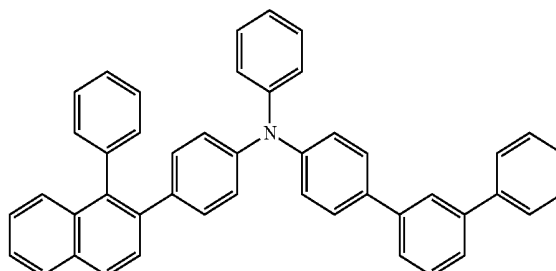
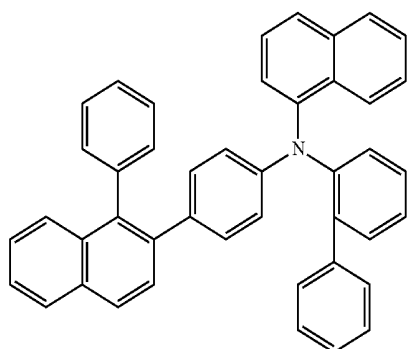


G3

G6

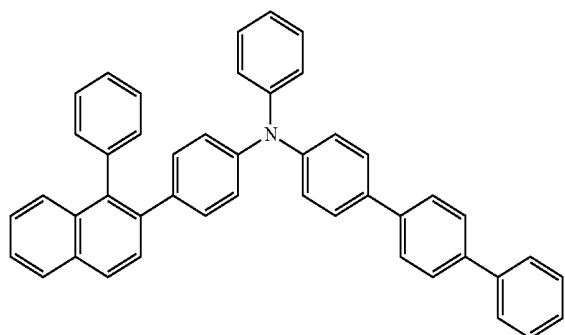


G7



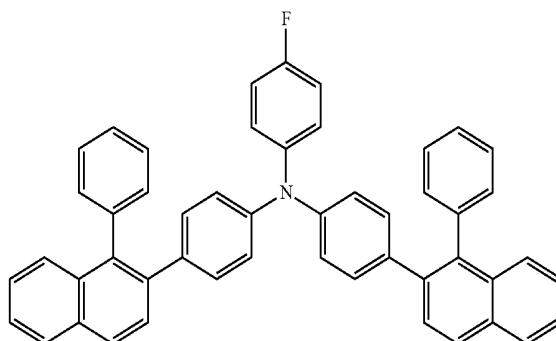
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G8

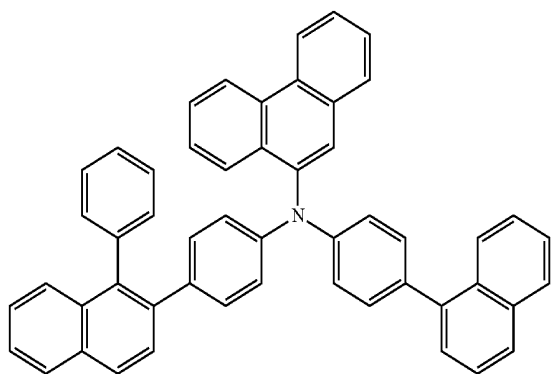


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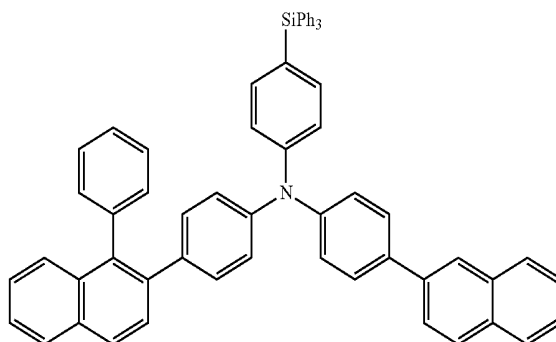
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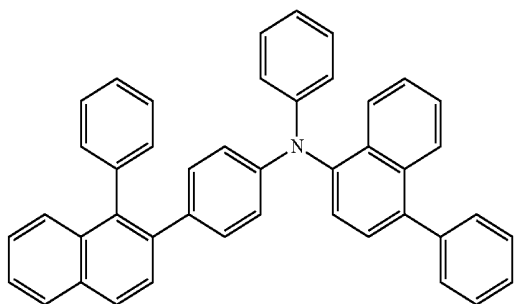
G9



G13

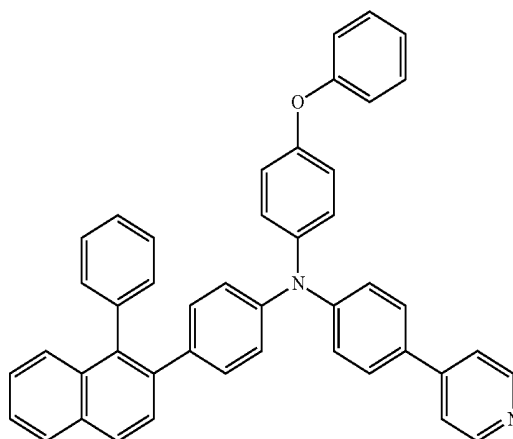
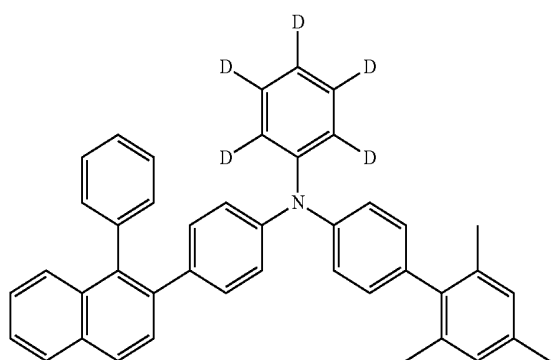


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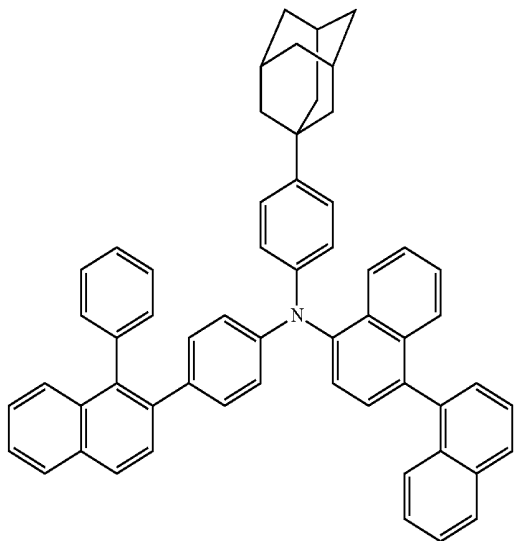
G14

G11



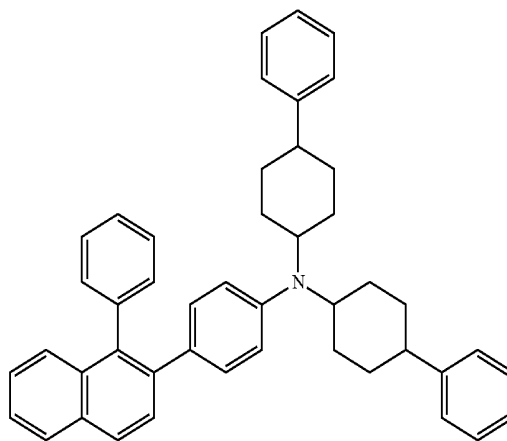
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G15



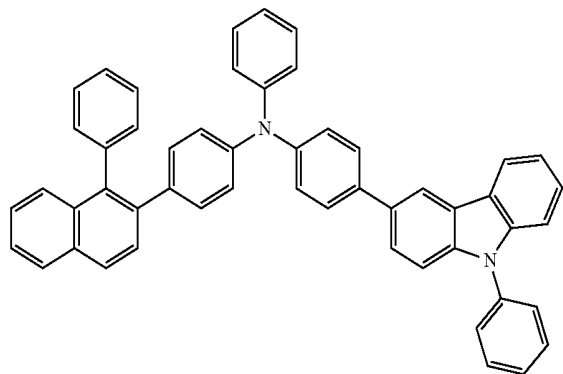
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G18

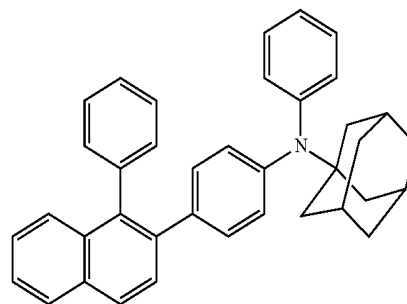


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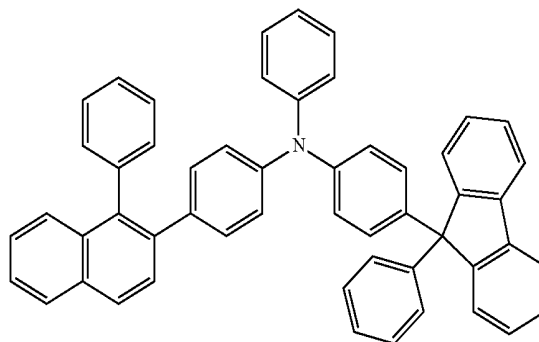
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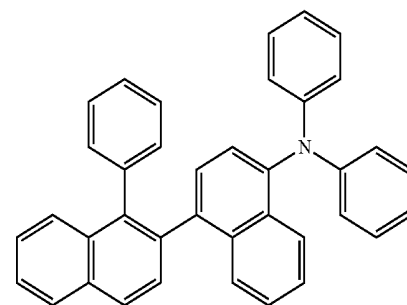
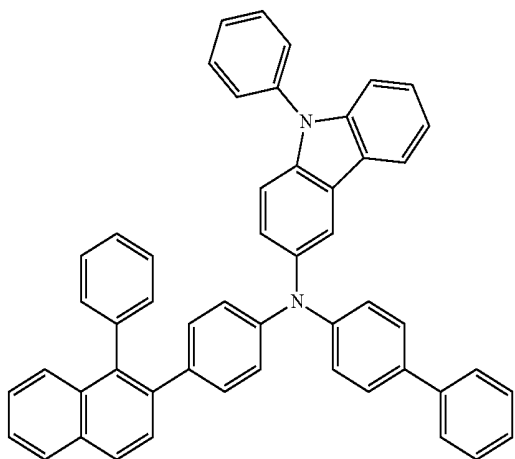
G20



G17

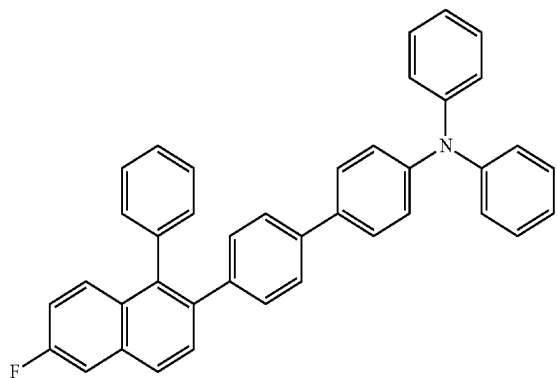


G21



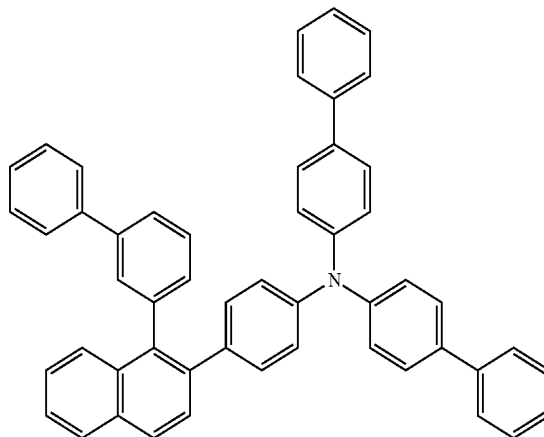
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G22

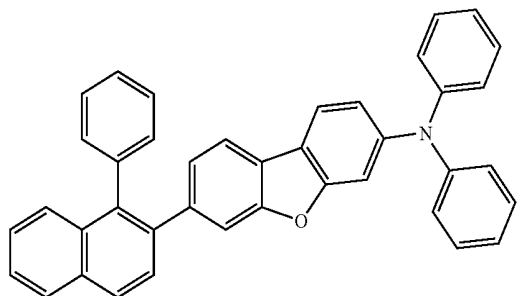


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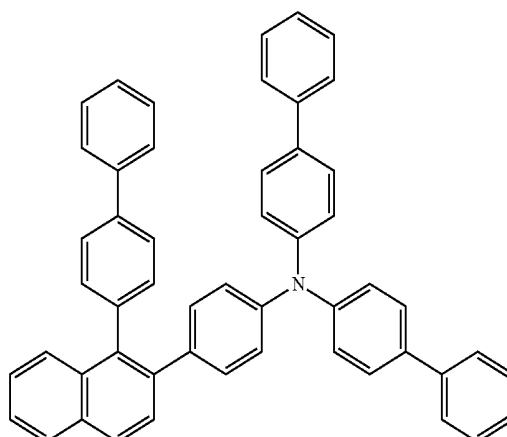
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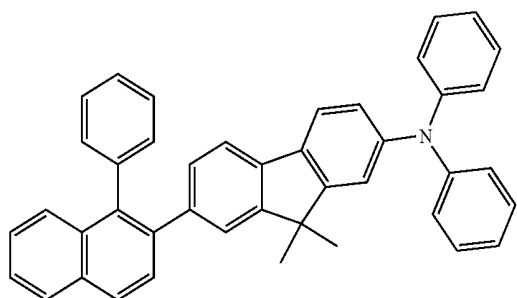
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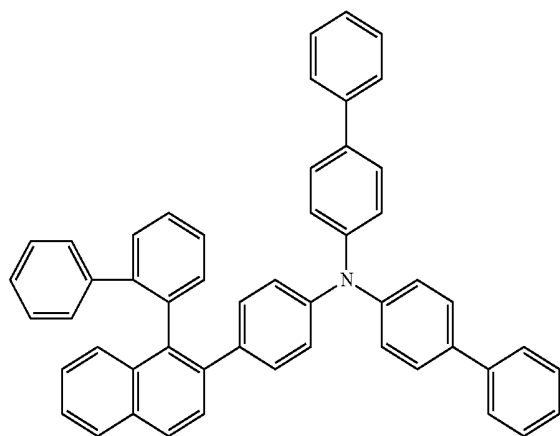
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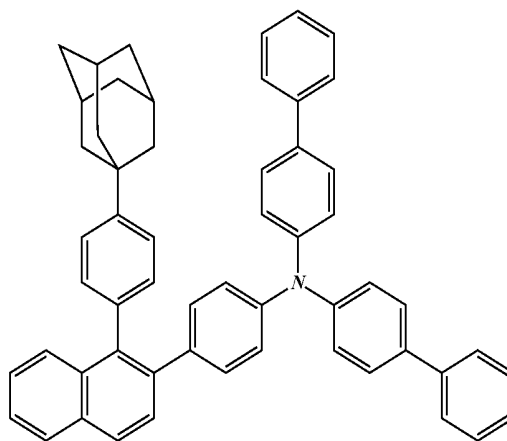
G24



G25

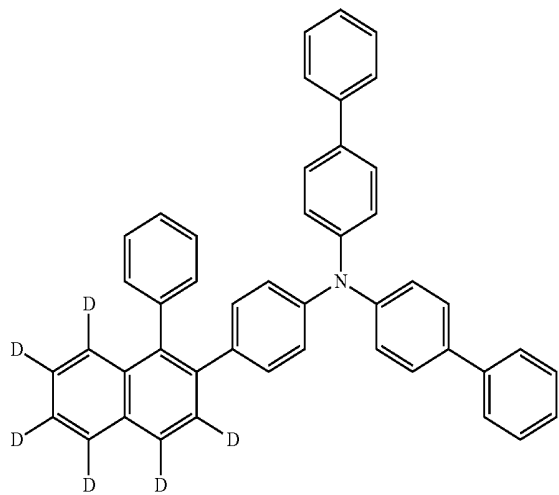


G28



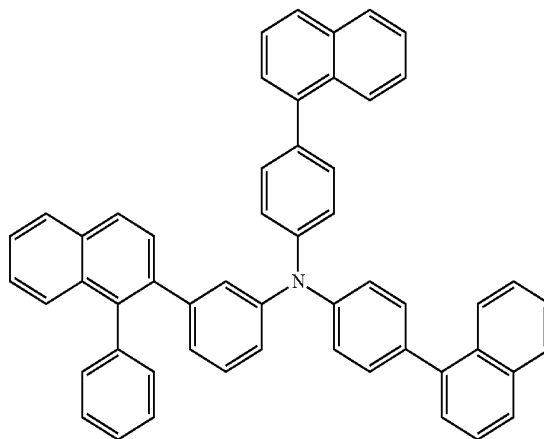
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G29



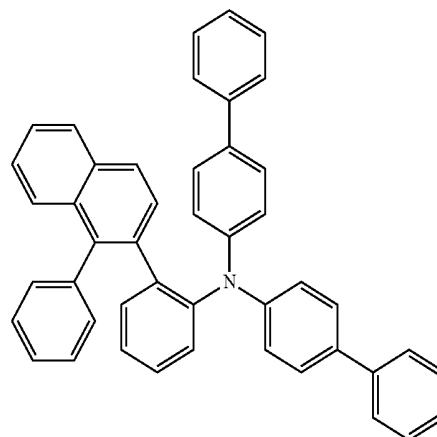
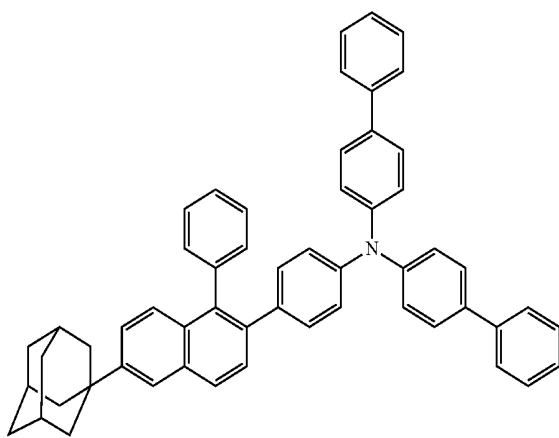
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G32



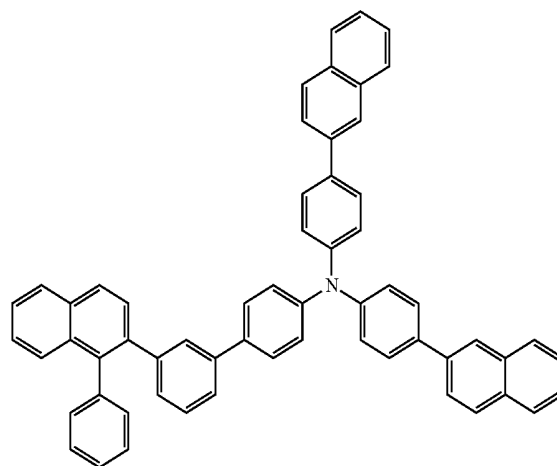
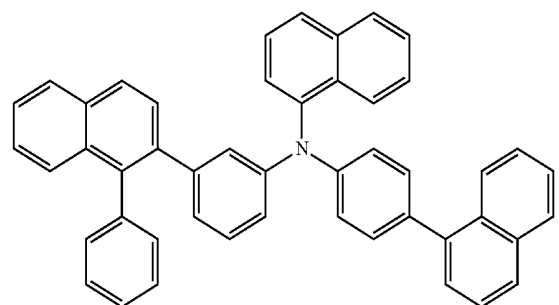
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G30



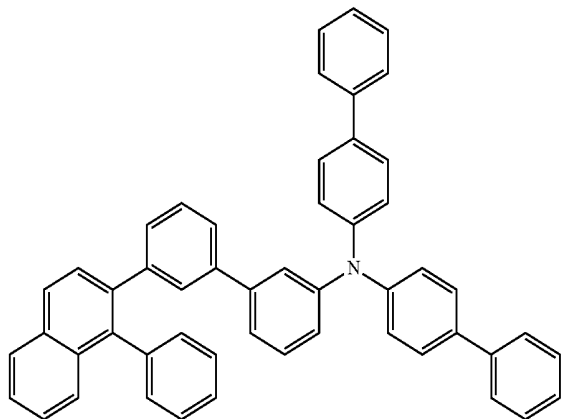
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G31



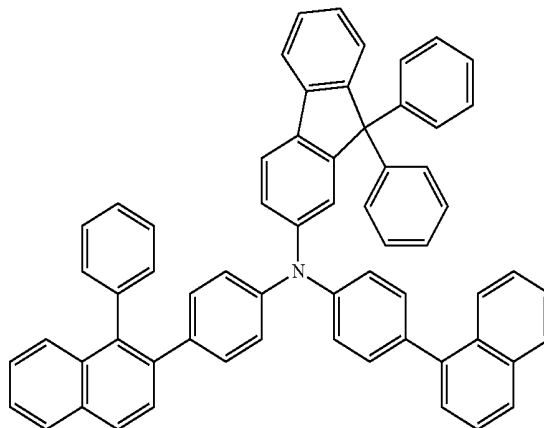
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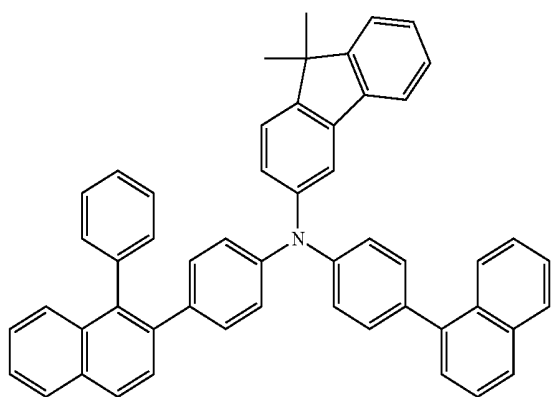


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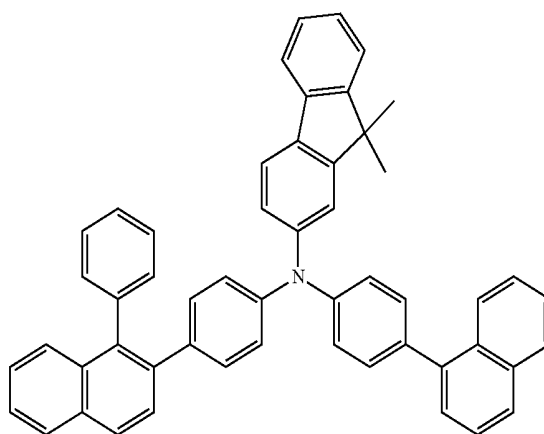
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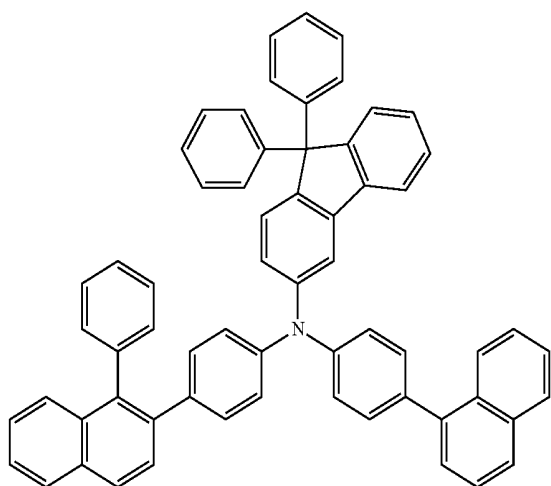
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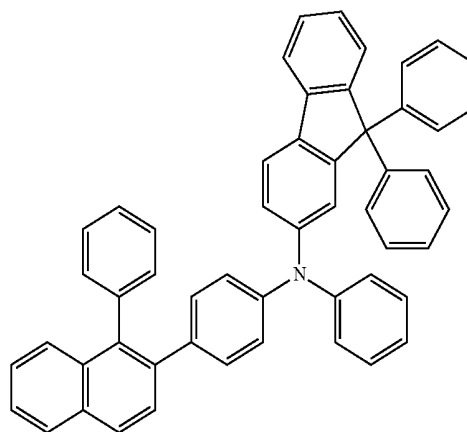
G39



G37

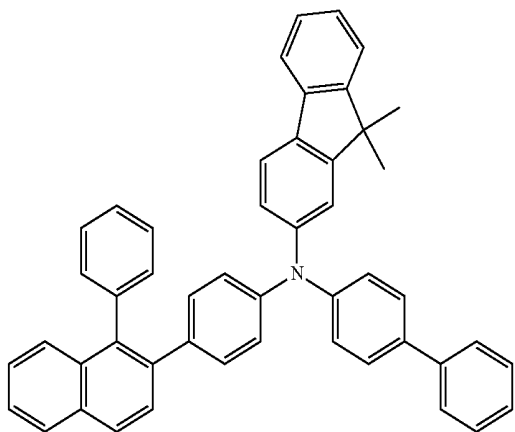


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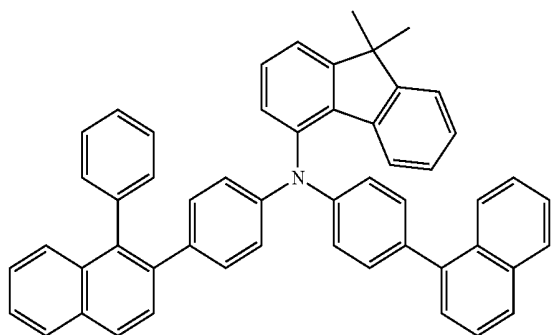


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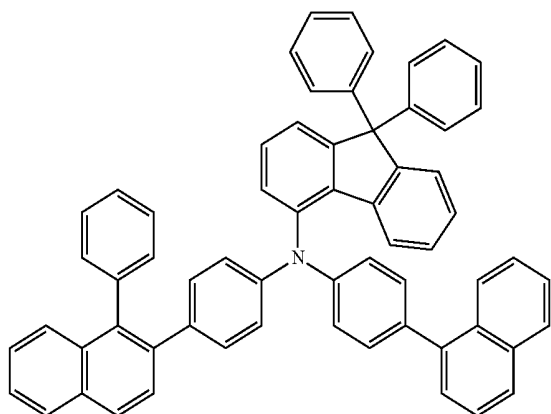
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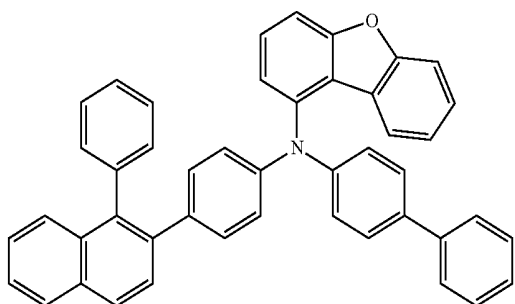
G42



G43

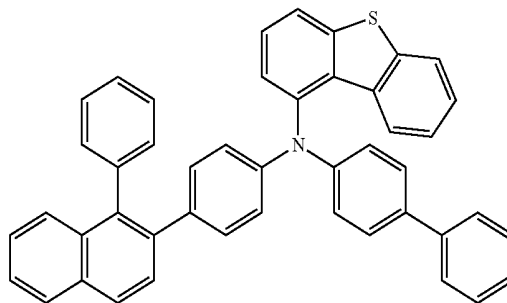


G44

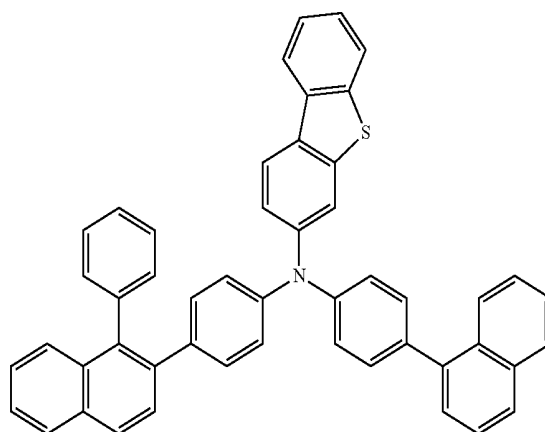


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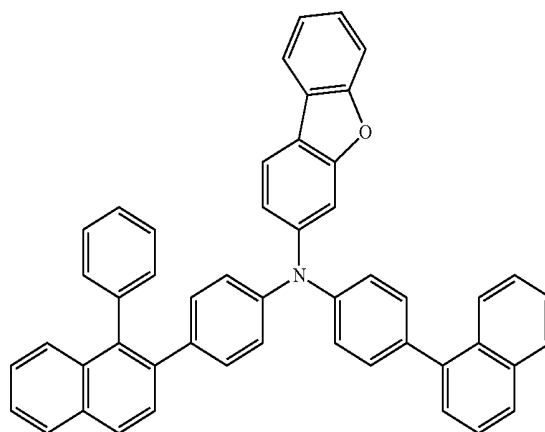
G45



G46

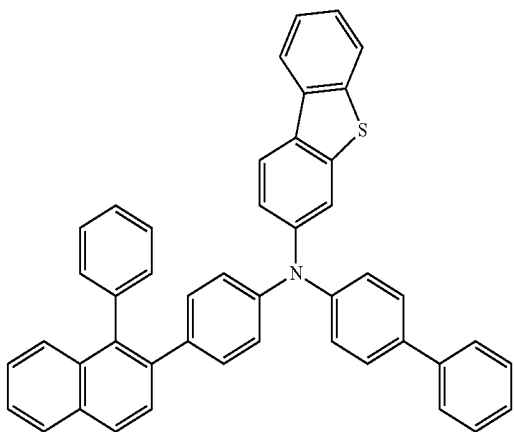


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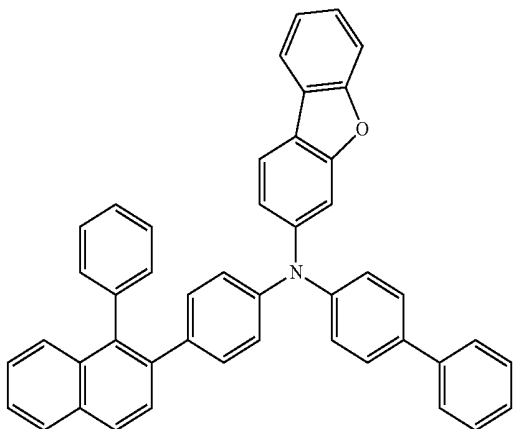


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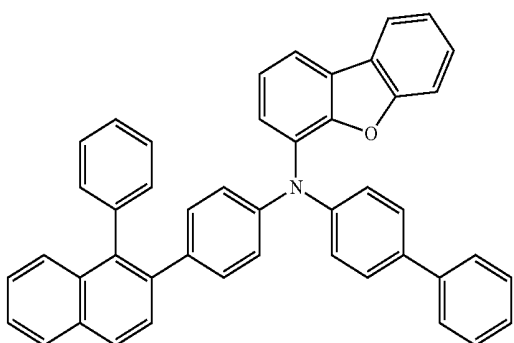
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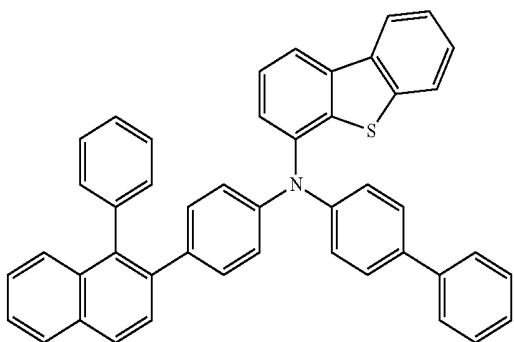
G49



G50

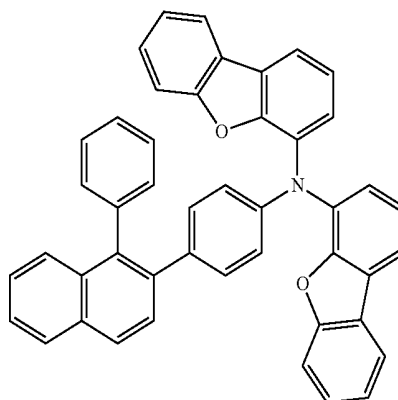


G51

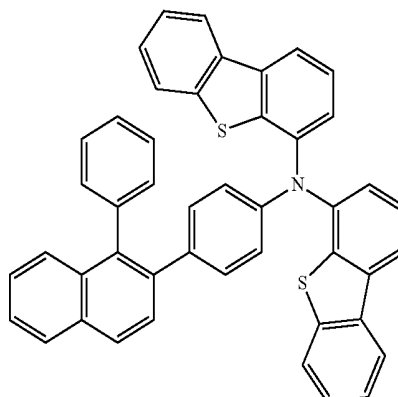


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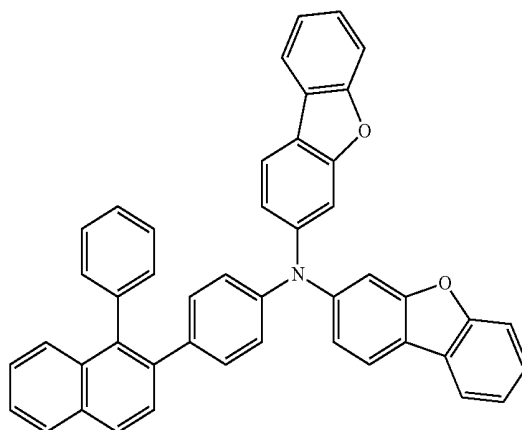
G52



G53

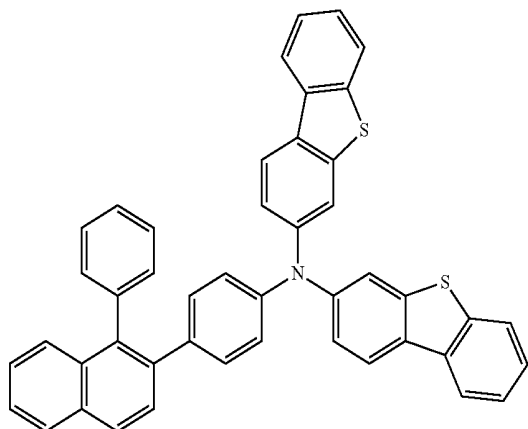


G54



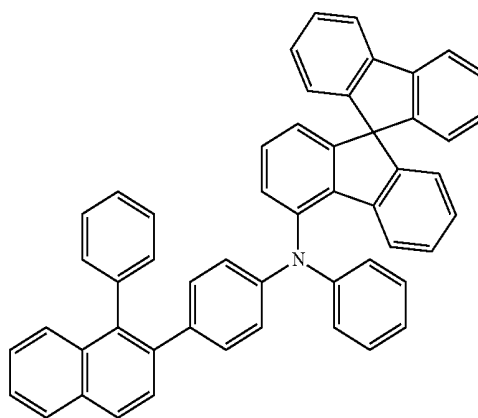
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G55



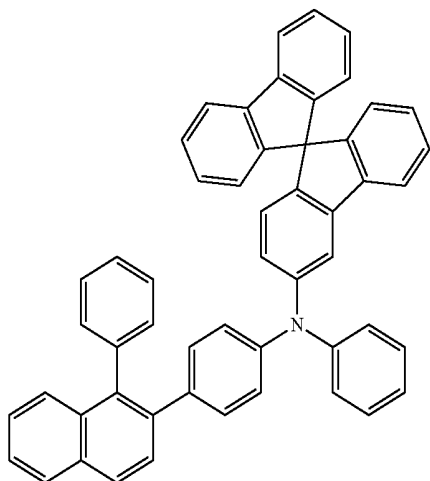
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G58

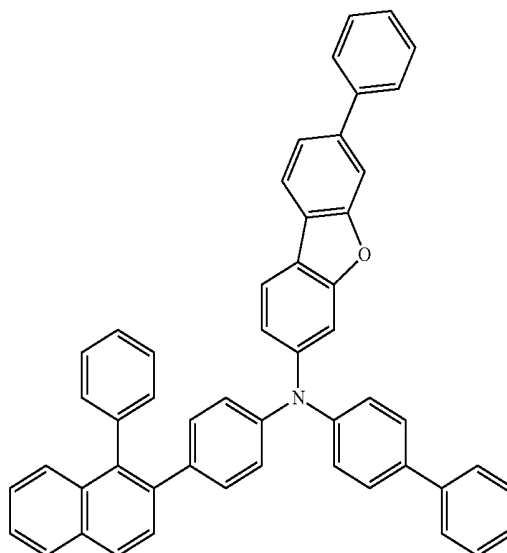
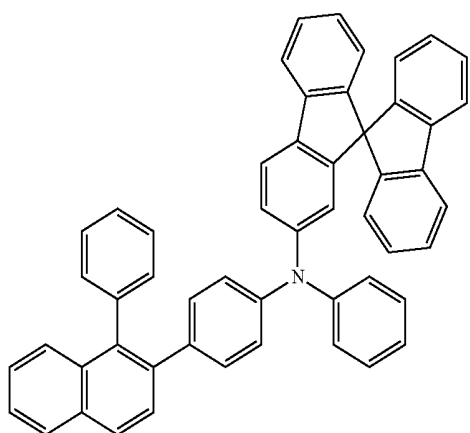


G59

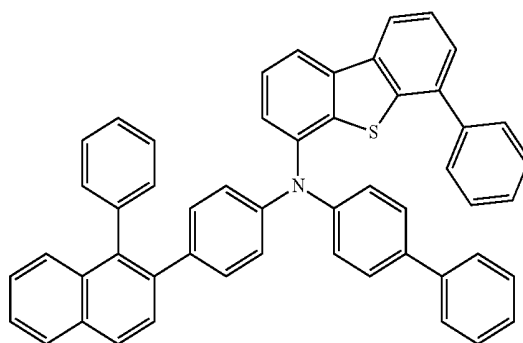
G56



G57



G60



* * * * *

专利名称(译)	有机电致发光器件和用于有机电致发光器件的单胺化合物		
公开(公告)号	US20190237668A1	公开(公告)日	2019-08-01
申请号	US16/256225	申请日	2019-01-24
[标]申请(专利权)人(译)	三星显示有限公司		
申请(专利权)人(译)	三星DISPLAY CO. , LTD.		
当前申请(专利权)人(译)	三星DISPLAY CO. , LTD.		
[标]发明人	MIYAKE HIDEO UENO MASATSUGU JIN XIULAN TAKADA ICHINORI UNO TAKUYA ITOI HIROAKI		
发明人	MIYAKE, HIDEO UENO, MASATSUGU JIN, XIULAN TAKADA, ICHINORI UNO, TAKUYA ITOI, HIROAKI		
IPC分类号	H01L51/00 H01L51/50 C07C211/61 C07C211/58 C07C211/60		
CPC分类号	H01L51/006 H01L51/0067 H01L51/0061 H01L51/0058 H01L51/0072 H01L51/0073 H01L51/0074 H01L51/5012 H01L51/5096 C07C211/61 C07C211/58 C07C211/60 C07C2603/16 C07C2603/26 C07C2602/26 C07C2603/74 C07C2603/97 H01L51/5064 H01L51/5072 C07C211/54 C07C211/57 C07D213/38 C07D307/91 C07D333/76 C09K11/06 C09K2211/1007 C09K2211/1011 C09K2211/1029 C09K2211/1088 C09K2211/1092 H01L51/0052 H01L51/0056 C07C211/56 C07D209/82 C07D407/12 C07D409/12 H01L51/5056 H05B33/22		
优先权	1020180009993 2018-01-26 KR 1020180146236 2018-11-23 KR		
外部链接	Espacenet USPTO		

摘要(译)

有机电致发光器件包括第一电极，第一电极上的空穴传输区域，空穴传输区域上的发光层，发光层上的电子传输区域和电子传输区域上的第二电极。空穴传输区域包括由下式1表示的单胺化合物：## STR00001 ##

