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(54) **LUMINESCENT MATERIAL AND ORGANIC ELECTROLUMINESCENT DEVICE USING THE SAME**

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C07D 211/80	(2006.01)

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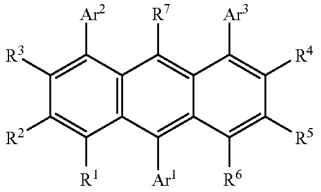
(57) **ABSTRACT**

The subject of the present invention is to provide an emission material which contributes to high emission efficiency, low drive voltage, excellent heat resistance and long life in an organic electroluminescent device, particularly an emission material which is excellent in emission of blue color. Further, the subject is to provide an organic electroluminescent device using the above emission material. The above subjects can be achieved by an emission material represented by Formula (1) and an organic electroluminescent device comprising the same.

(1)



wherein R^1 to R^7 are independently hydrogen, alkyl or cycloalkyl; Ar^1 is one selected from the group consisting of non-condensed aryl having 6 to 50 carbon atoms, 2-naphthyl, 9-phenanthryl, 6-chrysenyl, 2-triphenylenyl, 2-fluorenyl, 9-carbazolyl, 2-thienyl and 2-benzothienyl; and Ar^2 and Ar^3 are independently non-condensed aryl having 6 to 50 carbon atoms, condensed aryl having 10 to 50 carbon atoms or heteroaryl having 2 to 50 carbon atoms.

LUMINESCENT MATERIAL AND ORGANIC ELECTROLUMINESCENT DEVICE USING THE SAME

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a novel emission material having an anthracene skeleton and an organic electroluminescent device (hereinafter abbreviated as an organic EL device) using the above emission material.

RELATED ART

[0002] In recent years, attentions are paid to an organic EL device as a full color fiat panel in the subsequent generation, and emission materials of blue, green and red colors are actively researched and developed. Among the emission materials, particularly a blue color emission material is requested to be improved. Blue color emission materials which have so far been reported are distyrylarylene derivatives (refer to, for example, a patent document 1), zinc metal complexes (refer to, for example, a patent document 2), aluminum complexes (refer to, for example, a patent document 3), aromatic amine derivatives (refer to, for example, a patent document 4) and anthracene derivatives (refer to, for example, a patent document 5). Examples in which the anthracene derivatives are used for emission materials are disclosed in a non-patent document 1, a patent document 6, a patent document 7 and a patent document 8 in addition to the patent document 5. In the non-patent document 1, a 9,10-diphenylanthracene compound is used, but there used to be the problems that the crystallinity is high and that the ability to form a thin film is inferior. Organic EL devices using derivatives having an anthracene structure substituted with phenyls in 9 and 10 positions are disclosed as emission materials in the patent document 6, the patent document 7 and the patent document 8. Organic EL devices using anthracene derivatives substituted with naphthalenes in 9 and 10 positions are disclosed as emission materials in the patent document 5. However, any of the above compounds has symmetric molecular structure, and possibility of having high crystallinity is concerned. Organic EL devices using compounds having two or more anthracene rings as emission materials in order to reduce crystallinity to form a film having good amorphous state are proposed in a patent document 9, a patent document 10, a patent document 11 and a patent document 12. It is reported that emission of bluish green color is achieved by the above materials.

Patent document 1: JP H2-247278 A/1990
Patent document 2: JP H6-336586 A/1994
Patent document 3: JP H5-198378 A/1993
Patent document 4: JP H6-240248 A/1994
Patent document 5: JP H11-3782 A/1999
Patent document 6: JP H11-312588 A/1999
Patent document 7: JP H11-323323 A/1999
Patent document 8: JP H11-329732 A/1999
Patent document 9: JP H8-12600 A/1996
Patent document 10: JP H11-111458 A/1999
Patent document 11: JP H12-344691 A/2000
Patent document 12: JP H14-154993 A/2002
Non-patent document 1: Applied Physics Letters, 56 (9), 799 (1990)

DISCLOSURE OF THE INVENTION

Problems to be Solved by the Invention

[0003] The present invention has been made in light of the problems involved in such conventional techniques as described above, and an object of the present invention is to provide an emission material contributing to high emission efficiency, low drive voltage, excellent heat resistance and long life in an organic EL device, particularly an emission material which is excellent in emission of blue color. Further, an object of the present invention is to provide an organic EL device using the above emission material.

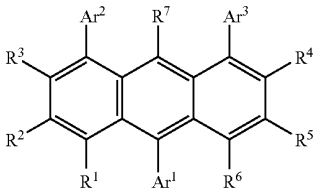
Means for Solving the Problems

[0004] Intensive investigations repeated by the present inventors have resulted in finding that an organic EL device which has high emission efficiency, high luminance and long life and which can be driven at low voltage can be obtained by using alone for an emission layer of the organic EL device, a novel emission material having specific structure in which anthracene is fundamental structure and in which 1-position, 8-position and 10-position are independently replaced by aryl or heteroaryl or using it in combination with other emission materials, and they have completed the present invention based on the above knowledge.

[0005] Terms used in the present invention are defined as follows. Alkyl may be a linear group or a branched group. This applies to a case where optional —CH_2— in this group is replaced by —O— or arylene. The term "optional" used in the present invention shows that the position and the number are optional, and it means "at least one selected without distinguishing". When plural groups or atoms are replaced by other groups, they each may be replaced by different groups. For example, a case where optional —CH_2— in alkyl may be replaced by —O— or phenylene shows that it may be any of alkoxyphenyl, alkoxyphenylalkyl, alkoxyalkylphenylalkyl, phenoxy, phenylalkoxy, phenylalkoxyalkyl, alkylphenoxy, alkylphenylalkoxy and alkylphenylalkoxyalkyl. The groups of alkoxy and alkoxyalkyl in the above groups may be linear groups or branched groups. Provided that when it is described in the present invention that optional —CH_2— may be replaced by —O—, a case where continuous plural —CH_2— are replaced by —O— is not included. Further, "an emission material represented by Formula (1)" is shown by "an emission material (1)" in the present specification.

[0006] The problems described above are solved by the respective items shown below.

[1] An emission material represented by the following Formula (1):



(1)

wherein R^1 to R^7 are independently hydrogen, alkyl having 1 to 24 carbon atoms or cycloalkyl having 3 to 24 carbon atoms; optional —CH_2— in the above alkyl having 1 to 24 carbon

atoms may be replaced by —O—, and optional —CH_2— other than —CH_2— directly bonded to the anthracene ring may be replaced by arylene having 6 to 24 carbon atoms; optional hydrogens in the above cycloalkyl having 3 to 24 carbon atoms may be replaced by alkyl having 1 to 24 carbon atoms or aryl having 6 to 50 carbon atoms;

Ar^1 is one selected from the group consisting of non-condensed aryl having 6 to 50 carbon atoms, 2-naphthyl, 9-phenanthryl, 6-chrysenyl, 2-triphenylenyl, 2-fluorenyl, 9-carbazolyl, 2-thienyl and 2-benzothienyl;

optional hydrogens in the above groups may be replaced by alkyl having 1 to 24 carbon atoms, cycloalkyl having 3 to 12 carbon atoms, aryl having 6 to 24 carbon atoms or heteroaryl; optional —CH_2— in the above alkyl having 1 to 24 carbon atoms may be replaced by —O—, and optional —CH_2— other than —CH_2— directly bonded to the above groups may be replaced by arylene having 6 to 24 carbon atoms; optional hydrogens in the above cycloalkyl having 3 to 24 carbon atoms may be replaced by alkyl having 1 to 24 carbon atoms or aryl having 6 to 24 carbon atoms; optional hydrogens in the above aryl having 6 to 24 carbon atoms may be replaced by alkyl having 1 to 12 carbon atoms, cycloalkyl having 3 to 12 carbon atoms or aryl having 6 to 24 carbon atoms, and optional hydrogens in the above heteroaryl may be replaced by alkyl having 1 to 12 carbon atoms, cycloalkyl having 3 to 12 carbon atoms or aryl having 6 to 24 carbon atoms; and

Ar^2 and Ar^3 are independently non-condensed aryl having 6 to 50 carbon atoms, condensed aryl having 10 to 50 carbon atoms or heteroaryl.

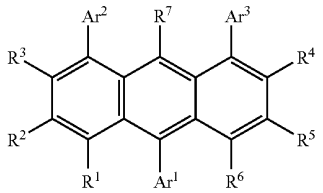
[2] The emission material as described in the above item 1, wherein R^1 to R^7 are independently hydrogen, methyl or tert-butyl, and Ar^1 is non-condensed aryl having 6 to 50 carbon atoms.

[3] The emission material as described in the above item 1, wherein R^1 to R^7 are independently hydrogen, methyl or tert-butyl, and Ar^1 is phenyl, biphenylyl, terphenylyl or quaterphenylyl.

[4] The emission material as described in the above item 1, wherein R^1 to R^7 are independently hydrogen, methyl or tert-butyl, and Ar^1 is 2-naphthyl, 9-phenanthryl, 6-chrysenyl, 2-triphenylenyl, 2-fluorenyl, 9-carbazolyl, 2-thienyl or 2-benzothienyl.

[5] An emission material represented by the following Formula (1):

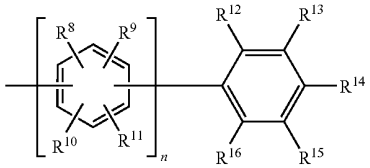
(1)



wherein R^1 to R^7 are independently hydrogen, methyl or tert-butyl, and Ar^1 is non-condensed aryl represented by Formula (2);

Ar^2 and Ar^3 are independently phenyl, 4-tert-butylphenyl, 4-(9-carbazolyl)phenyl, 2-biphenylyl, 3-biphenylyl, 4-biphenylyl, m-terphenyl-5'-yl, 3,5-di(2-naphthyl)phenyl, p-quaterphenyl-3'-yl, m-quaterphenyl-3-yl, o-quaterphenyl-2-yl, 1-naphthyl, 4-phenyl-1-naphthyl, 4-(9-carbazolyl)-1-naphthyl, 2-naphthyl, 6-(m-terphenyl-5'-yl)-2-naphthyl, 6-(2-naphthyl)-2-naphthyl, 9-phenanthryl, 2-benzothienyl or 3-phenyl-2-benzothienyl;

(2)



wherein n is an integer of 0 to 8;

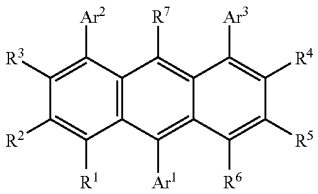
R^8 to R^{16} are independently hydrogen, alkyl having 1 to 24 carbon atoms, cycloalkyl having 3 to 24 carbon atoms, aryl having 6 to 24 carbon atoms or heteroaryl; optional —CH_2— in the above alkyl having 1 to 24 carbon atoms may be replaced by —O—, and optional —CH_2— other than —CH_2— directly bonded to the benzene ring may be replaced by arylene having 6 to 24 carbon atoms; optional hydrogens in the above cycloalkyl having 3 to 24 carbon atoms may be replaced by alkyl having 1 to 24 carbon atoms or aryl having 6 to 24 carbon atoms; optional hydrogens in the above aryl having 6 to 24 carbon atoms may be replaced by alkyl having 1 to 24 carbon atoms, cycloalkyl having 3 to 24 carbon atoms or aryl having 6 to 24 carbon atoms; and optional hydrogens in the above heteroaryl may be replaced by alkyl having 1 to 12 carbon atoms, cycloalkyl having 3 to 12 carbon atoms or aryl having 6 to 24 carbon atoms.

[6] The emission material as described in the above item 5, wherein Ar^1 is phenyl, biphenylyl, terphenylyl or quaterphenylyl in which optional hydrogens may be replaced by methyl, tert-butyl, phenyl, 2-naphthyl, 1-naphthyl, 2-benzothienyl, 3-phenyl-2-benzothienyl or 9-carbazolyl.

[7] The emission material as described in the above item 5, wherein Ar^1 is phenyl, 2-biphenylyl, 3-biphenylyl, 4-biphenylyl, m-terphenyl-5'-yl, m-quaterphenyl-3-yl or o-quaterphenyl-3-yl in which optional hydrogens may be replaced by methyl, tert-butyl, phenyl, 2-naphthyl, 1-naphthyl, 2-benzothienyl, 3-phenyl-2-benzothienyl or 9-carbazolyl.

[8] An emission material represented by the following Formula (1):

(1)



wherein R^1 to R^7 are independently hydrogen, methyl or tert-butyl;

Ar^1 is 2-naphthyl, 9-phenanthryl, 6-chrysenyl, 2-triphenylenyl, 2-fluorenyl, 9-carbazolyl, 2-thienyl or 2-benzothienyl in which optional hydrogens may be replaced by methyl, tert-butyl, phenyl, m-terphenyl-5'-yl, 2-naphthyl, 1-naphthyl, 2-benzothienyl, 3-phenyl-2-benzothienyl or 9-carbazolyl; and

Ar^2 and Ar^3 are independently phenyl, 4-tert-butylphenyl, 4-(9-carbazolyl)phenyl, 2-biphenylyl, 3-biphenylyl, 4-biphenylyl, m-terphenyl-5'-yl, 3,5-di(2-naphthyl)phenyl, p-quater-

phenyl-3'-yl, m-quaterphenyl-3-yl, o-quaterphenyl-2-yl, 1-naphthyl, 4-phenyl-1-naphthyl, 4-(9-carbazolyl)-1-naphthyl, 2-naphthyl, 6-(m-terphenyl-5'-yl)-2-naphthyl, 6-(2-naphthyl)-2-naphthyl, 9-phenanthryl, 2-benzothienyl or 3-phenyl-2-benzothienyl.

[9] The emission material as described in any of the above items 5 to 7, wherein Ar^1 is one selected from phenyl, 4-tert-butylphenyl and 4-(9-carbazolyl)phenyl.

[10] The emission material as described in any of the above items 5 to 7, wherein Ar^1 is one selected from 2-biphenylyl, 3-biphenylyl and 4-biphenylyl.

[11] The emission material as described in any of claims **5** to **7**, wherein Ar^1 is m-terphenyl-5'-yl.

[12] The emission material as described in any of the above items 5 to 7, wherein Ar^1 is 3,5-di(2-naphthyl)phenyl.

[13] The emission material as described in any of the above items 5 to 7, wherein Ar^1 is m-quaterphenyl-3-yl or o-quaterphenyl-2-yl.

[14] The emission material as described in the above item 8,

[0007] wherein Ar^1 is one selected from 2-naphthyl, 6-(m-terphenyl-5'-yl)-2-naphthyl, 6-(2-naphthyl)-2-naphthyl and 6-(9-carbazolyl)-2-naphthyl.

[15] The emission material as described in the above item 8, wherein Ar^1 is 9-phenanthryl.

[16] The emission material as described in the above item 8, wherein Ar^1 is 9-carbazolyl.

[17] The emission material as described in the above item 8, wherein Ar^1 is 2-benzothienyl or 3-phenyl-2-benzothienyl.

[18] The emission material as described in any of the above items 9 to 17, wherein R^1 to R^6 are hydrogens; R^7 is hydrogen or methyl; and Ar^2 and Ar^3 are one selected from phenyl, 4-tert-butylphenyl and 4-(9-carbazolyl)phenyl.

[19] The emission material as described in any of the above items 9 to 17, wherein R^1 to R^6 are hydrogens; R^7 is hydrogen or methyl; and Ar^2 and Ar^3 are one selected from 2-biphenylyl, 3-biphenylyl and 4-biphenylyl.

[20] The emission material as described in any of the above items 9 to 17, wherein R^1 to R^6 are hydrogens; R^7 is hydrogen or methyl; and Ar^2 and Ar^3 are m-terphenyl-5'-yl.

[21] The emission material as described in any of the above items 9 to 17, wherein R^1 to R^6 are hydrogens; R^7 is hydrogen or methyl; and Ar^2 and Ar^3 are 3,5-di(2-naphthyl)phenyl.

[22] The emission material as described in any of the above items 9 to 17, wherein R^1 to R^6 are hydrogens; R^7 is hydrogen or methyl; and Ar^2 and Ar^3 are one selected from p-quaterphenyl-3'-yl, m-quaterphenyl-3-yl and o-quaterphenyl-2-yl.

[23] The emission material as described in any of the above items 9 to 17, wherein R^1 to R^6 are hydrogens; R^7 is hydrogen or methyl; and Ar^2 and Ar^3 are one selected from 1-naphthyl, 4-phenyl-1-naphthyl and 4-(9-carbazolyl)-1-naphthyl.

[24] The emission material as described in any of the above items 9 to 17, wherein R^1 to R^6 are hydrogens; R^7 is hydrogen or methyl; and Ar^2 and Ar^3 are one selected from 2-naphthyl, 6-(m-terphenyl-5'-yl)-2-naphthyl and 6-(2-naphthyl)-2-naphthyl.

[25] The emission material as described in any of the above items 9 to 17, wherein R^1 to R^6 are hydrogens; R^7 is hydrogen or methyl; and Ar^2 and Ar^3 are 9-phenanthryl.

[26] The emission material as described in any of the above items 9 to 18, wherein R^1 to R^6 are hydrogens; R^7 is hydrogen or methyl; and Ar^2 and Ar^3 are 2-benzothienyl or 3-phenyl-2-benzothienyl.

[27] An organic electroluminescent device comprising a substrate and provided thereon at least a hole transport layer, an emission layer and an electron transport layer which are sandwiched between an anode and a cathode, wherein the above emission layer comprises the emission material as described in the above items 1 to 26.

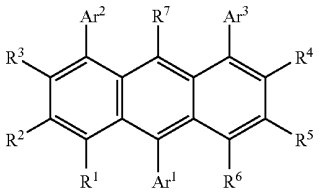
EFFECTS OF THE INVENTION

[0008] The emission material of the present invention can be used for emission of various colors, and it is particularly excellent in emission of blue color. Use of the above emission material makes it possible to provide an organic EL device having high emission efficiency, low drive voltage, excellent heat resistance and long life. Use of the organic EL device of the present invention makes it possible to produce a display unit having a high performance used for full color display.

BEST MODE FOR CARRYING OUT THE INVENTION

[0009] The present invention shall be explained below in further details.

[0010] The first present invention is an emission material having an anthracene skeleton represented by Formula (1):



(1)

[0011] In Formula (1), R^1 to R^7 are independently hydrogen, alkyl having 1 to 24 carbon atoms or cycloalkyl having 3 to 24 carbon atoms. R^1 to R^7 may be the same or different.

[0012] The examples of the alkyl having 1 to 24 carbon atoms are methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, sec-butyl, tert-butyl, n-pentyl, isopentyl, tert-pentyl, neopentyl, n-hexyl, isohexyl, 1-methylpentyl, 2-methylpentyl, n-hexyl, isohexyl, 1-methylpentyl, 2-methylpentyl and 5-methylhexyl.

[0013] Optional —CH_2— in the above alkyl having 1 to 24 carbon atoms may be replaced by —O—, and optional —CH_2— other than —CH_2— directly bonded to the anthracene ring may be replaced by arylene having 6 to 24 carbon atoms. The examples of the arylene having a carbon number of 6 to 24 are 1,2-phenylene, 1,3-phenylene, 1,4-phenylene, naphthalene-2,6-diyl and naphthalene-1,4-diyl. The preferred example of the arylene having 6 to 24 carbon atoms is 1,4-phenylene.

[0014] The examples of the alkyl having 1 to 24 carbon atoms in which optional —CH_2— is replaced by —O— are methoxy, ethoxy, propyloxy, isopropyloxy, n-butyloxy, isobutyloxy, sec-butyloxy, tert-butyloxy, n-pentyloxy, isopentyloxy, tert-pentyloxy, neopentyloxy, n-hexyloxy, isohexyloxy, 1-methylpentyloxy, 2-methylpentyloxy and n-hexyloxy.

[0015] The examples of the alkyl having 1 to 24 carbon atoms in which optional —CH_2— is replaced by arylene having 6 to 24 carbon atoms are 2-phenylethyl, 2-(4-methylphenyl)ethyl, 1-methyl-1-phenylethyl, 1,1-dimethyl-2-phenylethyl and trityl.

[0016] The examples of the alkyl having 1 to 24 carbon atoms in which optional —CH_2— is replaced by —O— and in which optional —CH_2— other than —CH_2— directly bonded to anthracene is replaced by arylene having 6 to 24 carbon atoms are phenoxy, o-tolyloxy, m-tolyloxy, p-tolyloxy, 1-naphthoxy, 2-naphthoxy, 2,4-dimethylphenoxy, 2,6-dimethylphenoxy, 2,4,6-trimethylphenoxy, 4-tert-butylphenoxy, 2,4-di-tert-butylphenoxy, 2,4,6-tri-tert-butylphenoxy, 2-phenylethoxy and 2-(4-methylphenyl)ethoxy.

[0017] The examples of the cycloalkyl having 3 to 24 carbon atoms are cyclopropyl, cyclobutyl, cyclopentyl and cyclohexyl. Optional hydrogens in the above cycloalkyl having 3 to 24 carbon atoms may be replaced by alkyl having 1 to 24 carbon atoms or aryl having 6 to 50 carbon atoms.

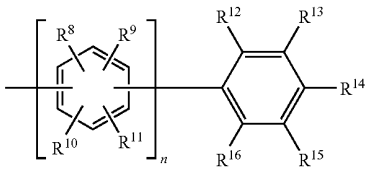
[0018] The examples of the cycloalkyl having 3 to 24 carbon atoms in which optional hydrogens are replaced by alkyl having 1 to 24 carbon atoms are 2-methylcyclohexyl, 3-methylcyclohexyl, 4-methylcyclohexyl, 2,4,6-trimethylcyclohexyl, 2-tert-butylcyclohexyl, 3-tert-butylcyclohexyl, 4-tert-butylcyclohexyl and 2,4,6-tri-tert-butylcyclohexyl.

[0019] The examples of the cycloalkyl having 3 to 24 carbon atoms in which optional hydrogens are replaced by aryl having 6 to 50 carbon atoms are 2-phenylcyclohexyl, 3-phenylcyclohexyl, 4-phenylcyclohexyl, 2,4-diphenylcyclohexyl and 3,5-diphenylcyclohexyl.

[0020] The preferred examples of R^1 to R^7 are hydrogen, methyl and tert-butyl, and the more preferred examples of R^7 are hydrogen and methyl.

[0021] Ar^1 is one selected from the group consisting of non-condensed aryl having 6 to 50 carbon atoms, 2-naphthyl, 9-phenanthryl, 6-chrysenyl, 2-triphenylenyl, 2-fluorenyl, 9-carbazolyl, 2-thienyl and 2-benzothienyl.

[0022] The non-condensed aryl having 6 to 50 carbon atoms is represented by Formula (2):



(2)

[0023] In Formula (2), n is an integer of 0 to 8, preferably 0 to 4. When n is an integer of 1 to 8, phenylene in the middle is independently optionally selected from 1,2-phenylene, 1,3-phenylene and 1,4-phenylene. If 1,2-phenylene is selected, an emission wavelength of a blue color originating in the fundamental skeleton can be maintained, and therefore it is preferred. If 1,4-phenylene is selected, the compound is characterized by that it is increased in rigidity, excellent in a heat resistance and extended in a life. 1,3-Phenylene brings characteristics positioned in the middle of both to the compound. Considering a wavelength, heat resistance and life which are expected to the emission material based on the design of the device, the conditions of the number of n and the kind of the phenylene are added, whereby the emission material meeting the objects can be obtained.

[0024] R^8 to R^{16} are independently hydrogen, alkyl having 1 to 24 carbon atoms, cycloalkyl having 3 to 24 carbon atoms, aryl having 6 to 24 carbon atoms or heteroaryl.

[0025] The examples of the alkyl having 1 to 24 carbon atoms are methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, sec-butyl, tert-butyl, n-pentyl, isopentyl, tert-pentyl, neopentyl, n-hexyl, isohexyl, 1-methylpentyl, 2-methylpentyl, n-hexyl, isohexyl, 1-methylpentyl, 2-methylpentyl and 5-methylhexyl.

[0026] Optional —CH_2— in the above alkyl having 1 to 24 carbon atoms may be replaced by —O—, and optional —CH_2— other than —CH_2— directly bonded to the benzene ring may be replaced by arylene having 6 to 24 carbon atoms. The examples of the arylene having 6 to 24 carbon atoms are the same as described above, and the preferred example thereof is 1,4-phenylene.

[0027] The examples of the alkyl having 1 to 24 carbon atoms in which optional —CH_2— is replaced by —O— are methoxy, ethoxy, propyloxy, isopropyloxy, n-butyloxy, isobutyloxy, sec-butyloxy, tert-butyloxy, n-pentyloxy, isopentyloxy, tert-pentyloxy, neopentyloxy, n-hexyloxy, isohexyloxy, 1-methylpentyloxy, 2-methylpentyloxyloxy and n-hexyloxy.

[0028] The examples of the alkyl having 1 to 24 carbon atoms in which optional —CH_2— is replaced by arylene having 6 to 24 carbon atoms are 2-phenylethyl, 2-(4-methylphenyl)ethyl, 1-methyl-1-phenylethyl, 1,1-dimethyl-2-phenylethyl and trityl.

[0029] The examples of the alkyl having 1 to 24 carbon atoms in which optional —CH_2— is replaced by —O— and in which optional —CH_2— other than —CH_2— directly bonded to the benzene ring is replaced by arylene having 6 to 24 carbon atoms are phenoxy, o-tolyloxy, m-tolyloxy, p-tolyloxy, 1-naphthoxy, 2-naphthoxy, 2,4-dimethylphenoxy, 2,6-dimethylphenoxy, 2,4,6-trimethylphenoxy, 4-tert-butylphenoxy, 2,4-di-tert-butylphenoxy, 2,4,6-tri-tert-butylphenoxy, 2-phenylethoxy and 2-(4-methylphenyl)ethoxy.

[0030] The examples of the cycloalkyl having 3 to 24 carbon atoms are cyclopropyl, cyclobutyl, cyclopentyl and cyclohexyl.

[0031] Optional hydrogens in the above cycloalkyl having 3 to 24 carbon atoms may be replaced by alkyl having 1 to 24 carbon atoms or aryl having 6 to 24 carbon atoms.

[0032] The examples of the cycloalkyl having 3 to 24 carbon atoms in which optional hydrogens are replaced by alkyl having 1 to 24 carbon atoms are 2-methylcyclohexyl, 3-methylcyclohexyl, 4-methylcyclohexyl, 2,4,6-trimethylcyclohexyl, 2-tert-butylcyclohexyl, 3-tert-butylcyclohexyl, 4-tert-butylcyclohexyl and 2,4,6-tri-tert-butylcyclohexyl.

[0033] The examples of the cycloalkyl having 3 to 24 carbon atoms in which optional hydrogens are replaced by aryl having 6 to 24 carbon atoms are 2-phenylcyclohexyl, 3-phenylcyclohexyl, 4-phenylcyclohexyl, 2,4-diphenylcyclohexyl and 3,5-diphenylcyclohexyl.

[0034] The examples of the aryl having 6 to 24 carbon atoms are phenyl, 1-naphthyl, 2-naphthyl, 1-anthryl, 2-anthryl, 9-anthryl, 1-phenanthryl, 2-phenanthryl, 3-phenanthryl, 4-phenanthryl, 9-phenanthryl, 1-pyrenyl, 2-pyrenyl, 4-pyrenyl, 1-perylenyl, 2-perylenyl, 1-chrysenyl, 2-chrysenyl, 3-chrysenyl, 5-chrysenyl, 6-chrysenyl, 1-triphenylenyl, 2-triphenylenyl and 2-fluorenyl.

[0035] Optional hydrogens in the above aryl having 6 to 24 carbon atoms may be replaced by alkyl having 1 to 24 carbon atoms, cycloalkyl having 3 to 12 carbon atoms or aryl having 6 to 24 carbon atoms. The examples of the aryl having 6 to 24 carbon atoms in which optional hydrogens are replaced by the alkyl having 1 to 24 carbon atoms are o-tolyl, m-tolyl, p-tolyl, 2-biphenylyl, 3-biphenylyl, 4-biphenylyl, 2,4-dimethylphenyl, 2,6-dimethylphenyl, 2,4,6-trimethylphenyl, 4-tert-bu-

tylphenyl, 2,4-di-tert-butylphenyl, 2,4,6-tri-tert-butylphenyl, 4-methyl-1-naphthyl, 4-tert-butyl-1-naphthyl, 6-methyl-2-naphthyl, 6-tert-butyl-2-naphthyl, 4-methyl-1-anthryl, 4-tert-butyl-1-anthryl, 10-methyl-9-anthryl, 10-tert-butyl-9-anthryl and 9,9-dimethyl-2-fluorenyl.

[0036] The examples of the aryl having 6 to 24 carbon atoms in which optional hydrogens are replaced by the cycloalkyl having 3 to 12 carbon atoms are 2-cyclohexylphenyl, 3-cyclohexylphenyl, 4-cyclohexylphenyl, 2,4-dicyclohexylphenyl and 3,5-dicyclohexylphenyl.

[0037] The examples of the aryl having 6 to 24 carbon atoms in which optional hydrogens are replaced by the aryl having 6 to 24 carbon atoms are m-terphenyl-2'-yl, m-terphenyl-4'-yl, m-terphenyl-5'-yl, o-terphenyl-3'-yl, o-terphenyl-4'-yl, p-terphenyl-2'-yl, m-terphenyl-2-yl, m-terphenyl-3-yl, m-terphenyl-4-yl, o-terphenyl-2-yl, o-terphenyl-3-yl, o-terphenyl-4-yl, p-terphenyl-2-yl, p-terphenyl-3-yl, p-terphenyl-4-yl, 5'-phenyl-m-terphenyl-2-yl, 5'-phenyl-m-terphenyl-3-yl, 5'-phenyl-m-terphenyl-4-yl, m-quaterphenyl-2-yl, m-quaterphenyl-3-yl, m-quaterphenyl-4-yl, o-quaterphenyl-2-yl, o-quaterphenyl-3-yl, o-quaterphenyl-4-yl, 3,5-di(1-naphthyl)phenyl, 3,5-di(2-naphthyl)phenyl, 4-phenyl-1-naphthyl, 6-phenyl-2-naphthyl, 6-(2-naphthyl)-2-naphthyl, 6-(1-naphthyl)-2-naphthyl, 4-(2-naphthyl)-1-naphthyl, 4-(1-naphthyl)-1-naphthyl and 9,9-diphenyl-2-fluorenyl.

[0038] The examples of the heteroaryl are 1-pyrroryl, 2-pyrroryl, 3-pyrroryl, 2-pyridyl, 3-pyridyl, 4-pyridyl, 2,2'-bipyridyl-6-yl, 2,3'-bipyridyl-6-yl, 2,4'-bipyridyl-6-yl, 3,2'-bipyridyl-6-yl, 3,3'-bipyridyl-6-yl, 3,4'-bipyridyl-6-yl, 1-indolyl, 2-indolyl, 3-indolyl, 4-indolyl, 5-indolyl, 6-indolyl, 7-indolyl, 1-isoindolyl, 2-isoindolyl, 3-isoindolyl, 4-isoindolyl, 5-isoindolyl, 6-isoindolyl, 7-isoindolyl, 2-furyl, 3-furyl, 2-benzofuranyl, 3-benzofuranyl, 4-benzofuranyl, 5-benzofuranyl, 6-benzofuranyl, 7-benzofuranyl, 1-isobenzofuranyl, 3-isobenzofuranyl, 4-isobenzofuranyl, 5-isobenzofuranyl, 6-isobenzofuranyl, 7-isobenzofuranyl, 2-quinolyl, 3-quinolyl, 4-quinolyl, 5-quinolyl, 6-quinolyl, 7-quinolyl, 8-quinolyl, 1-isoquinolyl, 3-isoquinolyl, 4-isoquinolyl, 5-isoquinolyl, 6-isoquinolyl, 7-isoquinolyl, 8-isoquinolyl, 2-quinoxalinyl, 5-quinoxalinyl, 6-quinoxalinyl, 1-carbazolyl, 2-carbazolyl, 3-carbazolyl, 4-carbazolyl, 9-carbazolyl, 1-phenanthridinyl, 2-phenanthridinyl, 3-phenanthridinyl, 4-phenanthridinyl, 6-phenanthridinyl, 7-phenanthridinyl, 8-phenanthridinyl, 9-phenanthridinyl, 10-phenanthridinyl, 1-acridinyl, 2-acridinyl, 3-acridinyl, 4-acridinyl, 9-acridinyl, 1,7-phenanthroline-2-yl, 1,7-phenanthroline-3-yl, 1,7-phenanthroline-4-yl, 1,7-phenanthroline-5-yl, 1,7-phenanthroline-6-yl, 1,7-phenanthroline-8-yl, 1,7-phenanthroline-9-yl, 1,7-phenanthroline-10-yl, 1,8-phenanthroline-2-yl, 1,8-phenanthroline-3-yl, 1,8-phenanthroline-4-yl, 1,8-phenanthroline-5-yl, 1,8-phenanthroline-6-yl, 1,8-phenanthroline-7-yl, 1,8-phenanthroline-9-yl, 1,8-phenanthroline-10-yl, 1,9-phenanthroline-2-yl, 1,9-phenanthroline-3-yl, 1,9-phenanthroline-4-yl, 1,9-phenanthroline-5-yl, 1,9-phenanthroline-6-yl, 1,9-phenanthroline-7-yl, 1,9-phenanthroline-8-yl, 1,9-phenanthroline-10-yl, 1,10-phenanthroline-2-yl, 1,10-phenanthroline-3-yl, 1,10-phenanthroline-4-yl, 1,10-phenanthroline-5-yl, 2,9-phenanthroline-1-yl, 2,9-phenanthroline-3-yl, 2,9-phenanthroline-4-yl, 2,9-phenanthroline-5-yl, 2,8-phenanthroline-1-yl, 2,8-phenanthroline-3-yl, 2,8-phenanthroline-4-yl, 2,8-phenanthroline-5-yl, 2,8-phenanthroline-6-yl, 2,8-phenanthroline-7-yl, 2,8-phenanthroline-9-yl, 2,8-phenanthroline-10-yl, 2,7-phenanthroline-1-yl, 2,7-phenanthroline-3-yl, 2,7-phenanthroline-4-yl, 2,7-phenanthroline-5-yl, 2,7-phenanthroline-6-yl, 2,7-phenanthroline-8-yl, 2,7-phenanthroline-9-yl, 2,7-phenanthroline-10-yl, 1-phenazinyl, 2-phenazinyl, 1-phenothiazinyl, 2-phenothiazinyl, 3-phenothiazinyl, 4-phenothiazinyl, 10-phenothiazinyl, 1-phenoxazinyl, 2-phenoxazinyl, 3-phenoxazinyl, 4-phenoxazinyl, 10-phenoxazinyl, 3-furazanyl, 2-thienyl, 3-thienyl, 2-benzothienyl, 3-benzothienyl, 4-benzothienyl, 5-benzothienyl, 6-benzothienyl, 7-benzothienyl, 1-isobenzothienyl, 3-isobenzothienyl, 4-isobenzothienyl, 5-isobenzothienyl, 6-isobenzothienyl and 7-isobenzothienyl.

[0039] Optional hydrogens in the above heteroaryl may be replaced by alkyl having 1 to 24 carbon atoms, cycloalkyl having 3 to 12 carbon atoms or aryl having 6 to 24 carbon atoms. The examples of the heteroaryl in which optional hydrogens are replaced by the alkyl having 1 to 24 carbon atoms are 5-methyl-2-thienyl, 5-methyl-3-thienyl, 2,5-dimethyl-3-thienyl, 3,4,5-trimethyl-2-thienyl, 3-methyl-2-benzothienyl, 2-methyl-3-benzothienyl, 2-methylpyrrole-1-yl, 2,5-dimethylpyrrole-1-yl, 2-methyl-1-indolyl, 2-tert-butyl-1-indolyl, 3-methyl-9-carbazolyl, 3,6-dimethyl-9-carbazolyl, 3,6-di-tert-butyl-9-carbazolyl and 9-methyl-3-carbazolyl.

[0040] The examples of the heteroaryl in which optional hydrogens are replaced by the cycloalkyl having 3 to 12 carbon atoms are 5-cyclohexyl-2-thienyl, 3-cyclohexyl-2-benzothienyl, 2-cyclohexyl-3-benzothienyl, 3-cyclohexyl-9-carbazolyl, 3,6-dicyclohexyl-9-carbazolyl and 9-cyclohexyl-3-carbazolyl.

[0041] The examples of the heteroaryl in which optional hydrogens are replaced by the aryl having 6 to 24 carbon atoms are 5-phenyl-2-thienyl, 5-(1-naphthyl)-2-thienyl, 5-(2-naphthyl)-2-thienyl, 5-phenyl-3-thienyl, 2,5-diphenyl-3-thienyl, 2-phenyl-5-(1-naphthyl)-3-thienyl, 2-phenyl-5-(2-naphthyl)-3-thienyl, 3,4,5-triphenyl-2-thienyl, 3,4-diphenyl-5-(1-naphthyl)-2-thienyl, 3,4-diphenyl-5-(2-naphthyl)-2-thienyl, 3-phenyl-2-benzothienyl, 3-(1-naphthyl)-2-benzothienyl, 3-(2-naphthyl)-2-benzothienyl, 2-phenyl-3-benzothienyl, 3-phenyl-9-carbazolyl, 3-(1-naphthyl)-9-carbazolyl, 3-(2-naphthyl)-9-carbazolyl, 3,6-diphenyl-9-carbazolyl, 3,6-di(1-naphthyl)-9-carbazolyl, 3,6-di(2-naphthyl)-9-carbazolyl, 3,6-di(4-tert-butylphenyl)-9-carbazolyl, 9-phenyl-3-carbazolyl, 9-(1-naphthyl)-3-carbazolyl and 9-(2-naphthyl)-3-carbazolyl.

[0042] In 2-naphthyl, 9-phenanthryl, 6-chrysenyl, 2-triphenylenyl, 2-fluorenyl, 9-carbazolyl, 2-thienyl and 2-benzothienyl, optional hydrogens in the above rings may be replaced by alkyl having 1 to 24 carbon atoms, cycloalkyl having 3 to 24 carbon atoms, aryl having 6 to 24 carbon atoms or heteroaryl.

[0043] If hydrogen in a position adjacent to an atom bonded to anthracene in 2-naphthyl, 9-phenanthryl, 6-chrysenyl, 2-triphenylenyl, 2-fluorenyl, 9-carbazolyl, 2-thienyl or 2-benzothienyl is substituted with a substituent, an emission wavelength of a blue color originating in a fundamental skeleton thereof can be maintained, and it is suited to blue color emission. If hydrogens in the other positions are substituted, the compound is increased in rigidity and excellent in heat resistance. The emission material meeting the object can be obtained by suitably selecting the number of the substituents

and the positions thereof considering emission wavelength and heat resistance expected to the emission material based on the design of the device.

[0044] The examples of the alkyl having 1 to 24 carbon atoms are methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, sec-butyl, tert-butyl, n-pentyl, isopentyl, tert-pentyl, neopentyl, n-hexyl, isohexyl, 1-methylpentyl, 2-methylpentyl, n-hexyl, isohexyl, 1-methylpentyl, 2-methylpentyl and 5-methylhexyl.

[0045] Optional —CH_2— in the above alkyl having 1 to 24 carbon atoms may be replaced by —O—, and optional —CH_2— other than —CH_2— bonded directly to the groups described above may be replaced by arylene having 6 to 24 carbon atoms. The examples of the arylene having 6 to 24 carbon atoms are the same as described above, and the preferred example thereof is 1,4-phenylene.

[0046] The examples of the alkyl having 1 to 24 carbon atoms in which optional —CH_2— is replaced by —O— are methoxy, ethoxy, propyloxy, isopropyloxy, n-butyloxy, isobutyloxy, sec-butyloxy, tert-butyloxy, n-pentyloxy, isopentyloxy, tert-pentyloxy, neopentyloxy, n-hexyloxy, isohexyloxy, 1-methylpentyloxy, 2-methylpentyloxy and n-hexyloxy.

[0047] The examples of the alkyl having 1 to 24 carbon atoms in which optional —CH_2— is replaced by arylene having 6 to 24 carbon atoms are 2-phenylethyl, 2-(4-methylphenyl)ethyl, 1-methyl-1-phenylethyl, 1,1-dimethyl-2-phenylethyl and trityl.

[0048] The examples of the alkyl having 1 to 24 carbon atoms in which optional —CH_2— is replaced by —O— and in which optional —CH_2— other than —CH_2— bonded directly to the groups described above is replaced by arylene having 6 to 24 carbon atoms are phenoxy, o-tolyloxy, m-tolyloxy, p-tolyloxy, 1-naphthoxy, 2-naphthoxy, 2,4-dimethylphenoxy, 2,6-dimethylphenoxy, 2,4,6-trimethylphenoxy, 4-tert-butylphenoxy, 2,4-di-tert-butylphenoxy, 2,4,6-tri-tert-butylphenoxy, 2-phenylethoxy and 2-(4-methylphenyl) ethoxy.

[0049] The examples of the cycloalkyl having 3 to 24 carbon atoms are cyclopropyl, cyclobutyl, cyclopentyl and cyclohexyl. Optional hydrogens in the above cycloalkyl having 3 to 24 carbon atoms may be replaced by alkyl having 1 to 24 carbon atoms or aryl having 6 to 24 carbon atoms.

[0050] The examples of the cycloalkyl having 3 to 24 carbon atoms in which optional hydrogens are replaced by the alkyl having 1 to 24 carbon atoms are 2-methylcyclohexyl, 3-methylcyclohexyl, 4-methylcyclohexyl, 2,4,6-trimethylcyclohexyl, 2-tert-butylcyclohexyl, 3-tert-butylcyclohexyl, 4-tert-butylcyclohexyl and 2,4,6-tri-tert-butylcyclohexyl.

[0051] The examples of the cycloalkyl having 3 to 24 carbon atoms in which optional hydrogens are replaced by the aryl having 6 to 24 carbon atoms are 2-phenylcyclohexyl, 3-phenylcyclohexyl, 4-phenylcyclohexyl, 2,4-diphenylcyclohexyl and 3,5-diphenylcyclohexyl.

[0052] The examples of the aryl having 6 to 24 carbon atoms are phenyl, 1-naphthyl, 2-naphthyl, 1-anthryl, 2-anthryl, 9-anthryl, 1-phenanthryl, 2-phenanthryl, 3-phenanthryl, 4-phenanthryl, 9-phenanthryl, 1-pyrenyl, 2-pyrenyl, 4-pyrenyl, 1-perylenyl, 2-perylenyl, 1-chrysenyl, 2-chrysenyl, 3-chrysenyl, 5-chrysenyl, 6-chrysenyl, 1-triphenylenyl, 2-triphenylenyl and 2-fluorenyl. Optional hydrogens in the above aryl having 6 to 24 carbon atoms may be replaced by alkyl having 1 to 24 carbon atoms, cycloalkyl having 3 to 12 carbon atoms or aryl having 6 to 24 carbon atoms.

[0053] The examples of the aryl having 6 to 24 carbon atoms in which optional hydrogens are replaced by the alkyl having 1 to 24 carbon atoms are o-tolyl, m-tolyl, p-tolyl, 2-biphenylyl, 3-biphenylyl, 4-biphenylyl, 2,4-dimethylphenyl, 2,6-dimethylphenyl, 2,4,6-trimethylphenyl, 4-tert-butylphenyl, 2,4-di-tert-butylphenyl, 2,4,6-tri-tert-butylphenyl, 4-methyl-1-naphthyl, 4-tert-butyl-1-naphthyl, 6-methyl-2-naphthyl, 6-tert-butyl-2-naphthyl, 4-methyl-1-anthryl, 4-tert-butyl-1-anthryl, 10-methyl-9-anthryl, 10-tert-butyl-9-anthryl and 9,9-dimethyl-2-fluorenyl.

[0054] The examples of the aryl having 6 to 24 carbon atoms in which optional hydrogens are replaced by the cycloalkyl having 3 to 12 carbon atoms are 2-cyclohexylphenyl, 3-cyclohexylphenyl, 4-cyclohexylphenyl, 2,4-dicyclohexylphenyl and 3,5-dicyclohexylphenyl.

[0055] The examples of the aryl having 6 to 24 carbon atoms in which optional hydrogens are replaced by the aryl having 6 to 24 carbon atoms are m-terphenyl-2'-yl, m-terphenyl-4'-yl, m-terphenyl-5'-yl, o-terphenyl-3'-yl, o-terphenyl-4'-yl, p-terphenyl-2'-yl, m-terphenyl-2-yl, m-terphenyl-3-yl, m-terphenyl-4-yl, o-terphenyl-2-yl, o-terphenyl-3-yl, o-terphenyl-4-yl, p-terphenyl-2-yl, p-terphenyl-3-yl, p-terphenyl-4-yl, 51-phenyl-m-terphenyl-2-yl, 5'-phenyl-m-terphenyl-3-yl, 5'-phenyl-m-terphenyl-4-yl, m-quaterphenyl-2-yl, m-quaterphenyl-3-yl, m-quaterphenyl-4-yl, o-quaterphenyl-2-yl, o-quaterphenyl-3-yl, o-quaterphenyl-4-yl, 3,5-di(1-naphthyl)-phenyl, 3,5-di(2-naphthyl)-phenyl, 4-phenyl-1-naphthyl, 6-phenyl-2-naphthyl, 6-(2-naphthyl)-2-naphthyl, 6-(1-naphthyl)-2-naphthyl, 4-(2-naphthyl)-1-naphthyl, 4-(1-naphthyl)-1-naphthyl and 9,9-diphenyl-2-fluorenyl.

[0056] The examples of the heteroaryl are 1-pyrroryl, 2-pyrroryl, 3-pyrroryl, 2-pyridyl, 3-pyridyl, 4-pyridyl, 2,2'-bipyridyl-6-yl, 2,3'-bipyridyl-6-yl, 2,4'-bipyridyl-6-yl, 3,2'-bipyridyl-6-yl, 3,3'-bipyridyl-6-yl, 3,4'-bipyridyl-6-yl, 1-indolyl, 2-indolyl, 3-indolyl, 4-indolyl, 5-indolyl, 6-indolyl, 7-indolyl, 1-isoindolyl, 2-isoindolyl, 3-isoindolyl, 4-isoindolyl, 5-isoindolyl, 6-isoindolyl, 7-isoindolyl, 2-furyl, 3-furyl, 2-benzofuranyl, 3-benzofuranyl, 4-benzofuranyl, 5-benzofuranyl, 6-benzofuranyl, 7-benzofuranyl, 1-isobenzofuranyl, 3-isobenzofuranyl, 4-isobenzofuranyl, 5-isobenzofuranyl, 6-isobenzofuranyl, 7-isobenzofuranyl, 2-quinolyl, 3-quinolyl, 4-quinolyl, 5-quinolyl, 6-quinolyl, 7-quinolyl, 8-quinolyl, 1-isoquinolyl, 3-isoquinolyl, 4-isoquinolyl, 5-isoquinolyl, 6-isoquinolyl, 7-isoquinolyl, 8-isoquinolyl, 2-quinoxalinyl, 5-quinoxalinyl, 6-quinoxalinyl, 1-carbazolyl, 2-carbazolyl, 3-carbazolyl, 4-carbazolyl, 9-carbazolyl, 1-phenanthridinyl, 2-phenanthridinyl, 3-phenanthridinyl, 4-phenanthridinyl, 6-phenanthridinyl, 7-phenanthridinyl, 8-phenanthridinyl, 9-phenanthridinyl, 10-phenanthridinyl, 1-acridinyl, 2-acridinyl, 3-acridinyl, 4-acridinyl, 9-acridinyl, 1,7-phenanthroline-2-yl, 1,7-phenanthroline-3-yl, 1,7-phenanthroline-4-yl, 1,7-phenanthroline-5-yl, 1,7-phenanthroline-6-yl, 1,7-phenanthroline-8-yl, 1,7-phenanthroline-9-yl, 1,7-phenanthroline-10-yl, 1,8-phenanthroline-2-yl, 1,8-phenanthroline-3-yl, 1,8-phenanthroline-4-yl, 1,8-phenanthroline-5-yl, 1,8-phenanthroline-6-yl, 1,8-phenanthroline-7-yl, 1,8-phenanthroline-9-yl, 1,8-phenanthroline-10-yl, 1,9-phenanthroline-2-yl, 1,9-phenanthroline-3-yl, 1,9-phenanthroline-4-yl, 1,9-phenanthroline-5-yl, 1,9-phenanthroline-6-yl, 1,9-phenanthroline-7-yl, 1,9-phenanthroline-8-yl, 1,9-phenanthroline-10-yl, 1,10-phenanthroline-2-yl, 1,10-phenanthroline-3-yl, 1,10-phenanthroline-4-yl, 1,10-phenanthroline-5-yl, 2,9-phenanthroline-1-yl, 2,9-phenanthroline-3-yl, 2,9-phenanthroline-4-yl, 2,9-phenanthroline-5-yl, 2,8-phenanthroline-1-yl, 2,8-phenanthroline-3-yl, 2,8-phenanthroline-4-yl, 2,8-phenanthroline-5-yl, 2,8-phenanthroline-6-yl, 2,8-phenanthroline-7-yl, 2,8-phenanthroline-9-yl, 2,8-phenanthroline-10-yl, 2,7-

phenanthroline-1-yl, 2,7-phenanthroline-3-yl, 2,7-phenanthroline-4-yl, 2,7-phenanthroline-5-yl, 2,7-phenanthroline-6-yl, 2,7-phenanthroline-8-yl, 2,7-phenanthroline-9-yl, 2,7-phenanthroline-10-yl, 1-phenazinyl, 2-phenazinyl, 1-phenothiazinyl, 2-phenothiazinyl, 3-phenothiazinyl, 4-phenothiazinyl, 10-phenothiazinyl, 1-phenoxazinyl, 2-phenoxazinyl, 3-phenoxazinyl, 4-phenoxazinyl, 10-phenoxazinyl, 3-furazanyl, 2-thienyl, 3-thienyl, 2-benzothienyl, 3-benzothienyl, 4-benzothienyl, 5-benzothienyl, 6-benzothienyl, 7-benzothienyl, 1-isobenzothienyl, 3-isobenzothienyl, 4-isobenzothienyl, 5-isobenzothienyl, 6-isobenzothienyl and 7-isobenzothienyl.

[0057] Optional hydrogens in the above heteroaryl may be replaced by alkyl having 1 to 24 carbon atoms, cycloalkyl having 3 to 12 carbon atoms or aryl having 6 to 24 carbon atoms.

[0058] The examples of the heteroaryl in which optional hydrogens are replaced by with the alkyl having 1 to 24 carbon atoms are 5-methyl-2-thienyl, 5-methyl-3-thienyl, 2,5-dimethyl-3-thienyl, 3,4,5-trimethyl-2-thienyl, 3-methyl-2-benzothienyl, 2-methyl-3-benzothienyl, 2-methylpyrrole-1-yl, 2,5-dimethylpyrrole-1-yl, 2-methyl-1-indolyl, 2-tert-butyl-1-indolyl, 3-methyl-9-carbazolyl, 3,6-dimethyl-9-carbazolyl, 3,6-di-tert-butyl-9-carbazolyl and 9-methyl-3-carbazolyl.

[0059] The examples of the heteroaryl in which optional hydrogens are replaced by the cycloalkyl having 3 to 12 carbon atoms are 5-cyclohexyl-2-thienyl, 3-cyclohexyl-2-benzothienyl, 2-cyclohexyl-3-benzothienyl, 3-cyclohexyl-9-carbazolyl, 3,6-dicyclohexyl-9-carbazolyl and 9-cyclohexyl-3-carbazolyl.

[0060] The examples of the heteroaryl in which optional hydrogens are replaced by the aryl having 6 to 24 carbon atoms are 5-phenyl-2-thienyl, 5-(1-naphthyl)-2-thienyl, 5-(2-naphthyl)-2-thienyl, 5-phenyl-3-thienyl, 2,5-diphenyl-3-thienyl, 2-phenyl-5-(1-naphthyl)-3-thienyl, 2-phenyl-5-(2-naphthyl)-3-thienyl, 3,4,5-triphenyl-2-thienyl, 3,4-diphenyl-5-(1-naphthyl)-2-thienyl, 3,4-diphenyl-5-(2-naphthyl)-2-thienyl, 3-phenyl-2-benzothienyl, 3-(1-naphthyl)-2-benzothienyl, 3-(2-naphthyl)-2-benzothienyl, 2-phenyl-3-benzothienyl, 3-phenyl-9-carbazolyl, 3-(1-naphthyl)-9-carbazolyl, 3-(2-naphthyl)-9-carbazolyl, 3,6-diphenyl-9-carbazolyl, 3,6-di(1-naphthyl)-9-carbazolyl, 3,6-di(2-naphthyl)-9-carbazolyl, 3,6-di(4-tert-butylphenyl)-9-carbazolyl, 9-phenyl-3-carbazolyl, 9-(1-naphthyl)-3-carbazolyl and 9-(2-naphthyl)-3-carbazolyl.

[0061] The preferred examples of Ar^1 are phenyl, 2-biphenylyl, 3-biphenylyl, 4-biphenylyl, 2,6-dimethylphenyl, 2,4,6-trimethylphenyl, 4-tert-butylphenyl, 2,4-di-tert-butylphenyl, m-terphenyl-4'-yl, m-terphenyl-5'-yl, p-terphenyl-2'-yl, m-terphenyl-2-yl, m-terphenyl-3-yl, o-terphenyl-2-yl, o-terphenyl-3-yl, m-quaterphenyl-3-yl, o-quaterphenyl-2-yl, 3,5-di(2-naphthyl)phenyl, 3,5-di(1-naphthyl)phenyl, 4-(9-carbazolyl)phenyl, 3,5-di(9-carbazolyl)phenyl, 2-naphthyl, 6-phenyl-2-naphthyl, 6-(m-terphenyl-5'-yl)-2-naphthyl, 6-(2-naphthyl)-2-naphthyl, 6-(9-carbazolyl)-2-naphthyl, 9-phenanthryl, 6-chrysenyl, 2-triphenylenyl, 9,9-dimethyl-2-fluorenyl, 9,9-diphenyl-2-fluorenyl, 5-phenyl-2-thienyl, 2,5-diphenyl-3-thienyl, 3,4,5-triphenyl-2-thienyl, 2-benzothienyl, 3-phenyl-2-benzothienyl, 2-phenyl-3-benzothienyl, 9-carbazolyl and 3,6-diphenyl-9-carbazolyl.

[0062] The more preferred examples of Ar^1 are phenyl, 2-biphenylyl, 3-biphenylyl, 4-biphenylyl, 4-tert-butylphenyl, m-terphenyl-5'-yl, m-quaterphenyl-3-yl, o-quaterphenyl-2-yl, 3,5-di(2-naphthyl)phenyl, 4-(9-carbazolyl)phenyl, 2-naphthyl, 6-(2-naphthyl)-2-naphthyl, 6-(9-carbazolyl)-2-naphthyl, 9-phenanthryl, 2-benzothienyl, 3-phenyl-2-benzothienyl and 9-carbazolyl.

[0063] Ar^2 and Ar^3 are independently non-condensed aryl having 6 to 50 carbon atoms, condensed aryl having 10 to 50 carbon atoms or heteroaryl. The non-condensed aryl having 6 to 50 carbon atoms is the same as the non-condensed aryl having 6 to 50 carbon atoms in Ar^1 described above. Ar^2 and Ar^3 may be the same or different.

[0064] The examples of the condensed aryl having 10 to 50 carbon atoms are 1-naphthyl, 2-naphthyl, 1-anthryl, 2-anthryl, 9-anthryl, 1-phenanthryl, 2-phenanthryl, 3-phenanthryl, 4-phenanthryl, 9-phenanthryl, 1-pyrenyl, 2-pyrenyl, 4-pyrenyl, 1-perylenyl, 2-perylenyl, 1-chrysenyl, 2-chrysenyl, 3-chrysenyl, 5-chrysenyl, 6-chrysenyl, 1-triphenylenyl, 2-triphenylenyl and 2-fluorenyl. Optional hydrogens in the above condensed aryl having a carbon number of 10 to 50 may be substituted with alkyl having a carbon number of 1 to 24, cycloalkyl having a carbon number of 3 to 24 or aryl having a carbon number of 6 to 24.

[0065] The examples of the condensed aryl having 10 to 50 carbon atoms in which optional hydrogens are replaced by the alkyl having 1 to 24 carbon atoms are 4-methyl-1-naphthyl, 4-tert-butyl-1-naphthyl, 6-methyl-2-naphthyl, 6-tert-butyl-2-naphthyl, 4-methyl-1-anthryl, 4-tert-butyl-1-anthryl, 10-methyl-9-anthryl, 10-tert-butyl-9-anthryl and 9,9-dimethyl-2-fluorenyl.

[0066] The examples of the condensed aryl having 10 to 50 carbon atoms in which optional hydrogens are replaced by with the cycloalkyl having 3 to 24 carbon atoms are 4-cyclohexyl-1-naphthyl, 6-cyclohexyl-2-naphthyl, 4-cyclohexyl-1-anthryl, 10-cyclohexyl-9-anthryl and 9,9-dicyclohexyl-2-fluorenyl.

[0067] The examples of the condensed aryl having 10 to 50 carbon atoms in which optional hydrogens are replaced by the aryl having a carbon number of 6 to 24 carbon atoms are 4-phenyl-1-naphthyl, 6-phenyl-2-naphthyl, 6-(2-naphthyl)-2-naphthyl, 6-(1-naphthyl)-2-naphthyl, 4-(2-naphthyl)-1-naphthyl, 4-(1-naphthyl)-1-naphthyl and 9,9-diphenyl-2-fluorenyl.

[0068] The examples of the heteroaryl are 1-pyrroryl, 2-pyrroryl, 3-pyrroryl, 2-pyridyl, 3-pyridyl, 4-pyridyl, 2,2'-bipyridyl-6-yl, 2,3'-bipyridyl-6-yl, 2,4'-bipyridyl-6-yl, 3,2'-bipyridyl-6-yl, 3,3'-bipyridyl-6-yl, 3,4'-bipyridyl-6-yl, 1-indolyl, 2-indolyl, 3-indolyl, 4-indolyl, 5-indolyl, 6-indolyl, 7-indolyl, 1-isoindolyl, 2-isoindolyl, 3-isoindolyl, 4-isoindolyl, 5-isoindolyl, 6-isoindolyl, 7-isoindolyl, 2-furyl, 3-furyl, 2-benzofuranyl, 3-benzofuranyl, 4-benzofuranyl, 5-benzofuranyl, 6-benzofuranyl, 7-benzofuranyl, 1-isobenzofuranyl, 3-isobenzofuranyl, 4-isobenzofuranyl, 5-isobenzofuranyl, 6-isobenzofuranyl, 7-isobenzofuranyl, 2-quinolyl, 3-quinolyl, 4-quinolyl, 5-quinolyl, 6-quinolyl, 7-quinolyl, 8-quinolyl, 1-isoquinolyl, 3-isoquinolyl, 4-isoquinolyl, 5-isoquinolyl, 6-isoquinolyl, 7-isoquinolyl, 8-isoquinolyl, 2-quinoxalinyl, 5-quinoxalinyl, 6-quinoxalinyl, 1-carbazolyl, 2-carbazolyl, 3-carbazolyl, 4-carbazolyl, 9-carbazolyl, 1-phenanthridinyl, 2-phenanthridinyl, 3-phenanthridinyl, 4-phenanthridinyl, 6-phenanthridinyl, 7-phenanthridinyl, 8-phenanthridinyl, 9-phenanthridinyl, 10-phenanthridinyl, 1-acridinyl, 2-acridinyl, 3-acridinyl, 4-acridinyl, 9-acridinyl, 1,7-phenanthroline-2-yl, 1,7-phenanthroline-3-yl, 1,7-phenanthroline-4-yl, 1,7-phenanthroline-5-yl, 1,7-phenanthroline-6-yl, 1,7-phenanthroline-8-yl, 1,7-phenanthroline-9-yl, 1,7-phenanthroline-10-yl, 1,8-phenanthroline-2-yl, 1,8-phenanthroline-3-yl, 1,8-phenanthroline-4-yl, 1,8-phenanthroline-5-yl, 1,8-

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[0069] Optional hydrogens in the above heteroaryl may be replaced by alkyl having 1 to 24 carbon atoms, cycloalkyl having 3 to 24 carbon atoms or aryl having 6 to 24 carbon atoms.

[0070] The examples of the heteroaryl in which optional hydrogens are replaced by the alkyl having 1 to 24 carbon are 5-methyl-2-thienyl, 5-methyl-3-thienyl, 2,5-dimethyl-3-thienyl, 3,4,5-trimethyl-2-thienyl, 3-methyl-2-benzothienyl, 2-methyl-3-benzothienyl, 2-methylpyrrole-1-yl, 2,5-dimethylpyrrole-1-yl, 2-methyl-1-indolyl, 2-tert-butyl-1-indolyl, 3-methyl-9-carbazolyl, 3,6-dimethyl-9-carbazolyl, 3,6-di-tert-butyl-9-carbazolyl and 9-methyl-3-carbazolyl.

[0071] The examples of the heteroaryl in which optional hydrogens are replaced by the cycloalkyl having 3 to 24 carbon atoms are 5-cyclohexyl-2-thienyl, 3-cyclohexyl-2-benzothienyl, 2-cyclohexyl-3-benzothienyl, 3-cyclohexyl-9-carbazolyl, 3,6-dicyclohexyl-9-carbazolyl and 9-cyclohexyl-3-carbazolyl.

[0072] The examples of the heteroaryl in which optional hydrogens are replaced by the aryl having 6 to 24 carbon atoms are 5-phenyl-2-thienyl, 5-(1-naphthyl)-2-thienyl, 5-(2-naphthyl)-2-thienyl, 5-phenyl-3-thienyl, 2,5-diphenyl-3-thienyl, 2-phenyl-5-(1-naphthyl)-3-thienyl, 2-phenyl-5-(2-naphthyl)-3-thienyl, 3,4,5-triphenyl-2-thienyl, 3,4-diphenyl-5-(1-naphthyl)-2-thienyl, 3,4-diphenyl-5-(2-naphthyl)-2-thienyl, 3-phenyl-2-benzothienyl, 3-(1-naphthyl)-2-benzothienyl, 3-(2-naphthyl)-2-benzothienyl, 2-phenyl-3-benzothienyl, 3-phenyl-9-carbazolyl, 3-(1-naphthyl)-9-carbazolyl, 3-(2-naphthyl)-9-carbazolyl, 3,6-diphenyl-9-carbazolyl, 3,6-di(1-naphthyl)-9-carbazolyl, 3,6-di(2-naphthyl)-9-carbazolyl, 3,6-di(4-tert-butylphenyl)-9-carbazolyl, 9-phenyl-3-carbazolyl, 9-(1-naphthyl)-3-carbazolyl and 9-(2-naphthyl)-3-carbazolyl.

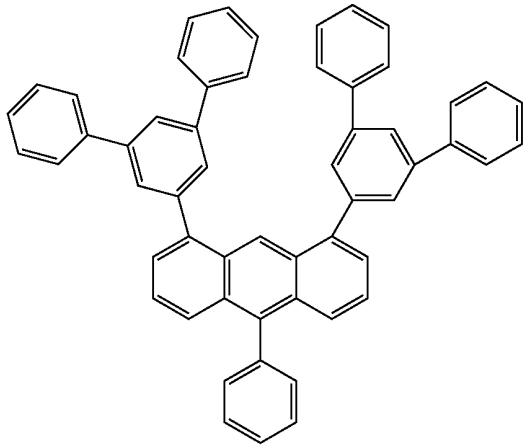
[0073] The preferred examples of Ar^2 and Ar^3 are phenyl, 2-biphenylyl, 3-biphenylyl, 4-biphenylyl, 2,6-dimethylphenyl, 2,4,6-trimethylphenyl, 4-tert-butylphenyl, 2,4-di-tert-butylphenyl, m-terphenyl-4'-yl, m-terphenyl-5'-yl, p-terphenyl-2'-yl, m-terphenyl-2-yl, m-terphenyl-3-yl, o-terphenyl-2-yl, o-terphenyl-3-yl, p-quaterphenyl-3-yl, m-quaterphenyl-3-yl, o-quaterphenyl-2-yl, 3,5-di(2-naphthyl)phenyl, 3,5-di(1-naphthyl)phenyl, 4-(9-carbazolyl)phenyl, 3,5-di(9-carbazolyl)phenyl, 1-naphthyl, 2-naphthyl, 4-phenyl-1-naphthyl, 6-phenyl-2-naphthyl, 4-(2-naphthyl)-1-naphthyl, 6-(2-naphthyl)-2-naphthyl, 4-(9-carbazolyl)-1-naphthyl, 6-(9-carbazolyl)-2-naphthyl, 9-phenanthryl, 2-triphenylenyl, 9,9-dimethyl-2-fluorenyl, 9,9-diphenyl-2-fluorenyl, 5-phenyl-2-thienyl, 2,5-diphenyl-3-thienyl, 3,4,5-triphenyl-2-thienyl, 2-benzothienyl, 3-phenyl-2-benzothienyl, 2-phenyl-3-benzothienyl and 9-carbazolyl.

[0074] The more preferred examples of Ar^2 and Ar^3 are phenyl, 2-biphenylyl, 3-biphenylyl, 4-biphenylyl, 4-tert-butylphenyl, m-terphenyl-5'-yl, 4-(9-carbazolyl)phenyl, p-quaterphenyl-3-yl, m-quaterphenyl-3-yl, o-quaterphenyl-2-yl, 3,5-di(2-naphthyl)phenyl, 1-naphthyl, 2-naphthyl, 4-phenyl-1-naphthyl, 6-(m-terphenyl-5'-yl)-2-naphthyl, 6-(2-naphthyl)-2-naphthyl, 4-(9-carbazolyl)-1-naphthyl, 9-phenanthryl, 2-benzothienyl and 3-phenyl-2-benzothienyl.

[0075] If hydrogens in positions adjacent to atoms bonded to anthracene in Ar^2 and Ar^3 are substituted with substituents, emission wavelength of blue color originating in the fundamental skeleton can be maintained, and it is suited to blue color emission. If hydrogens in the other positions are substituted, the compound is increased in rigidity and excellent in heat resistance. The emission material meeting the object can be obtained by suitably selecting the number of the substituents and the positions thereof considering emission wavelength and heat resistance expected to the emission material based on the design of the device.

[0076] Compounds of (1-1) to (1-1426) which are the specific examples of the emission material (1) of the present invention are shown in the following Table 2-1 to Table 2-31. Codes used in Table 2-1 to Table 2-31 are shown in Table 1-1 to Table 1-5. For example, the compound (1-15) shown in Table 2-1, the compound (1-412) shown in Table 2-9, the compound (1-419) shown in Table 2-10 and the compound (1-606) shown in Table 2-14 have the following structures. However, the present invention shall not be restricted by disclosing these specific structures.

(1-15)



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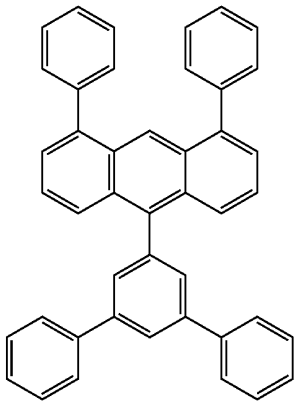
(1-412)



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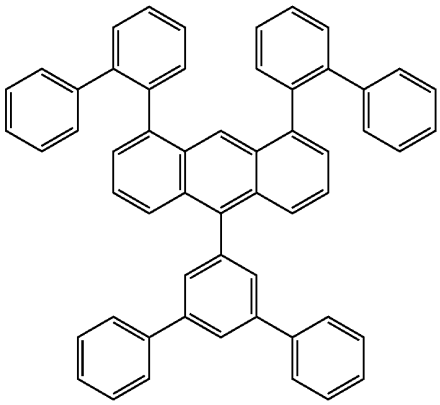

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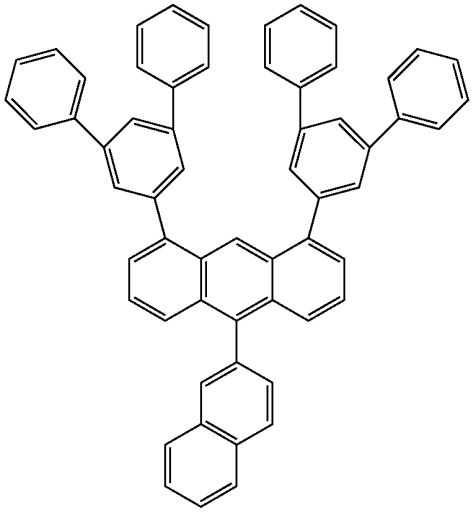

TABLE 1

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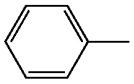
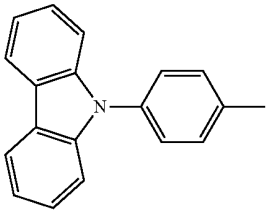
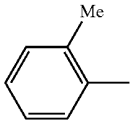
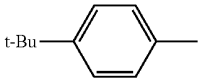
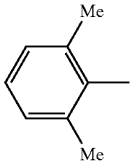
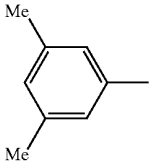
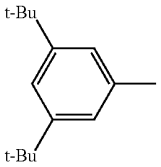
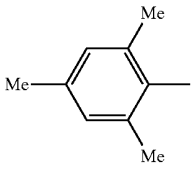
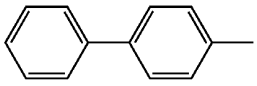
P1	
P2	
P3	
P4	
P5	
P6	
P7	
P8	
BP1	

TABLE 1-continued

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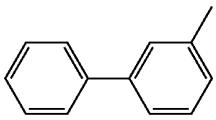
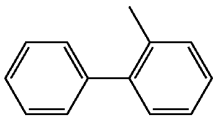
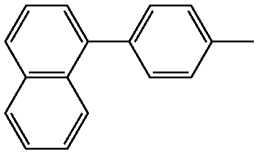
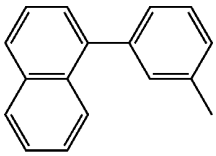
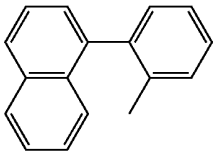
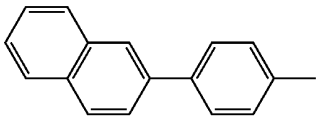
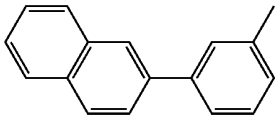
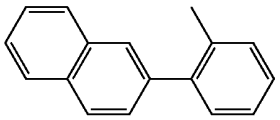
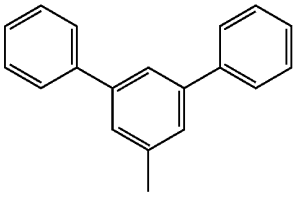
BP2	
BP3	
BP4	
BP5	
BP6	
BP7	
BP8	
BP9	
TP1	

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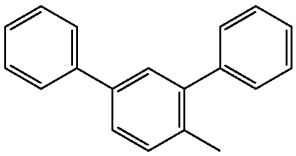
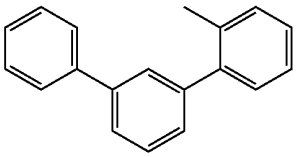
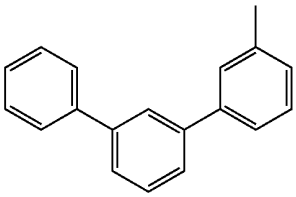
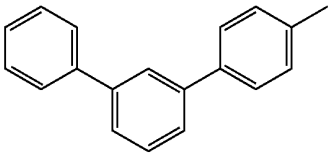
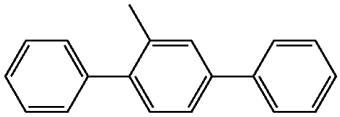
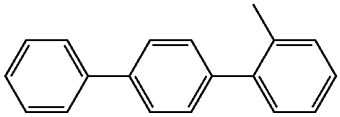
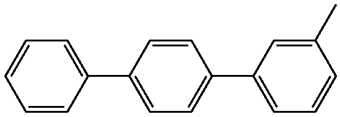
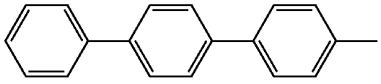
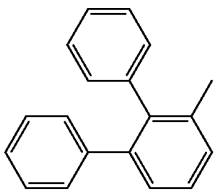
TP2	
TP3	
TP4	
TP5	
TP6	
TP7	
TP8	
TP9	
TP10	

TABLE 1-continued

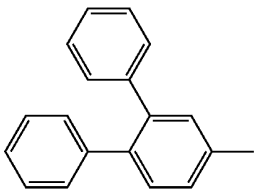
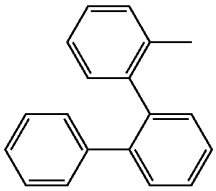
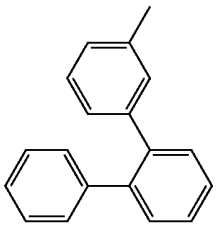
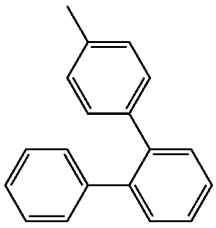
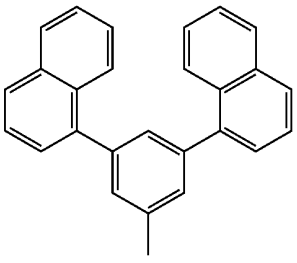
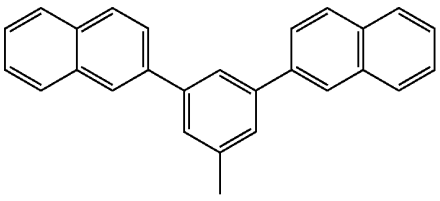
symbol	structural formula
TP11	
TP12	
TP13	
TP14	
TP15	
TP16	

TABLE 1-continued

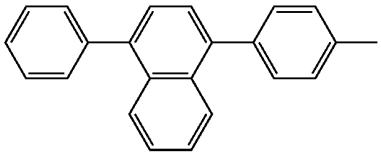
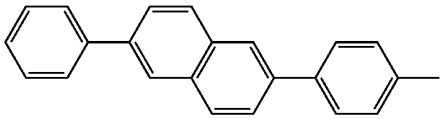
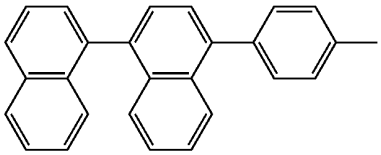
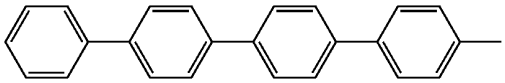
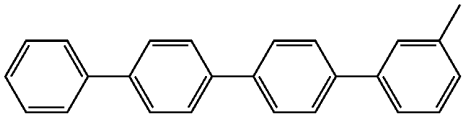
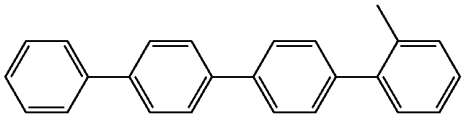
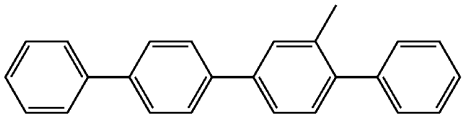
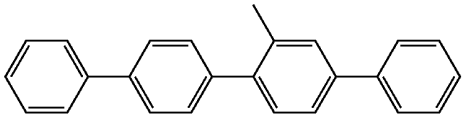
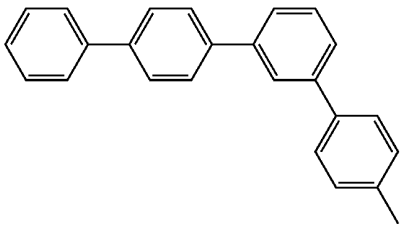
symbol	structural formula
TP17	
TP18	
TP19	
QP1	
QP2	
QP3	
QP4	
QP5	
QP6	

TABLE 1-continued

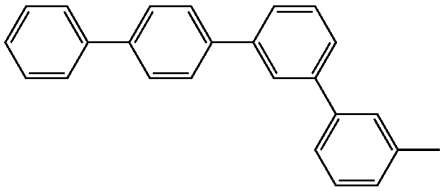
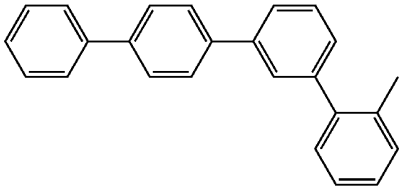
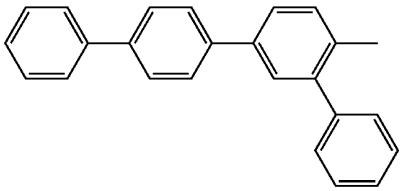
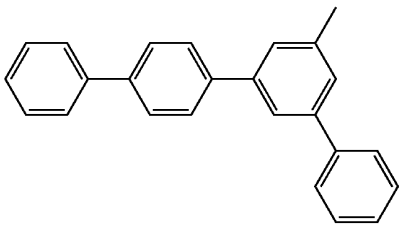
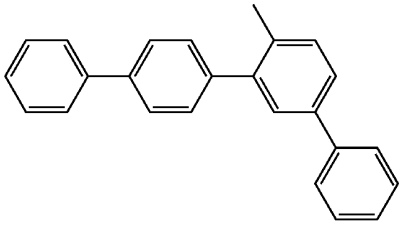
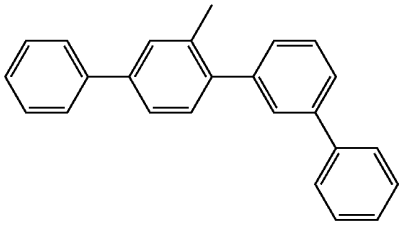
symbol	structural formula
QP7	
QP8	
QP9	
QP10	
QP11	
QP12	

TABLE 1-continued

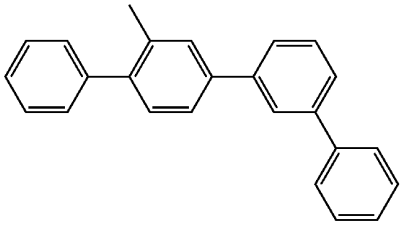
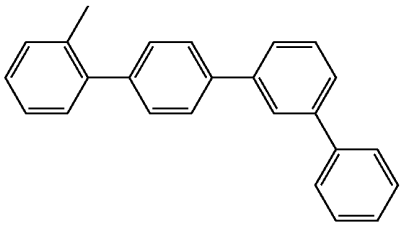
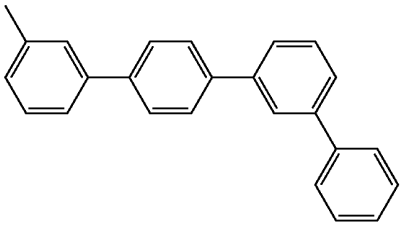
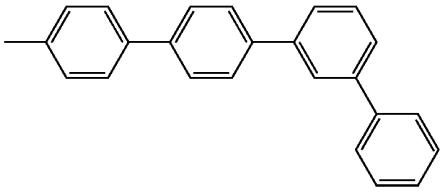
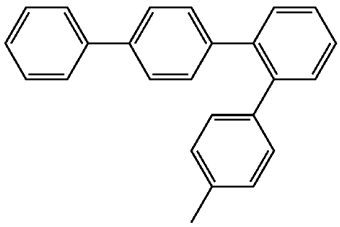
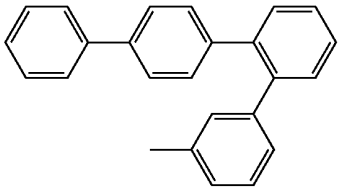
symbol	structural formula
QP13	
QP14	
QP15	
QP16	
QP17	
QP18	

TABLE 1-continued

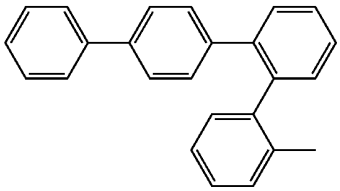
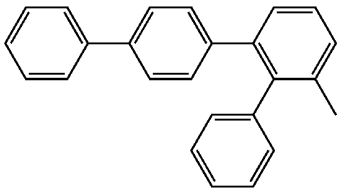
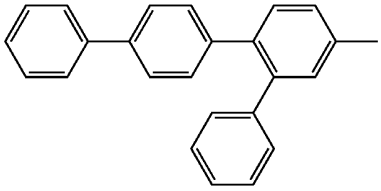
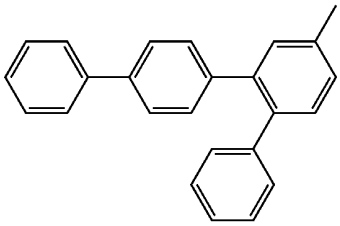
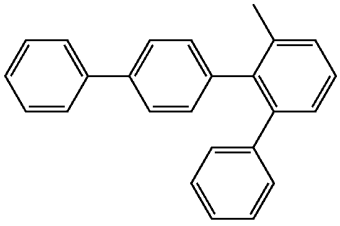
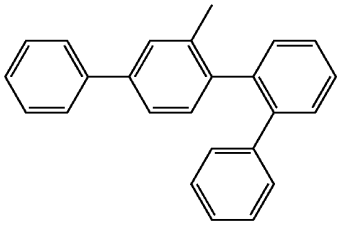
symbol	structural formula
QP19	
QP20	
QP21	
QP22	
QP23	
QP24	

TABLE 1-continued

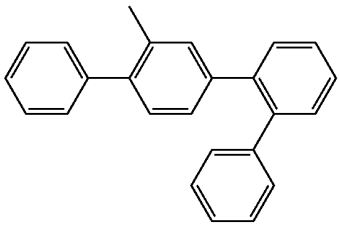
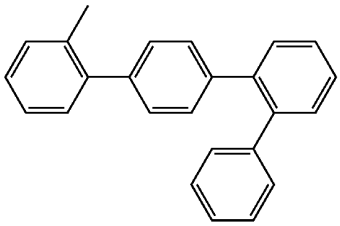
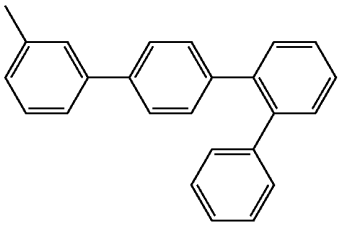
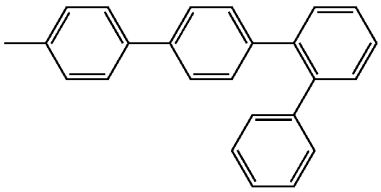
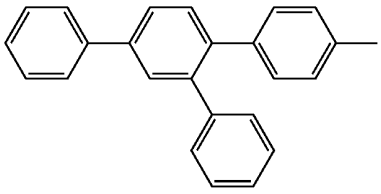
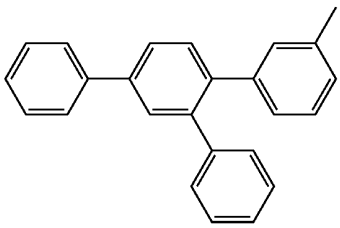
symbol	structural formula
QP25	
QP26	
QP27	
QP28	
QP29	
QP30	

TABLE 1-continued

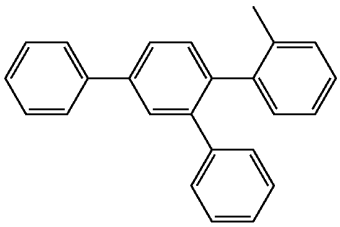
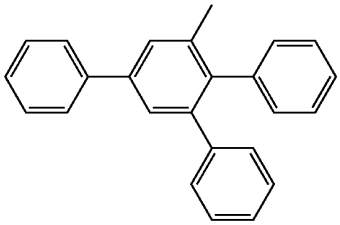
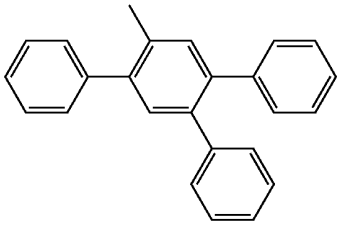
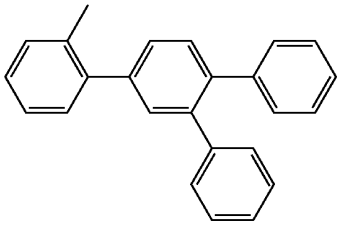
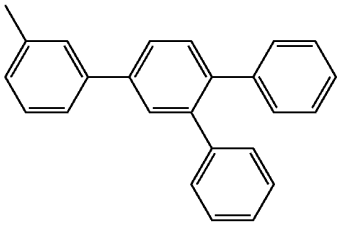
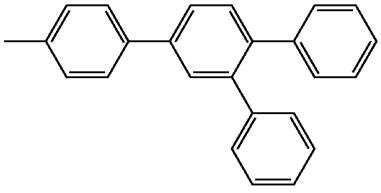
symbol	structural formula
QP31	
QP32	
QP33	
QP34	
QP35	
QP36	

TABLE 1-continued

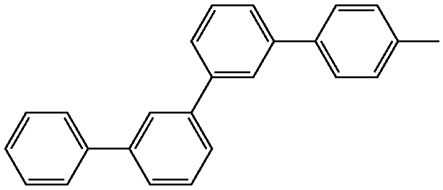
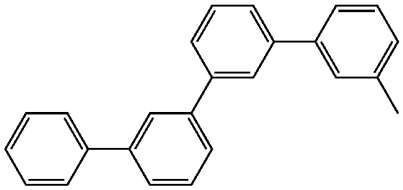
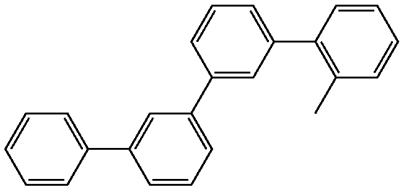
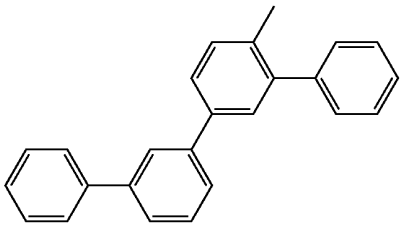
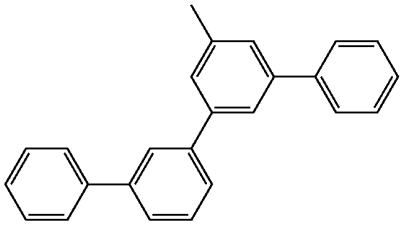
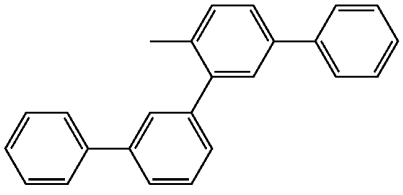
symbol	structural formula
QP37	
QP38	
QP39	
QP40	
QP41	
QP42	

TABLE 1-continued

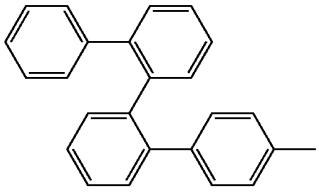
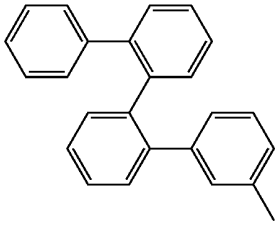
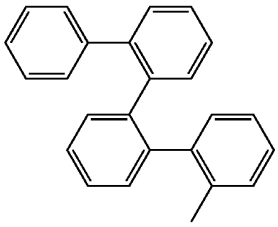
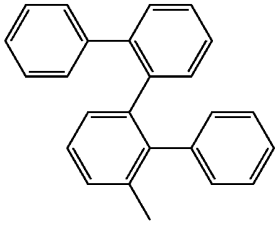
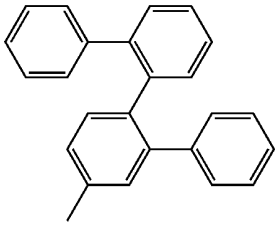
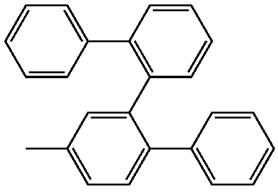
symbol	structural formula
QP43	
QP44	
QP45	
QP46	
QP47	
QP48	

TABLE 1-continued

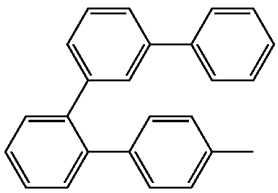
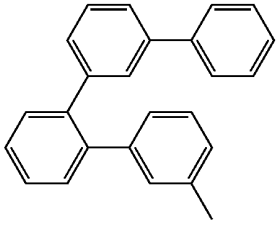
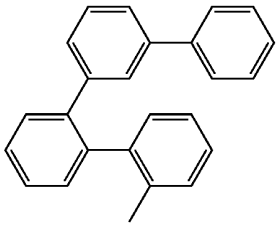
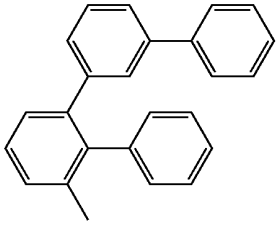
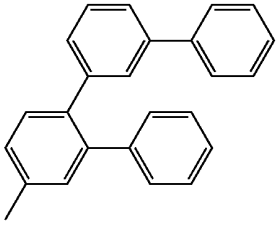
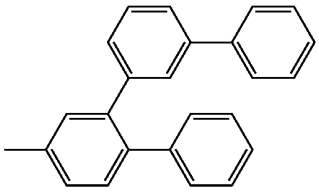
symbol	structural formula
QP49	
QP50	
QP51	
QP52	
QP53	
QP54	

TABLE 1-continued

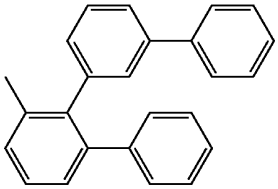
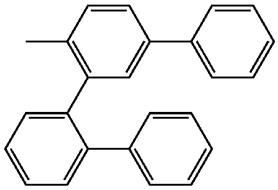
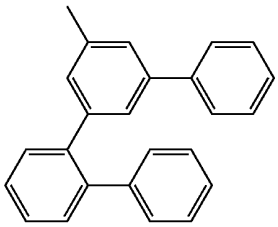
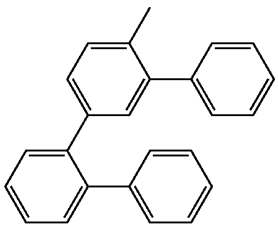
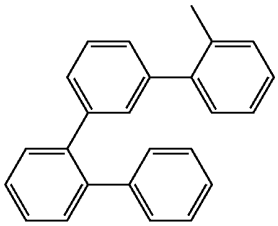
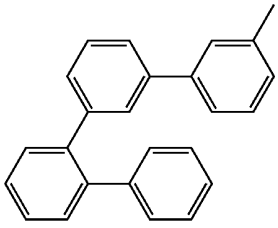
symbol	structural formula
QP55	
QP56	
QP57	
QP58	
QP59	
QP60	

TABLE 1-continued

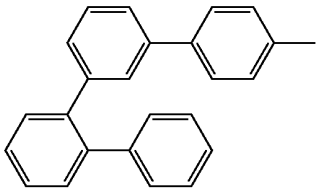
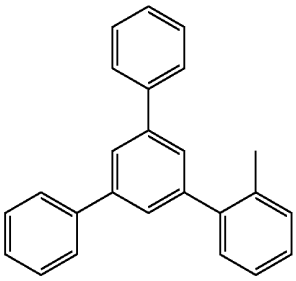
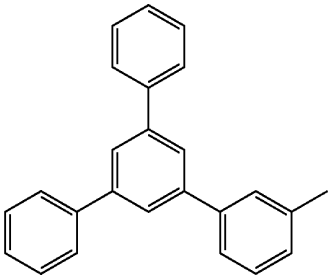
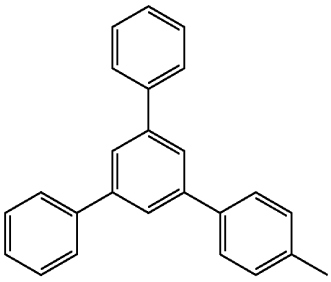
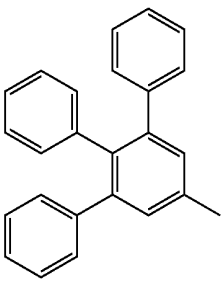
symbol	structural formula
QP61	
QP62	
QP63	
QP64	
QP65	

TABLE 1-continued

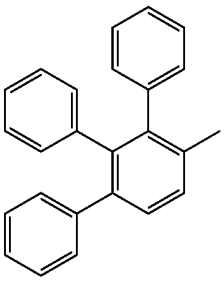
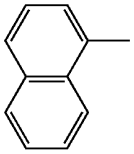
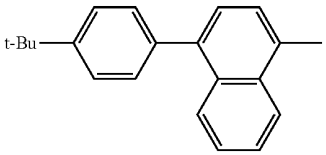
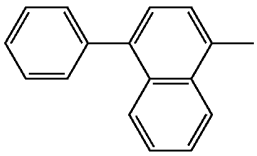
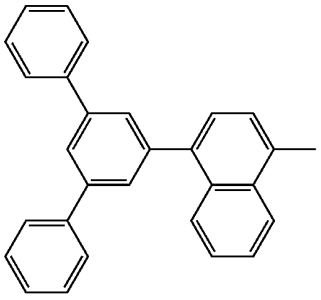
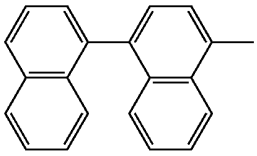
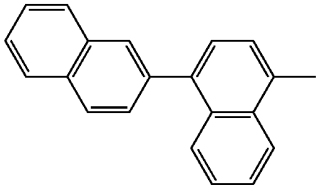
sym-bol	structural formula
QP66	
NP1	
NP2	
NP3	
NP4	
NP5	
NP6	

TABLE 1-continued

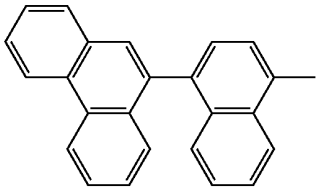
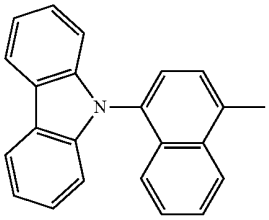
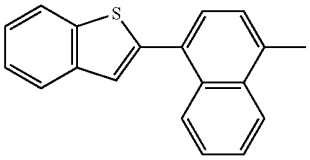
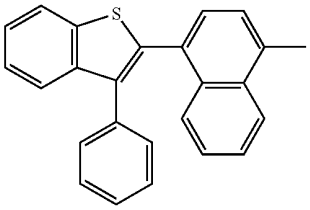
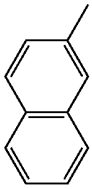
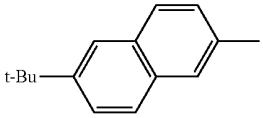
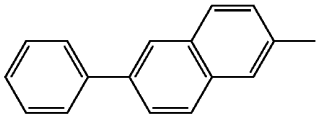
sym-bol	structural formula
NP7	
NP8	
NP9	
NP10	
NP11	
NP12	
NP13	

TABLE 1-continued

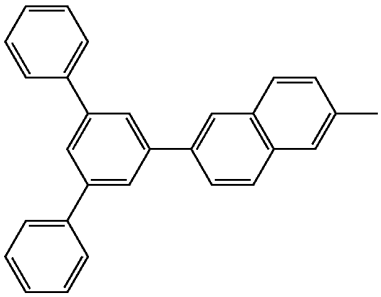
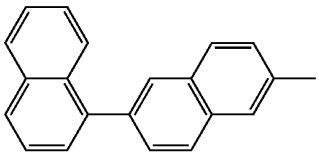
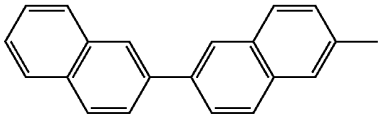
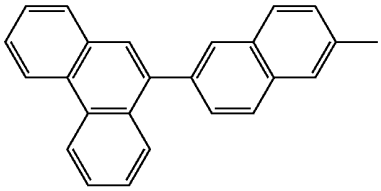
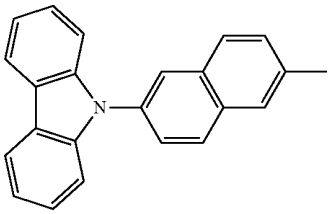
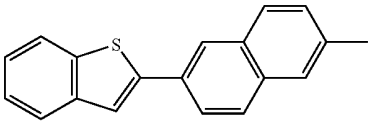
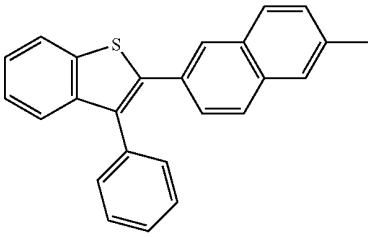
symbol	structural formula
NP14	
NP15	
NP16	
NP17	
NP18	
NP19	
NP20	

TABLE 1-continued

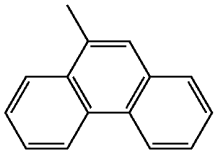
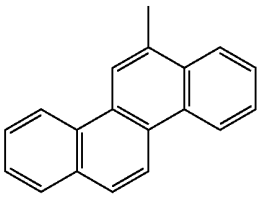
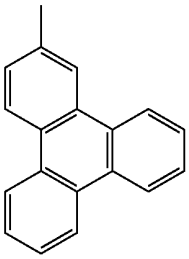
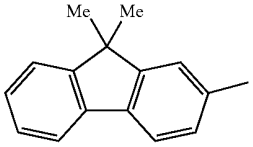
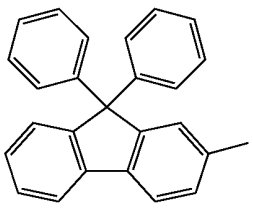
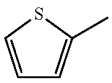
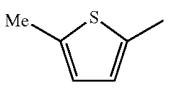
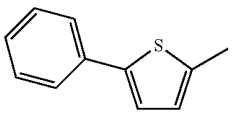
symbol	structural formula
PN1	
CS1	
TPL1	
FL1	
FL2	
TH1	
TH2	
TH3	

TABLE 1-continued

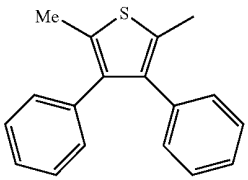
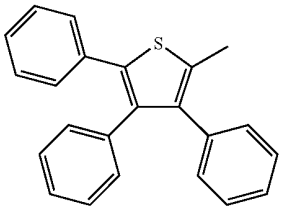
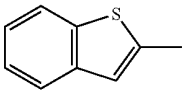
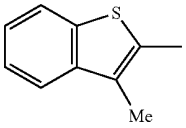
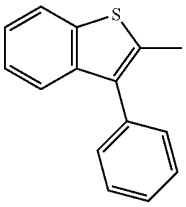
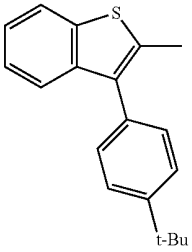
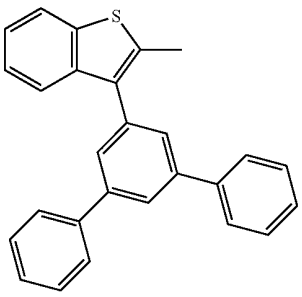
symbol	structural formula
TH4	
TH5	
BT1	
BT2	
BT3	
BT4	
BT5	

TABLE 1-continued

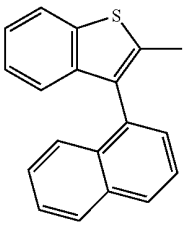
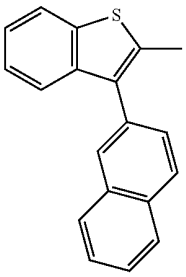
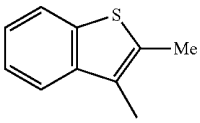
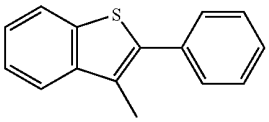
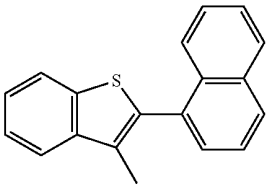
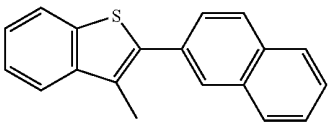
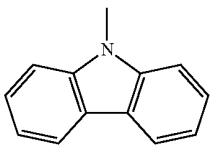
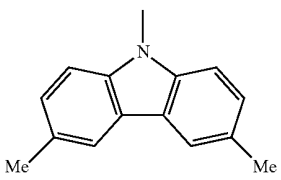
symbol	structural formula
BT6	
BT7	
BT8	
BT9	
BT10	
BT11	
CZ1	
CZ2	

TABLE 1-continued

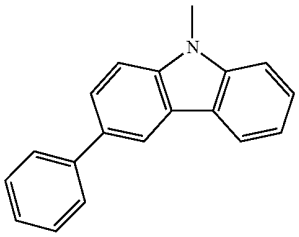
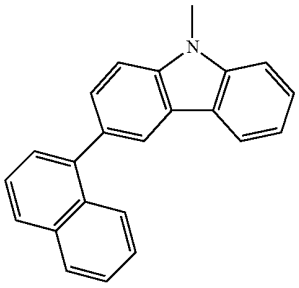
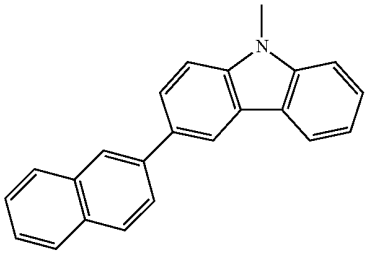
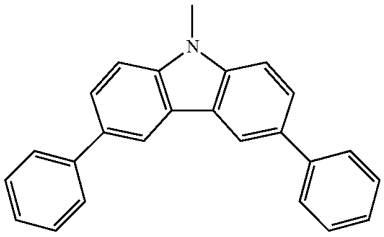
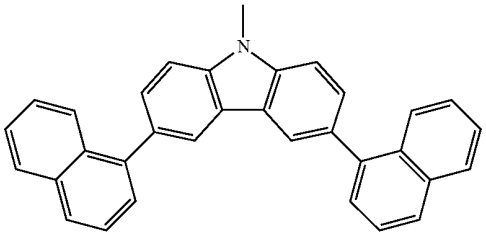
symbol	structural formula
CZ3	
CZ4	
CZ5	
CZ6	
CZ7	

TABLE 1-continued

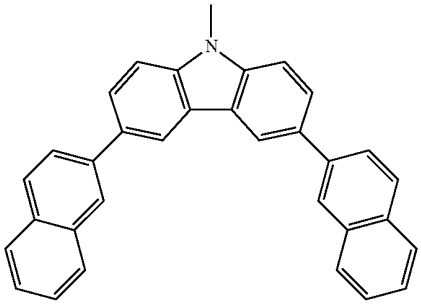
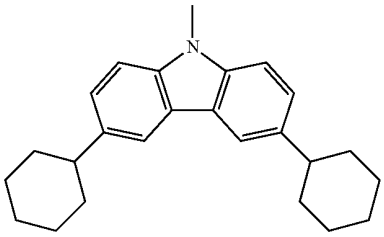
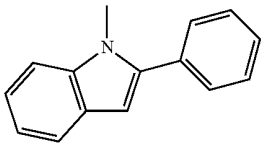
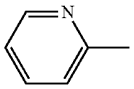
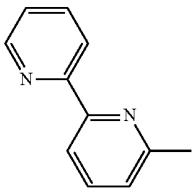
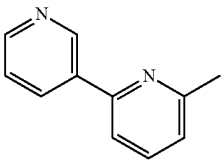
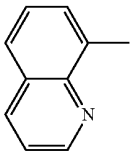
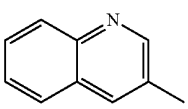
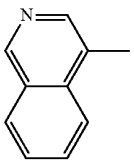
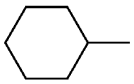
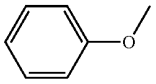
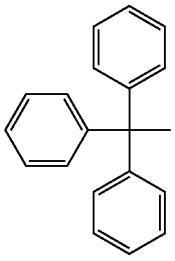
symbol	structural formula
CZ8	
CZ9	
IN1	
PY1	
PY2	
PY3	
QN1	
QN2	

TABLE 1-continued

symbol	structural formula
QN3	
CY	
PO	
TPM	

No.	Ar^1	Ar^2	Ar^3	R^1	R^2	R^3	R^4	R^5	R^6	R^7
			Table 2-1							
1-1	P1	P2	P2	H	H	H	H	H	H	H
1-2	P1	P4	P4	H	H	H	H	H	H	H
1-3	P1	P5	P5	H	H	H	H	H	H	H
1-4	P1	P6	P6	H	H	H	H	H	H	H
1-5	P1	P8	P8	H	H	H	H	H	H	H
1-6	P1	BP1	BP1	H	H	H	H	H	H	H
1-7	P1	BP2	BP2	H	H	H	H	H	H	H
1-8	P1	BP3	BP3	H	H	H	H	H	H	H
1-9	P1	BP4	BP4	H	H	H	H	H	H	H
1-10	P1	BP5	BP5	H	H	H	H	H	H	H
1-11	P1	BP6	BP6	H	H	H	H	H	H	H
1-12	P1	BP7	BP7	H	H	H	H	H	H	H
1-13	P1	BP8	BP8	H	H	H	H	H	H	H
1-14	P1	BP9	BP9	H	H	H	H	H	H	H
1-15	P1	TP1	TP1	H	H	H	H	H	H	H
1-16	P1	TP2	TP2	H	H	H	H	H	H	H
1-17	P1	TP3	TP3	H	H	H	H	H	H	H
1-18	P1	TP4	TP4	H	H	H	H	H	H	H
1-19	P1	TP5	TP5	H	H	H	H	H	H	H
1-20	P1	TP6	TP6	H	H	H	H	H	H	H
1-21	P1	TP7	TP7	H	H	H	H	H	H	H
1-22	P1	TP8	TP8	H	H	H	H	H	H	H
1-23	P1	TP9	TP9	H	H	H	H	H	H	H
1-24	P1	TP10	TP10	H	H	H	H	H	H	H
1-25	P1	TP11	TP11	H	H	H	H	H	H	H
1-26	P1	TP12	TP12	H	H	H	H	H	H	H
1-27	P1	TP13	TP13	H	H	H	H	H	H	H
1-28	P1	TP14	TP14	H	H	H	H	H	H	H
1-29	P1	TP15	TP15	H	H	H	H	H	H	H
1-30	P1	TP16	TP16	H	H	H	H	H	H	H
1-31	P1	TP17	TP17	H	H	H	H	H	H	H

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No.	Ar^1	Ar^2	Ar^3	R^1	R^2	R^3	R^4	R^5	R^6	R^7
1-32	P1	TP18	TP18	H	H	H	H	H	H	H
1-33	P1	TP19	TP19	H	H	H	H	H	H	H
1-34	P1	QP1	QP1	H	H	H	H	H	H	H
1-35	P1	QP2	QP2	H	H	H	H	H	H	H
1-36	P1	QP3	QP3	H	H	H	H	H	H	H
1-37	P1	QP4	QP4	H	H	H	H	H	H	H
1-38	P1	QP5	QP5	H	H	H	H	H	H	H
1-39	P1	QP6	QP6	H	H	H	H	H	H	H
1-40	P1	QP7	QP7	H	H	H	H	H	H	H
1-41	P1	QP8	QP8	H	H	H	H	H	H	H
1-42	P1	QP9	QP9	H	H	H	H	H	H	H
1-43	P1	QP10	QP10	H	H	H	H	H	H	H
1-44	P1	QP11	QP11	H	H	H	H	H	H	H
1-45	P1	QP12	QP12	H	H	H	H	H	H	H
1-46	P1	QP13	QP13	H	H	H	H	H	H	H
			Table 2-2							
1-47	P1	QP14	QP14	H	H	H	H	H	H	H
1-48	P1	QP15	QP15	H	H	H	H	H	H	H
1-49	P1	QP16	QP16	H	H	H	H	H	H	H
1-50	P1	QP17	QP17	H	H	H	H	H	H	H
1-51	P1	QP18	QP18	H	H	H	H	H	H	H
1-52	P1	QP19	QP19	H	H	H	H	H	H	H
1-53	P1	QP20	QP20	H	H	H	H	H	H	H
1-54	P1	QP21	QP21	H	H	H	H	H	H	H
1-55	P1	QP22	QP22	H	H	H	H	H	H	H
1-56	P1	QP23	QP23	H	H	H	H	H	H	H
1-57	P1	QP24	QP24	H	H	H	H	H	H	H
1-58	P1	QP25	QP25	H	H	H	H	H	H	H
1-59	P1	QP26	QP26	H	H	H	H	H	H	H
1-60	P1	QP27	QP27	H	H	H	H	H	H	H
1-61	P1	QP28	QP28	H	H	H	H	H	H	H
1-62	P1	QP29	QP29	H	H	H	H	H	H	H
1-63	P1	QP30	QP30	H	H	H	H	H	H	H
1-64	P1	QP31	QP31	H	H	H	H	H	H	H
1-65	P1	QP32	QP32	H	H	H	H	H	H	H
1-66	P1	QP33	QP33	H	H	H	H	H	H	H
1-67	P1	QP34	QP34	H	H	H	H	H	H	H
1-68	P1	QP35	QP35	H	H	H	H	H	H	H
1-69	P1	QP36	QP36	H	H	H	H	H	H	H
1-70	P1	QP37	QP37	H	H	H	H	H	H	H
1-71	P1	QP38	QP38	H	H	H	H	H	H	H
1-72	P1	QP39	QP39	H	H	H	H	H	H	H
1-73	P1	QP40	QP40	H	H	H	H	H	H	H
1-74	P1	QP41	QP41	H	H	H	H	H	H	H
1-75	P1	QP42	QP42	H	H	H	H	H	H	H
1-76	P1	QP43	QP43	H	H	H	H	H	H	H
1-77	P1	QP44	QP44	H	H	H	H	H	H	H
1-78	P1	QP45	QP45	H	H	H	H	H	H	H
1-79	P1	QP46	QP46	H	H	H	H	H	H	H
1-80	P1	QP47	QP47	H	H	H	H	H	H	H
1-81	P1	QP48	QP48	H	H	H	H	H	H	H
1-82	P1	QP49	QP49	H	H	H	H	H	H	H
1-83	P1	QP50	QP50	H	H	H	H	H	H	H
1-84	P1	QP51	QP51	H	H	H	H	H	H	H
1-85	P1	QP52	QP52	H	H	H	H	H	H	H
1-86	P1	QP53	QP53	H	H	H	H	H	H	H
1-87	P1	QP54	QP54	H	H	H	H	H	H	H
1-88	P1	QP55	QP55	H	H	H	H	H	H	H
1-89	P1	QP56	QP56	H	H	H	H	H	H	H
1-90	P1	QP57	QP57	H	H	H	H	H	H	H
1-91	P1	QP58	QP58	H	H	H	H	H	H	H
1-92	P1	QP59	QP59	H	H	H	H	H	H	H
			Table 2-3							
1-93	P1	QP60	QP60	H	H	H	H	H	H	H
1-94	P1	QP61	QP61	H	H	H	H	H	H	H
1-95	P1	QP62	QP62	H	H	H	H	H	H	H
1-96	P1	QP63	QP63	H	H	H	H	H	H	H
1-97	P1	QP64	QP64	H	H	H	H	H	H	H
1-98	P1	QP65	QP65	H	H	H	H	H	H	H
1-99	P1	QP66	QP66	H	H	H	H	H	H	H
1-100	P1	NP1	NP1	H	H	H	H	H	H	H
1-101	P1	NP2	NP2	H	H	H	H	H	H	H

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No.	Ar^1	Ar^2	Ar^3	R^1	R^2	R^3	R^4	R^5	R^6	R^7
1-102	P1	NP3	NP3	H	H	H	H	H	H	H
1-103	P1	NP4	NP4	H	H	H	H	H	H	H
1-104	P1	NP5	NP5	H	H	H	H	H	H	H
1-105	P1	NP6	NP6	H	H	H	H	H	H	H
1-106	P1	NP7	NP7	H	H	H	H	H	H	H
1-107	P1	NP8	NP8	H	H	H	H	H	H	H
1-108	P1	NP9	NP9	H	H	H	H	H	H	H
1-109	P1	NP10	NP10	H	H	H	H	H	H	H
1-110	P1	NP11	NP11	H	H	H	H	H	H	H
1-111	P1	NP12	NP12	H	H	H	H	H	H	H
1-112	P1	NP13	NP13	H	H	H	H	H	H	H
1-113	P1	NP14	NP14	H	H	H	H	H	H	H
1-114	P1	NP15	NP15	H	H	H	H	H	H	H
1-115	P1	NP16	NP16	H	H	H	H	H	H	H
1-116	P1	NP17	NP17	H	H	H	H	H	H	H
1-117	P1	NP18	NP18	H	H	H	H	H	H	H
1-118	P1	NP19	NP19	H	H	H	H	H	H	H
1-119	P1	NP20	NP20	H	H	H	H	H	H	H
1-120	P1	PN1	PN1	H	H	H	H	H	H	H
1-121	P1	CS1	CS1	H	H	H	H	H	H	H
1-122	P1	TPL1	TPL1	H	H	H	H	H	H	H
1-123	P1	FL1	FL1	H	H	H	H	H	H	H
1-124	P1	FL2	FL2	H	H	H	H	H	H	H
1-125	P1	TH1	TH1	H	H	H	H	H	H	H
1-126	P1	TH2	TH2	H	H	H	H	H	H	H
1-127	P1	TH3	TH3	H	H	H	H	H	H	H
1-128	P1	TH4	TH4	H	H	H	H	H	H	H
1-129	P1	TH5	TH5	H	H	H	H	H	H	H
1-130	P1	BT1	BT1	H	H	H	H	H	H	H
1-131	P1	BT2	BT2	H	H	H	H	H	H	H
1-132	P1	BT3	BT3	H	H	H	H	H	H	H
1-133	P1	BT4	BT4	H	H	H	H	H	H	H
1-134	P1	BT5	BT5	H	H	H	H	H	H	H
1-135	P1	BT6	BT6	H	H	H	H	H	H	H
1-136	P1	BT7	BT7	H	H	H	H	H	H	H
1-137	P1	BT8	BT8	H	H	H	H	H	H	H
1-138	P1	BT9	BT9	H	H	H	H	H	H	H

Table 2-4

1-139	P1	BT10	BT10	H	H	H	H	H	H	H
1-140	P1	BT11	BT11	H	H	H	H	H	H	H
1-141	P1	CZ1	CZ1	H	H	H	H	H	H	H
1-142	P1	CZ2	CZ2	H	H	H	H	H	H	H
1-143	P1	CZ3	CZ3	H	H	H	H	H	H	H
1-144	P1	CZ4	CZ4	H	H	H	H	H	H	H
1-145	P1	CZ5	CZ5	H	H	H	H	H	H	H
1-146	P1	CZ6	CZ6	H	H	H	H	H	H	H
1-147	P1	CZ7	CZ7	H	H	H	H	H	H	H
1-148	P1	CZ8	CZ8	H	H	H	H	H	H	H
1-149	P1	CZ9	CZ9	H	H	H	H	H	H	H
1-150	P2	P1	P1	H	H	H	H	H	H	H
1-151	P2	P2	P2	H	H	H	H	H	H	H
1-152	P2	P3	P3	H	H	H	H	H	H	H
1-153	P2	P4	P4	H	H	H	H	H	H	H
1-154	P2	P5	P5	H	H	H	H	H	H	H
1-155	P2	P7	P7	H	H	H	H	H	H	H
1-156	P2	P8	P8	H	H	H	H	H	H	H
1-157	P2	BP1	BP1	H	H	H	H	H	H	H
1-158	P2	BP2	BP2	H	H	H	H	H	H	H
1-159	P2	BP3	BP3	H	H	H	H	H	H	H
1-160	P2	BP4	BP4	H	H	H	H	H	H	H
1-161	P2	BP7	BP7	H	H	H	H	H	H	H
1-162	P2	BP8	BP8	H	H	H	H	H	H	H
1-163	P2	TP1	TP1	H	H	H	H	H	H	H
1-164	P2	TP3	TP3	H	H	H	H	H	H	H
1-165	P2	TP4	TP4	H	H	H	H	H	H	H
1-166	P2	TP5	TP5	H	H	H	H	H	H	H
1-167	P2	TP6	TP6	H	H	H	H	H	H	H
1-168	P2	TP7	TP7	H	H	H	H	H	H	H
1-169	P2	TP8	TP8	H	H	H	H	H	H	H
1-170	P2	TP9	TP9	H	H	H	H	H	H	H
1-171	P2	TP12	TP12	H	H	H	H	H	H	H
1-172	P2	TP13	TP13	H	H	H	H	H	H	H
1-173	P2	TP14	TP14	H	H	H	H	H	H	H

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No.	Ar^1	Ar^2	Ar^3	R^1	R^2	R^3	R^4	R^5	R^6	R^7
1-174	P2	TP15	TP15	H	H	H	H	H	H	H
1-175	P2	TP16	TP16	H	H	H	H	H	H	H
1-176	P2	TP17	TP17	H	H	H	H	H	H	H
1-177	P2	TP18	TP18	H	H	H	H	H	H	H
1-178	P2	TP19	TP19	H	H	H	H	H	H	H
1-179	P2	QP38	QP38	H	H	H	H	H	H	H
1-180	P2	QP39	QP39	H	H	H	H	H	H	H
1-181	P2	QP44	QP44	H	H	H	H	H	H	H
1-182	P2	QP45	QP45	H	H	H	H	H	H	H
1-183	P2	QP63	QP63	H	H	H	H	H	H	H
1-184	P2	QP64	QP64	H	H	H	H	H	H	H

Table 2-5

1-185	P2	NP1	NP1	H	H	H	H	H	H	H
1-186	P2	NP2	NP2	H	H	H	H	H	H	H
1-187	P2	NP3	NP3	H	H	H	H	H	H	H
1-188	P2	NP4	NP4	H	H	H	H	H	H	H
1-189	P2	NP5	NP5	H	H	H	H	H	H	H
1-190	P2	NP6	NP6	H	H	H	H	H	H	H
1-191	P2	NP7	NP7	H	H	H	H	H	H	H
1-192	P2	NP8	NP8	H	H	H	H	H	H	H
1-193	P2	NP11	NP11	H	H	H	H	H	H	H
1-194	P2	NP12	NP12	H	H	H	H	H	H	H
1-195	P2	NP13	NP13	H	H	H	H	H	H	H
1-196	P2	NP14	NP14	H	H	H	H	H	H	H
1-197	P2	NP15	NP15	H	H	H	H	H	H	H
1-198	P2	NP16	NP16	H	H	H	H	H	H	H
1-199	P2	NP17	NP17	H	H	H	H	H	H	H
1-200	P2	NP18	NP18	H	H	H	H	H	H	H
1-201	P2	PN1	PN1	H	H	H	H	H	H	H
1-202	P2	FL1	FL1	H	H	H	H	H	H	H
1-203	P2	TH1	TH1	H	H	H	H	H	H	H
1-204	P2	TH2	TH2	H	H	H	H	H	H	H
1-205	P2	TH3	TH3	H	H	H	H	H	H	H
1-206	P2	BT1	BT1	H	H	H	H	H	H	H
1-207	P2	BT3	BT3	H	H	H	H	H	H	H
1-208	P2	BT6	BT6	H	H	H	H	H	H	H
1-209	P2	BT7	BT7	H	H	H	H	H	H	H
1-210	P2	BT9	BT9	H	H	H	H	H	H	H
1-211	P2	CZ1	CZ1	H	H	H	H	H	H	H
1-212	P2	CZ2	CZ2	H	H	H	H	H	H	H
1-213	P2	CZ6	CZ6	H	H	H	H	H	H	H
1-214	P4	P1	P1	H	H	H	H	H	H	H
1-215	P4	P2	P2	H	H	H	H	H	H	H
1-216	P4	P4	P4	H	H	H	H	H	H	H
1-217	P4	P5	P5	H	H	H	H	H	H	H
1-218	P4	P6	P6	H	H	H	H	H	H	H
1-219	P4	P8	P8	H	H	H	H	H	H	H
1-220	P4	BP1	BP1	H	H	H	H	H	H	H
1-221	P4	BP2	BP2	H	H	H	H	H	H	H
1-222	P4	BP3	BP3	H	H	H	H	H	H	H
1-223	P4	BP4	BP4	H	H	H	H	H	H	H
1-224	P4	BP7	BP7	H	H	H	H	H	H	H
1-225	P4	TP1	TP1	H	H	H	H	H	H	H
1-226	P4	TP2	TP2	H	H	H	H	H	H	H
1-227	P4	TP4	TP4	H	H	H	H	H	H	H
1-228	P4	TP5	TP5	H	H	H	H	H	H	H
1-229	P4	TP6	TP6	H	H	H	H	H	H	H
1-230	P4	TP8	TP8	H	H	H	H	H	H	H

Table 2-6

1-231	P4	TP9	TP9	H	H	H	H	H	H	H
1-232	P4	TP12	TP12	H	H	H	H	H	H	H
1-233	P4	TP13	TP13	H	H	H	H	H	H	H
1-234	P4	TP14	TP14	H	H	H	H	H	H	H
1-235	P4	TP15	TP15	H	H	H	H	H	H	H
1-236	P4	TP16	TP16	H	H	H	H	H	H	H
1-237	P4	TP17	TP17	H	H	H	H	H	H	H
1-238	P4	TP18	TP18	H	H	H	H	H	H	H
1-239	P4	TP19	TP19	H	H	H	H	H	H	H
1-240	P4	QP38	QP38	H	H	H	H	H	H	H
1-241	P4	QP39	QP39	H	H	H	H	H	H	H
1-242	P4	QP44	QP44	H	H	H	H	H	H	H
1-243	P4	QP45	QP45	H	H	H	H	H	H	H

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No.	Ar^1	Ar^2	Ar^3	R^1	R^2	R^3	R^4	R^5	R^6	R^7
1-244	P4	QP63	QP63	H	H	H	H	H	H	H
1-245	P4	QP64	QP64	H	H	H	H	H	H	H
1-246	P4	NP1	NP1	H	H	H	H	H	H	H
1-247	P4	NP2	NP2	H	H	H	H	H	H	H
1-248	P4	NP3	NP3	H	H	H	H	H	H	H
1-249	P4	NP4	NP4	H	H	H	H	H	H	H
1-250	P4	NP5	NP5	H	H	H	H	H	H	H
1-251	P4	NP6	NP6	H	H	H	H	H	H	H
1-252	P4	NP7	NP7	H	H	H	H	H	H	H
1-253	P4	NP8	NP8	H	H	H	H	H	H	H
1-254	P4	NP11	NP11	H	H	H	H	H	H	H
1-255	P4	NP12	NP12	H	H	H	H	H	H	H
1-256	P4	NP13	NP13	H	H	H	H	H	H	H
1-257	P4	NP14	NP14	H	H	H	H	H	H	H
1-258	P4	NP15	NP15	H	H	H	H	H	H	H
1-259	P4	NP16	NP16	H	H	H	H	H	H	H
1-260	P4	NP17	NP17	H	H	H	H	H	H	H
1-261	P4	NP18	NP18	H	H	H	H	H	H	H
1-262	P4	PN1	PN1	H	H	H	H	H	H	H
1-263	P4	FL1	FL1	H	H	H	H	H	H	H
1-264	P4	TH1	TH1	H	H	H	H	H	H	H
1-265	P4	TH2	TH2	H	H	H	H	H	H	H
1-266	P4	TH3	TH3	H	H	H	H	H	H	H
1-267	P4	BT1	BT1	H	H	H	H	H	H	H
1-268	P4	BT3	BT3	H	H	H	H	H	H	H
1-269	P4	BT6	BT6	H	H	H	H	H	H	H
1-270	P4	BT7	BT7	H	H	H	H	H	H	H
1-271	P4	BT9	BT9	H	H	H	H	H	H	H
1-272	P4	CZ1	CZ1	H	H	H	H	H	H	H
1-273	P4	CZ2	CZ2	H	H	H	H	H	H	H
1-274	P4	CZ6	CZ6	H	H	H	H	H	H	H
1-275	BP1	P1	P1	H	H	H	H	H	H	H
1-276	BP1	P4	P4	H	H	H	H	H	H	H

Table 2-7

1-277	BP1	BP1	BP1	H	H	H	H	H	H	H
1-278	BP1	BP2	BP2	H	H	H	H	H	H	H
1-279	BP1	BP3	BP3	H	H	H	H	H	H	H
1-280	BP1	BP4	BP4	H	H	H	H	H	H	H
1-281	BP1	BP7	BP7	H	H	H	H	H	H	H
1-282	BP1	TP1	TP1	H	H	H	H	H	H	H
1-283	BP1	TP4	TP4	H	H	H	H	H	H	H
1-284	BP1	TP5	TP5	H	H	H	H	H	H	H
1-285	BP1	TP9	TP9	H	H	H	H	H	H	H
1-286	BP1	TP13	TP13	H	H	H	H	H	H	H
1-287	BP1	TP14	TP14	H	H	H	H	H	H	H
1-288	BP1	TP15	TP15	H	H	H	H	H	H	H
1-289	BP1	TP16	TP16	H	H	H	H	H	H	H
1-290	BP1	TP17	TP17	H	H	H	H	H	H	H
1-291	BP1	TP18	TP18	H	H	H	H	H	H	H
1-292	BP1	TP19	TP19	H	H	H	H	H	H	H
1-293	BP1	QP38	QP38	H	H	H	H	H	H	H
1-294	BP1	QP64	QP64	H	H	H	H	H	H	H
1-295	BP1	NP1	NP1	H	H	H	H	H	H	H
1-296	BP1	NP2	NP2	H	H	H	H	H	H	H
1-297	BP1	NP3	NP3	H	H	H	H	H	H	H
1-298	BP1	NP4	NP4	H	H	H	H	H	H	H
1-299	BP1	NP5	NP5	H	H	H	H	H	H	H
1-300	BP1	NP6	NP6	H	H	H	H	H	H	H
1-301	BP1	NP7	NP7	H	H	H	H	H	H	H
1-302	BP1	NP8	NP8	H	H	H	H	H	H	H
1-303	BP1	NP11	NP11	H	H	H	H	H	H	H
1-304	BP1	NP13	NP13	H	H	H	H	H	H	H
1-305	BP1	NP14	NP14	H	H	H	H	H	H	H
1-306	BP1	NP15	NP15	H	H	H	H	H	H	H
1-307	BP1	NP16	NP16	H	H	H	H	H	H	H
1-308	BP1	NP17	NP17	H	H	H	H	H	H	H
1-309	BP1	NP18	NP18	H	H	H	H	H	H	H
1-310	BP1	PN1	PN1	H	H	H	H	H	H	H
1-311	BP1	FL1	FL1	H	H	H	H	H	H	H
1-312	BP1	TH2	TH2	H	H	H	H	H	H	H
1-313	BP1	TH3	TH3	H	H	H	H	H	H	H
1-314	BP1	BT1	BT1	H	H	H	H	H	H	H
1-315	BP1	BT3	BT3	H	H	H	H	H	H	H

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No.	Ar^1	Ar^2	Ar^3	R^1	R^2	R^3	R^4	R^5	R^6	R^7
1-316	BP1	BT6	BT6	H	H	H	H	H	H	H
1-317	BP1	BT7	BT7	H	H	H	H	H	H	H
1-318	BP1	BT9	BT9	H	H	H	H	H	H	H
1-319	BP1	CZ1	CZ1	H	H	H	H	H	H	H
1-320	BP1	CZ2	CZ2	H	H	H	H	H	H	H
1-321	BP1	CZ6	CZ6	H	H	H	H	H	H	H
1-322	BP2	P1	P1	H	H	H	H	H	H	H

Table 2-8

1-323	BP2	P2	P2	H	H	H	H	H	H	H
1-324	BP2	P4	P4	H	H	H	H	H	H	H
1-325	BP2	P5	P5	H	H	H	H	H	H	H
1-326	BP2	BP1	BP1	H	H	H	H	H	H	H
1-327	BP2	BP2	BP2	H	H	H	H	H	H	H
1-328	BP2	BP3	BP3	H	H	H	H	H	H	H
1-329	BP2	BP4	BP4	H	H	H	H	H	H	H
1-330	BP2	BP7	BP7	H	H	H	H	H	H	H
1-331	BP2	TP1	TP1	H	H	H	H	H	H	H
1-332	BP2	TP4	TP4	H	H	H	H	H	H	H
1-333	BP2	TP12	TP12	H	H	H	H	H	H	H
1-334	BP2	TP15	TP15	H	H	H	H	H	H	H
1-335	BP2	TP16	TP16	H	H	H	H	H	H	H
1-336	BP2	TP17	TP17	H	H	H	H	H	H	H
1-337	BP2	TP18	TP18	H	H	H	H	H	H	H
1-338	BP2	QP38	QP38	H	H	H	H	H	H	H
1-339	BP2	QP39	QP39	H	H	H	H	H	H	H
1-340	BP2	QP44	QP44	H	H	H	H	H	H	H
1-341	BP2	QP45	QP45	H	H	H	H	H	H	H
1-342	BP2	QP63	QP63	H	H	H	H	H	H	H
1-343	BP2	QP64	QP64	H	H	H	H	H	H	H
1-344	BP2	NP1	NP1	H	H	H	H	H	H	H
1-345	BP2	NP3	NP3	H	H	H	H	H	H	H
1-346	BP2	NP4	NP4	H	H	H	H	H	H	H
1-347	BP2	NP5	NP5	H	H	H	H	H	H	H
1-348	BP2	NP6	NP6	H	H	H	H	H	H	H
1-349	BP2	NP7	NP7	H	H	H	H	H	H	H
1-350	BP2	NP8	NP8	H	H	H	H	H	H	H
1-351	BP2	NP11	NP11	H	H	H	H	H	H	H
1-352	BP2	NP13	NP13	H	H	H	H	H	H	H
1-353	BP2	NP14	NP14	H	H	H	H	H	H	H
1-354	BP2	NP15	NP15	H	H	H	H	H	H	H
1-355	BP2	NP16	NP16	H	H	H	H	H	H	H
1-356	BP2	NP17	NP17	H	H	H	H	H	H	H
1-357	BP2	NP18	NP18	H	H	H	H	H	H	H
1-358	BP2	PN1	PN1	H	H	H	H	H	H	H
1-359	BP2	FL1	FL1	H	H	H	H	H	H	H
1-360	BP2	TH3	TH3	H	H	H	H	H	H	H
1-361	BP2	BT1	BT1	H	H	H	H	H	H	H
1-362	BP2	BT3	BT3	H	H	H	H	H	H	H
1-363	BP2	BT6	BT6	H	H	H	H	H	H	H
1-364	BP2	BT7	BT7	H	H	H	H	H	H	H
1-365	BP2	CZ1	CZ1	H	H	H	H	H	H	H
1-366	BP2	CZ6	CZ6	H	H	H	H	H	H	H
1-367	BP3	P2	P2	H	H	H	H	H	H	H
1-368	BP3	P4	P4	H	H	H	H	H	H	H

Table 2-9

1-369	BP3	P5	P5	H	H	H	H	H	H	H
1-370	BP3	P8	P8	H	H	H	H	H	H	H
1-371	BP3	BP1	BP1	H	H	H	H	H	H	H
1-372	BP3	BP2	BP2	H	H	H	H	H	H	H
1-373	BP3	BP3	BP3	H	H	H	H	H	H	H
1-374	BP3	BP4	BP4	H	H	H	H	H	H	H
1-375	BP3	BP7	BP7	H	H	H	H	H	H	H
1-376	BP3	TP1	TP1	H	H	H	H	H	H	H
1-377	BP3	TP4	TP4	H	H	H	H	H	H	H
1-378	BP3	TP12	TP12	H	H	H	H	H	H	H
1-379	BP3	TP15	TP15	H	H	H	H	H	H	H
1-380	BP3	TP16	TP16	H	H	H	H	H	H	H
1-381	BP3	TP17	TP17	H	H	H	H	H	H	H
1-382	BP3	TP18	TP18	H	H	H	H	H	H	H
1-383	BP3	QP38	QP38	H	H	H	H	H	H	H
1-384	BP3	QP39	QP39	H	H	H	H	H	H	H
1-385	BP3	QP44	QP44	H	H	H	H	H	H	H

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No.	Ar^1	Ar^2	Ar^3	R^1	R^2	R^3	R^4	R^5	R^6	R^7
1-386	BP3	QP45	QP45	H	H	H	H	H	H	H
1-387	BP3	QP63	QP63	H	H	H	H	H	H	H
1-388	BP3	QP64	QP64	H	H	H	H	H	H	H
1-389	BP3	NP1	NP1	H	H	H	H	H	H	H
1-390	BP3	NP3	NP3	H	H	H	H	H	H	H
1-391	BP3	NP4	NP4	H	H	H	H	H	H	H
1-392	BP3	NP5	NP5	H	H	H	H	H	H	H
1-393	BP3	NP6	NP6	H	H	H	H	H	H	H
1-394	BP3	NP7	NP7	H	H	H	H	H	H	H
1-395	BP3	NP8	NP8	H	H	H	H	H	H	H
1-396	BP3	NP11	NP11	H	H	H	H	H	H	H
1-397	BP3	NP13	NP13	H	H	H	H	H	H	H
1-398	BP3	NP14	NP14	H	H	H	H	H	H	H
1-399	BP3	NP15	NP15	H	H	H	H	H	H	H
1-400	BP3	NP16	NP16	H	H	H	H	H	H	H
1-401	BP3	NP17	NP17	H	H	H	H	H	H	H
1-402	BP3	NP18	NP18	H	H	H	H	H	H	H
1-403	BP3	PN1	PN1	H	H	H	H	H	H	H
1-404	BP3	FL1	FL1	H	H	H	H	H	H	H
1-405	BP3	TH3	TH3	H	H	H	H	H	H	H
1-406	BP3	BT1	BT1	H	H	H	H	H	H	H
1-407	BP3	BT3	BT3	H	H	H	H	H	H	H
1-408	BP3	BT6	BT6	H	H	H	H	H	H	H
1-409	BP3	BT7	BT7	H	H	H	H	H	H	H
1-410	BP3	CZ1	CZ1	H	H	H	H	H	H	H
1-411	BP3	CZ6	CZ6	H	H	H	H	H	H	H
1-412	TP1	P1	P1	H	H	H	H	H	H	H
1-413	TP1	P2	P2	H	H	H	H	H	H	H
1-414	TP1	P4	P4	H	H	H	H	H	H	H

Table 2-10

1-415	TP1	P5	P5	H	H	H	H	H	H	H
1-416	TP1	P8	P8	H	H	H	H	H	H	H
1-417	TP1	BP1	BP1	H	H	H	H	H	H	H
1-418	TP1	BP2	BP2	H	H	H	H	H	H	H
1-419	TP1	BP3	BP3	H	H	H	H	H	H	H
1-420	TP1	BP4	BP4	H	H	H	H	H	H	H
1-421	TP1	BP7	BP7	H	H	H	H	H	H	H
1-422	TP1	TP1	TP1	H	H	H	H	H	H	H
1-423	TP1	TP4	TP4	H	H	H	H	H	H	H
1-424	TP1	TP12	TP12	H	H	H	H	H	H	H
1-425	TP1	TP15	TP15	H	H	H	H	H	H	H
1-426	TP1	TP16	TP16	H	H	H	H	H	H	H
1-427	TP1	TP17	TP17	H	H	H	H	H	H	H
1-428	TP1	TP18	TP18	H	H	H	H	H	H	H
1-429	TP1	QP38	QP38	H	H	H	H	H	H	H
1-430	TP1	QP39	QP39	H	H	H	H	H	H	H
1-431	TP1	QP44	QP44	H	H	H	H	H	H	H
1-432	TP1	QP45	QP45	H	H	H	H	H	H	H
1-433	TP1	QP63	QP63	H	H	H	H	H	H	H
1-434	TP1	QP64	QP64	H	H	H	H	H	H	H
1-435	TP1	NP1	NP1	H	H	H	H	H	H	H
1-436	TP1	NP3	NP3	H	H	H	H	H	H	H
1-437	TP1	NP4	NP4	H	H	H	H	H	H	H
1-438	TP1	NP5	NP5	H	H	H	H	H	H	H
1-439	TP1	NP6	NP6	H	H	H	H	H	H	H
1-440	TP1	NP7	NP7	H	H	H	H	H	H	H
1-441	TP1	NP8	NP8	H	H	H	H	H	H	H
1-442	TP1	NP11	NP11	H	H	H	H	H	H	H
1-443	TP1	NP13	NP13	H	H	H	H	H	H	H
1-444	TP1	NP14	NP14	H	H	H	H	H	H	H
1-445	TP1	NP15	NP15	H	H	H	H	H	H	H
1-446	TP1	NP16	NP16	H	H	H	H	H	H	H
1-447	TP1	NP17	NP17	H	H	H	H	H	H	H
1-448	TP1	NP18	NP18	H	H	H	H	H	H	H
1-449	TP1	PN1	PN1	H	H	H	H	H	H	H
1-450	TP1	FL1	FL1	H	H	H	H	H	H	H
1-451	TP1	TH3	TH3	H	H	H	H	H	H	H
1-452	TP1	BT1	BT1	H	H	H	H	H	H	H
1-453	TP1	BT3	BT3	H	H	H	H	H	H	H
1-454	TP1	BT6	BT6	H	H	H	H	H	H	H
1-455	TP1	BT7	BT7	H	H	H	H	H	H	H
1-456	TP1	CZ1	CZ1	H	H	H	H	H	H	H
1-457	TP1	CZ6	CZ6	H	H	H	H	H	H	H

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No.	Ar^1	Ar^2	Ar^3	R^1	R^2	R^3	R^4	R^5	R^6	R^7
1-458	TP16	P1	P1	H	H	H	H	H	H	H
1-459	TP16	P2	P2	H	H	H	H	H	H	H
1-460	TP16	P4	P4	H	H	H	H	H	H	H

Table 2-11

1-461	TP16	P5	P5	H	H	H	H	H	H	H
1-462	TP16	P8	P8	H	H	H	H	H	H	H
1-463	TP16	BP1	BP1	H	H	H	H	H	H	H
1-464	TP16	BP2	BP2	H	H	H	H	H	H	H
1-465	TP16	BP3	BP3	H	H	H	H	H	H	H
1-466	TP16	BP4	BP4	H	H	H	H	H	H	H
1-467	TP16	BP7	BP7	H	H	H	H	H	H	H
1-468	TP16	TP1	TP1	H	H	H	H	H	H	H
1-469	TP16	TP4	TP4	H	H	H	H	H	H	H
1-470	TP16	TP12	TP12	H	H	H	H	H	H	H
1-471	TP16	TP15	TP15	H	H	H	H	H	H	H
1-472	TP16	TP16	TP16	H	H	H	H	H	H	H
1-473	TP16	TP17	TP17	H	H	H	H	H	H	H
1-474	TP16	TP18	TP18	H	H	H	H	H	H	H
1-475	TP16	QP38	QP38	H	H	H	H	H	H	H
1-476	TP16	QP39	QP39	H	H	H	H	H	H	H
1-477	TP16	QP44	QP44	H	H	H	H	H	H	H
1-478	TP16	QP45	QP45	H	H	H	H	H	H	H
1-479	TP16	QP63	QP63	H	H	H	H	H	H	H
1-480	TP16	QP64	QP64	H	H	H	H	H	H	H
1-481	TP16	NP1	NP1	H	H	H	H	H	H	H
1-482	TP16	NP3	NP3	H	H	H	H	H	H	H
1-483	TP16	NP4	NP4	H	H	H	H	H	H	H
1-484	TP16	NP5	NP5	H	H	H	H	H	H	H
1-485	TP16	NP6	NP6	H	H	H	H	H	H	H
1-486	TP16	NP7	NP7	H	H	H	H	H	H	H
1-487	TP16	NP8	NP8	H	H	H	H	H	H	H
1-488	TP16	NP11	NP11	H	H	H	H	H	H	H
1-489	TP16	NP13	NP13	H	H	H	H	H	H	H
1-490	TP16	NP14	NP14	H	H	H	H	H	H	H
1-491	TP16	NP15	NP15	H	H	H	H	H	H	H
1-492	TP16	NP16	NP16	H	H	H	H	H	H	H
1-493	TP16	NP17	NP17	H	H	H	H	H	H	H
1-494	TP16	NP18	NP18	H	H	H	H	H	H	H
1-495	TP16	PN1	PN1	H	H	H	H	H	H	H
1-496	TP16	FL1	FL1	H	H	H	H	H	H	H
1-497	TP16	TH3	TH3	H	H	H	H	H	H	H
1-498	TP16	BT1	BT1	H	H	H	H	H	H	H
1-499	TP16	BT3	BT3	H	H	H	H	H	H	H
1-500	TP16	BT6	BT6	H	H	H	H	H	H	H
1-501	TP16	BT7	BT7	H	H	H	H	H	H	H
1-502	TP16	CZ1	CZ1	H	H	H	H	H	H	H
1-503	TP16	CZ6	CZ6	H	H	H	H	H	H	H
1-504	QP38	P1	P1	H	H	H	H	H	H	H
1-505	QP38	P2	P2	H	H	H	H	H	H	H
1-506	QP38	P4	P4	H	H	H	H	H	H	H

Table 2-12

1-507	QP38	P5	P5	H	H	H	H	H	H	H
1-508	QP38	P8	P8	H	H	H	H	H	H	H
1-509	QP38	BP1	BP1	H	H	H	H	H	H	H
1-510	QP38	BP2	BP2	H	H	H	H	H	H	H
1-511	QP38	BP3	BP3	H	H	H	H	H	H	H
1-512	QP38	BP4	BP4	H	H	H	H	H	H	H
1-513	QP38	BP7	BP7	H	H	H	H	H	H	H
1-514	QP38	TP1	TP1	H	H	H	H	H	H	H
1-515	QP38	TP4	TP4	H	H	H	H	H	H	H
1-516	QP38	TP12	TP12	H	H	H	H	H	H	H
1-517	QP38	TP15	TP15	H	H	H	H	H	H	H
1-518	QP38	TP16	TP16	H	H	H	H	H	H	H
1-519	QP38	TP17	TP17	H	H	H	H	H	H	H
1-520	QP38	TP18	TP18	H	H	H	H	H	H	H
1-521	QP38	QP38	QP38	H	H	H	H	H	H	H
1-522	QP38	QP39	QP39	H	H	H	H	H	H	H
1-523	QP38	QP44	QP44	H	H	H	H	H	H	H
1-524	QP38	QP45	QP45	H	H	H	H	H	H	H
1-525	QP38	QP63	QP63	H	H	H	H	H	H	H
1-526	QP38	QP64	QP64	H	H	H	H	H	H	H
1-527	QP38	NP1	NP1	H	H	H	H	H	H	H

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No.	Ar^1	Ar^2	Ar^3	R^1	R^2	R^3	R^4	R^5	R^6	R^7
1-528	QP38	NP3	NP3	H	H	H	H	H	H	H
1-529	QP38	NP4	NP4	H	H	H	H	H	H	H
1-530	QP38	NP5	NP5	H	H	H	H	H	H	H
1-531	QP38	NP6	NP6	H	H	H	H	H	H	H
1-532	QP38	NP7	NP7	H	H	H	H	H	H	H
1-533	QP38	NP8	NP8	H	H	H	H	H	H	H
1-534	QP38	NP11	NP11	H	H	H	H	H	H	H
1-535	QP38	NP13	NP13	H	H	H	H	H	H	H
1-536	QP38	NP14	NP14	H	H	H	H	H	H	H
1-537	QP38	NP15	NP15	H	H	H	H	H	H	H
1-538	QP38	NP16	NP16	H	H	H	H	H	H	H
1-539	QP38	NP17	NP17	H	H	H	H	H	H	H
1-540	QP38	NP18	NP18	H	H	H	H	H	H	H
1-541	QP38	PN1	PN1	H	H	H	H	H	H	H
1-542	QP38	FL1	FL1	H	H	H	H	H	H	H
1-543	QP38	TH3	TH3	H	H	H	H	H	H	H
1-544	QP38	BT1	BT1	H	H	H	H	H	H	H
1-545	QP38	BT3	BT3	H	H	H	H	H	H	H
1-546	QP38	BT6	BT6	H	H	H	H	H	H	H
1-547	QP38	BT7	BT7	H	H	H	H	H	H	H
1-548	QP38	CZ1	CZ1	H	H	H	H	H	H	H
1-549	QP38	CZ6	CZ6	H	H	H	H	H	H	H
1-550	QP45	P1	P1	H	H	H	H	H	H	H
1-551	QP45	P2	P2	H	H	H	H	H	H	H
1-552	QP45	P4	P4	H	H	H	H	H	H	H

Table 2-13

1-553	QP45	P5	P5	H	H	H	H	H	H	H
1-554	QP45	P8	P8	H	H	H	H	H	H	H
1-555	QP45	BP1	BP1	H	H	H	H	H	H	H
1-556	QP45	BP2	BP2	H	H	H	H	H	H	H
1-557	QP45	BP3	BP3	H	H	H	H	H	H	H
1-558	QP45	BP4	BP4	H	H	H	H	H	H	H
1-559	QP45	BP7	BP7	H	H	H	H	H	H	H
1-560	QP45	TP1	TP1	H	H	H	H	H	H	H
1-561	QP45	TP4	TP4	H	H	H	H	H	H	H
1-562	QP45	TP12	TP12	H	H	H	H	H	H	H
1-563	QP45	TP15	TP15	H	H	H	H	H	H	H
1-564	QP45	TP16	TP16	H	H	H	H	H	H	H
1-565	QP45	TP17	TP17	H	H	H	H	H	H	H
1-566	QP45	TP18	TP18	H	H	H	H	H	H	H
1-567	QP45	QP38	QP38	H	H	H	H	H	H	H
1-568	QP45	QP39	QP39	H	H	H	H	H	H	H
1-569	QP45	QP44	QP44	H	H	H	H	H	H	H
1-570	QP45	QP45	QP45	H	H	H	H	H	H	H
1-571	QP45	QP63	QP63	H	H	H	H	H	H	H
1-572	QP45	QP64	QP64	H	H	H	H	H	H	H
1-573	QP45	NP1	NP1	H	H	H	H	H	H	H
1-574	QP45	NP3	NP3	H	H	H	H	H	H	H
1-575	QP45	NP4	NP4	H	H	H	H	H	H	H
1-576	QP45	NP5	NP5	H	H	H	H	H	H	H
1-577	QP45	NP6	NP6	H	H	H	H	H	H	H
1-578	QP45	NP7	NP7	H	H	H	H	H	H	H
1-579	QP45	NP8	NP8	H	H	H	H	H	H	H
1-580	QP45	NP11	NP11	H	H	H	H	H	H	H
1-581	QP45	NP13	NP13	H	H	H	H	H	H	H
1-582	QP45	NP14	NP14	H	H	H	H	H	H	H
1-583	QP45	NP15	NP15	H	H	H	H	H	H	H
1-584	QP45	NP16	NP16	H	H	H	H	H	H	H
1-585	QP45	NP17	NP17	H	H	H	H	H	H	H
1-586	QP45	NP18	NP18	H	H	H	H	H	H	H
1-587	QP45	PN1	PN1	H	H	H	H	H	H	H
1-588	QP45	FL1	FL1	H	H	H	H	H	H	H
1-589	QP45	TH3	TH3	H	H	H	H	H	H	H
1-590	QP45	BT1	BT1	H	H	H	H	H	H	H
1-591	QP45	BT3	BT3	H	H	H	H	H	H	H
1-592	QP45	BT6	BT6	H	H	H	H	H	H	H
1-593	QP45	BT7	BT7	H	H	H	H	H	H	H
1-594	QP45	CZ1	CZ1	H	H	H	H	H	H	H
1-595	QP45	CZ6	CZ6	H	H	H	H	H	H	H
1-596	NP11	P1	P1	H	H	H	H	H	H	H
1-597	NP11	P2	P2	H	H	H	H	H	H	H
1-598	NP11	P4	P4	H	H	H	H	H	H	H

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No.	Ar^1	Ar^2	Ar^3	R^1	R^2	R^3	R^4	R^5	R^6	R^7

Table 2-14

1-599	NP11	P5	P5	H	H	H	H	H	H	H
1-600	NP11	P8	P8	H	H	H	H	H	H	H
1-601	NP11	BP1	BP1	H	H	H	H	H	H	H
1-602	NP11	BP2	BP2	H	H	H	H	H	H	H
1-603	NP11	BP3	BP3	H	H	H	H	H	H	H
1-604	NP11	BP4	BP4	H	H	H	H	H	H	H
1-605	NP11	BP7	BP7	H	H	H	H	H	H	H
1-606	NP11	TP1	TP1	H	H	H	H	H	H	H
1-607	NP11	TP4	TP4	H	H	H	H	H	H	H
1-608	NP11	TP12	TP12	H	H	H	H	H	H	H
1-609	NP11	TP15	TP15	H	H	H	H	H	H	H
1-610	NP11	TP16	TP16	H	H	H	H	H	H	H
1-611	NP11	TP17	TP17	H	H	H	H	H	H	H
1-612	NP11	TP18	TP18	H	H	H	H	H	H	H
1-613	NP11	QP38	QP38	H	H	H	H	H	H	H
1-614	NP11	QP39	QP39	H	H	H	H	H	H	H
1-615	NP11	QP44	QP44	H	H	H	H	H	H	H
1-616	NP11	QP45	QP45	H	H	H	H	H	H	H
1-617	NP11	QP63	QP63	H	H	H	H	H	H	H
1-618	NP11	QP64	QP64	H	H	H	H	H	H	H
1-619	NP11	NP1	NP1	H	H	H	H	H	H	H
1-620	NP11	NP3	NP3	H	H	H	H	H	H	H
1-621	NP11	NP4	NP4	H	H	H	H	H	H	H
1-622	NP11	NP5	NP5	H	H	H	H	H	H	H
1-623	NP11	NP6	NP6	H	H	H	H	H	H	H
1-624	NP11	NP7	NP7	H	H	H	H	H	H	H
1-625	NP11	NP8	NP8	H	H	H	H	H	H	H
1-626	NP11	NP11	NP11	H	H	H	H	H	H	H
1-627	NP11	NP13	NP13	H	H	H	H	H	H	H
1-628	NP11	NP14	NP14	H	H	H	H	H	H	H
1-629	NP11	NP15	NP15	H	H	H	H	H	H	H
1-630	NP11	NP16	NP16	H	H	H	H	H	H	H
1-631	NP11	NP17	NP17	H	H	H	H	H	H	H
1-632	NP11	NP18	NP18	H	H	H	H	H	H	H
1-633	NP11	PN1	PN1	H	H	H	H	H	H	H
1-634	NP11	FL1	FL1	H	H	H	H	H	H	H
1-635	NP11	TH3	TH3	H	H	H	H	H	H	H
1-636	NP11	BT1	BT1	H	H	H	H	H	H	H
1-637	NP11	BT3	BT3	H	H	H	H	H	H	H
1-638	NP11	BT6	BT6	H	H	H	H	H	H	H
1-639	NP11	BT7	BT7	H	H	H	H	H	H	H
1-640	NP11	CZ1	CZ1	H	H	H	H	H	H	H
1-641	NP11	CZ6	CZ6	H	H	H	H	H	H	H
1-642	NP14	P1	P1	H	H	H	H	H	H	H
1-643	NP14	P2	P2	H	H	H	H	H	H	H
1-644	NP14	P4	P4	H	H	H	H	H	H	H

Table 2-15

1-645	NP14	P5	P5	H	H	H	H	H	H	H
1-646	NP14	P8	P8	H	H	H	H	H	H	H
1-647	NP14	BP1	BP1	H	H	H	H	H	H	H
1-648	NP14	BP2	BP2	H	H	H	H	H	H	H
1-649	NP14	BP3	BP3	H	H	H	H	H	H	H
1-650	NP14	BP4	BP4	H	H	H	H	H	H	H
1-651	NP14	BP7	BP7	H	H	H	H	H	H	H
1-652	NP14	TP1	TP1	H	H	H	H	H	H	H
1-653	NP14	TP4	TP4	H	H	H	H	H	H	H
1-654	NP14	TP12	TP12	H	H	H	H	H	H	H
1-655	NP14	TP15	TP15	H	H	H	H	H	H	H
1-656	NP14	TP16	TP16	H	H	H	H	H	H	H
1-657	NP14	TP17	TP17	H	H	H	H	H	H	H
1-658	NP14	TP18	TP18	H	H	H	H	H	H	H
1-659	NP14	QP38	QP38	H	H	H	H	H	H	H
1-660	NP14	QP39	QP39	H	H	H	H	H	H	H
1-661	NP14	QP44	QP44	H	H	H	H	H	H	H
1-662	NP14	QP45	QP45	H	H	H	H	H	H	H
1-663	NP14	QP63	QP63	H	H	H	H	H	H	H
1-664	NP14	QP64	QP64	H	H	H	H	H	H	H
1-665	NP14	NP1	NP1	H	H	H	H	H	H	H
1-666	NP14	NP3	NP3	H	H	H	H	H	H	H
1-667	NP14	NP4	NP4	H	H	H	H	H	H	H
1-668	NP14	NP5	NP5	H	H	H	H	H	H	H

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No.	Ar^1	Ar^2	Ar^3	R^1	R^2	R^3	R^4	R^5	R^6	R^7
1-669	NP14	NP6	NP6	H	H	H	H	H	H	H
1-670	NP14	NP7	NP7	H	H	H	H	H	H	H
1-671	NP14	NP8	NP8	H	H	H	H	H	H	H
1-672	NP14	NP11	NP11	H	H	H	H	H	H	H
1-673	NP14	NP13	NP13	H	H	H	H	H	H	H
1-674	NP14	NP14	NP14	H	H	H	H	H	H	H
1-675	NP14	NP15	NP15	H	H	H	H	H	H	H
1-676	NP14	NP16	NP16	H	H	H	H	H	H	H
1-677	NP14	NP17	NP17	H	H	H	H	H	H	H
1-678	NP14	NP18	NP18	H	H	H	H	H	H	H
1-679	NP14	PN1	PN1	H	H	H	H	H	H	H
1-680	NP14	FL1	FL1	H	H	H	H	H	H	H
1-681	NP14	TH3	TH3	H	H	H	H	H	H	H
1-682	NP14	BT1	BT1	H	H	H	H	H	H	H
1-683	NP14	BT3	BT3	H	H	H	H	H	H	H
1-684	NP14	BT6	BT6	H	H	H	H	H	H	H
1-685	NP14	BT7	BT7	H	H	H	H	H	H	H
1-686	NP14	CZ1	CZ1	H	H	H	H	H	H	H
1-687	NP14	CZ6	CZ6	H	H	H	H	H	H	H
1-688	NP16	P1	P1	H	H	H	H	H	H	H
1-689	NP16	P2	P2	H	H	H	H	H	H	H
1-690	NP16	P4	P4	H	H	H	H	H	H	H

Table 2-16

1-691	NP16	P5	P5	H	H	H	H	H	H	H
1-692	NP16	P8	P8	H	H	H	H	H	H	H
1-693	NP16	BP1	BP1	H	H	H	H	H	H	H
1-694	NP16	BP2	BP2	H	H	H	H	H	H	H
1-695	NP16	BP3	BP3	H	H	H	H	H	H	H
1-696	NP16	BP4	BP4	H	H	H	H	H	H	H
1-697	NP16	BP7	BP7	H	H	H	H	H	H	H
1-698	NP16	TP1	TP1	H	H	H	H	H	H	H
1-699	NP16	TP4	TP4	H	H	H	H	H	H	H
1-700	NP16	TP12	TP12	H	H	H	H	H	H	H
1-701	NP16	TP15	TP15	H	H	H	H	H	H	H
1-702	NP16	TP16	TP16	H	H	H	H	H	H	H
1-703	NP16	TP17	TP17	H	H	H	H	H	H	H
1-704	NP16	TP18	TP18	H	H	H	H	H	H	H
1-705	NP16	QP38	QP38	H	H	H	H	H	H	H
1-706	NP16	QP39	QP39	H	H	H	H	H	H	H
1-707	NP16	QP44	QP44	H	H	H	H	H	H	H
1-708	NP16	QP45	QP45	H	H	H	H	H	H	H
1-709	NP16	QP63	QP63	H	H	H	H	H	H	H
1-710	NP16	QP64	QP64	H	H	H	H	H	H	H
1-711	NP16	NP1	NP1	H	H	H	H	H	H	H
1-712	NP16	NP3	NP3	H	H	H	H	H	H	H
1-713	NP16	NP4	NP4	H	H	H	H	H	H	H
1-714	NP16	NP5	NP5	H	H	H	H	H	H	H
1-715	NP16	NP6	NP6	H	H	H	H	H	H	H
1-716	NP16	NP7	NP7	H	H	H	H	H	H	H
1-717	NP16	NP8	NP8	H	H	H	H	H	H	H
1-718	NP16	NP11	NP11	H	H	H	H	H	H	H
1-719	NP16	NP13	NP13	H	H	H	H	H	H	H
1-720	NP16	NP14	NP14	H	H	H	H	H	H	H
1-721	NP16	NP15	NP15	H	H	H	H	H	H	H
1-722	NP16	NP16	NP16	H	H	H	H	H	H	H
1-723	NP16	NP17	NP17	H	H	H	H	H	H	H
1-724	NP16	NP18	NP18	H	H	H	H	H	H	H
1-725	NP16	PN1	PN1	H	H	H	H	H	H	H
1-726	NP16	FL1	FL1	H	H	H	H	H	H	H
1-727	NP16	TH3	TH3	H	H	H	H	H	H	H
1-728	NP16	BT1	BT1	H	H	H	H	H	H	H
1-729	NP16	BT3	BT3	H	H	H	H	H	H	H
1-730	NP16	BT6	BT6	H	H	H	H	H	H	H
1-731	NP16	BT7	BT7	H	H	H	H	H	H	H
1-732	NP16	CZ1	CZ1	H	H	H	H	H	H	H
1-733	NP16	CZ6	CZ6	H	H	H	H	H	H	H
1-734	NP18	P1	P1	H	H	H	H	H	H	H
1-735	NP18	P2	P2	H	H	H	H	H	H	H
1-736	NP18	P4	P4	H	H	H	H	H	H	H

Table 2-17

1-737	NP18	P5	P5	H	H	H	H	H	H	H
1-738	NP18	P8	P8	H	H	H	H	H	H	H

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No.	Ar^1	Ar^2	Ar^3	R^1	R^2	R^3	R^4	R^5	R^6	R^7
1-739	NP18	BP1	BP1	H	H	H	H	H	H	H
1-740	NP18	BP2	BP2	H	H	H	H	H	H	H
1-741	NP18	BP3	BP3	H	H	H	H	H	H	H
1-742	NP18	BP4	BP4	H	H	H	H	H	H	H
1-743	NP18	BP7	BP7	H	H	H	H	H	H	H
1-744	NP18	TP1	TP1	H	H	H	H	H	H	H
1-745	NP18	TP4	TP4	H	H	H	H	H	H	H
1-746	NP18	TP12	TP12	H	H	H	H	H	H	H
1-747	NP18	TP15	TP15	H	H	H	H	H	H	H
1-748	NP18	TP16	TP16	H	H	H	H	H	H	H
1-749	NP18	TP17	TP17	H	H	H	H	H	H	H
1-750	NP18	TP18	TP18	H	H	H	H	H	H	H
1-751	NP18	QP38	QP38	H	H	H	H	H	H	H
1-752	NP18	QP39	QP39	H	H	H	H	H	H	H
1-753	NP18	QP44	QP44	H	H	H	H	H	H	H
1-754	NP18	QP45	QP45	H	H	H	H	H	H	H
1-755	NP18	QP63	QP63	H	H	H	H	H	H	H
1-756	NP18	QP64	QP64	H	H	H	H	H	H	H
1-757	NP18	NP1	NP1	H	H	H	H	H	H	H
1-758	NP18	NP3	NP3	H	H	H	H	H	H	H
1-759	NP18	NP4	NP4	H	H	H	H	H	H	H
1-760	NP18	NP5	NP5	H	H	H	H	H	H	H
1-761	NP18	NP6	NP6	H	H	H	H	H	H	H
1-762	NP18	NP7	NP7	H	H	H	H	H	H	H
1-763	NP18	NP8	NP8	H	H	H	H	H	H	H
1-764	NP18	NP11	NP11	H	H	H	H	H	H	H
1-765	NP18	NP13	NP13	H	H	H	H	H	H	H
1-766	NP18	NP14	NP14	H	H	H	H	H	H	H
1-767	NP18	NP15	NP15	H	H	H	H	H	H	H
1-768	NP18	NP16	NP16	H	H	H	H	H	H	H
1-769	NP18	NP17	NP17	H	H	H	H	H	H	H
1-770	NP18	NP18	NP18	H	H	H	H	H	H	H
1-771	NP18	PN1	PN1	H	H	H	H	H	H	H
1-772	NP18	FL1	FL1	H	H	H	H	H	H	H
1-773	NP18	TH3	TH3	H	H	H	H	H	H	H
1-774	NP18	BT1	BT1	H	H	H	H	H	H	H
1-775	NP18	BT3	BT3	H	H	H	H	H	H	H
1-776	NP18	BT6	BT6	H	H	H	H	H	H	H
1-777	NP18	BT7	BT7	H	H	H	H	H	H	H
1-778	NP18	CZ1	CZ1	H	H	H	H	H	H	H
1-779	NP18	CZ6	CZ6	H	H	H	H	H	H	H
1-780	PN1	P1	P1	H	H	H	H	H	H	H
1-781	PN1	P2	P2	H	H	H	H	H	H	H
1-782	PN1	P4	P4	H	H	H	H	H	H	H

Table 2-18

1-783	PN1	P5	P5	H	H	H	H	H	H	H
1-784	PN1	P8	P8	H	H	H	H	H	H	H
1-785	PN1	BP1	BP1	H	H	H	H	H	H	H
1-786	PN1	BP2	BP2	H	H	H	H	H	H	H
1-787	PN1	BP3	BP3	H	H	H	H	H	H	H
1-788	PN1	BP4	BP4	H	H	H	H	H	H	H
1-789	PN1	TP1	TP1	H	H	H	H	H	H	H
1-790	PN1	TP4	TP4	H	H	H	H	H	H	H
1-791	PN1	TP12	TP12	H	H	H	H	H	H	H
1-792	PN1	TP15	TP15	H	H	H	H	H	H	H
1-793	PN1	TP16	TP16	H	H	H	H	H	H	H
1-794	PN1	TP17	TP17	H	H	H	H	H	H	H
1-795	PN1	TP18	TP18	H	H	H	H	H	H	H
1-796	PN1	QP38	QP38	H	H	H	H	H	H	H
1-797	PN1	QP45	QP45	H	H	H	H	H	H	H
1-798	PN1	QP64	QP64	H	H	H	H	H	H	H
1-799	PN1	NP1	NP1	H	H	H	H	H	H	H
1-800	PN1	NP3	NP3	H	H	H	H	H	H	H
1-801	PN1	NP4	NP4	H	H	H	H	H	H	H
1-802	PN1	NP5	NP5	H	H	H	H	H	H	H
1-803	PN1	NP6	NP6	H	H	H	H	H	H	H
1-804	PN1	NP7	NP7	H	H	H	H	H	H	H
1-805	PN1	NP8	NP8	H	H	H	H	H	H	H
1-806	PN1	NP11	NP11	H	H	H	H	H	H	H
1-807	PN1	NP13	NP13	H	H	H	H	H	H	H
1-808	PN1	NP14	NP14	H	H	H	H	H	H	H
1-809	PN1	NP15	NP15	H	H	H	H	H	H	H
1-810	PN1	NP16	NP16	H	H	H	H	H	H	H

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No.	Ar^1	Ar^2	Ar^3	R^1	R^2	R^3	R^4	R^5	R^6	R^7
1-811	PN1	NP17	NP17	H	H	H	H	H	H	H
1-812	PN1	NP18	NP18	H	H	H	H	H	H	H
1-813	PN1	PN1	PN1	H	H	H	H	H	H	H
1-814	PN1	FL1	FL1	H	H	H	H	H	H	H
1-815	PN1	TH3	TH3	H	H	H	H	H	H	H
1-816	PN1	BT1	BT1	H	H	H	H	H	H	H
1-817	PN1	BT3	BT3	H	H	H	H	H	H	H
1-818	PN1	CZ1	CZ1	H	H	H	H	H	H	H
1-819	PN1	CZ6	CZ6	H	H	H	H	H	H	H
1-820	CS1	P1	P1	H	H	H	H	H	H	H
1-821	CS1	P2	P2	H	H	H	H	H	H	H
1-822	CS1	P4	P4	H	H	H	H	H	H	H
1-823	CS1	P5	P5	H	H	H	H	H	H	H
1-824	CS1	P8	P8	H	H	H	H	H	H	H
1-825	CS1	BP1	BP1	H	H	H	H	H	H	H
1-826	CS1	BP2	BP2	H	H	H	H	H	H	H
1-827	CS1	BP3	BP3	H	H	H	H	H	H	H
1-828	CS1	BP4	BP4	H	H	H	H	H	H	H

Table 2-19

1-829	CS1	TP1	TP1	H	H	H	H	H	H	H
1-830	CS1	TP4	TP4	H	H	H	H	H	H	H
1-831	CS1	TP12	TP12	H	H	H	H	H	H	H
1-832	CS1	TP15	TP15	H	H	H	H	H	H	H
1-833	CS1	TP16	TP16	H	H	H	H	H	H	H
1-834	CS1	TP17	TP17	H	H	H	H	H	H	H
1-835	CS1	TP18	TP18	H	H	H	H	H	H	H
1-836	CS1	QP38	QP38	H	H	H	H	H	H	H
1-837	CS1	QP45	QP45	H	H	H	H	H	H	H
1-838	CS1	QP64	QP64	H	H	H	H	H	H	H
1-839	CS1	NP1	NP1	H	H	H	H	H	H	H
1-840	CS1	NP3	NP3	H	H	H	H	H	H	H
1-841	CS1	NP4	NP4	H	H	H	H	H	H	H
1-842	CS1	NP5	NP5	H	H	H	H	H	H	H
1-843	CS1	NP6	NP6	H	H	H	H	H	H	H
1-844	CS1	NP7	NP7	H	H	H	H	H	H	H
1-845	CS1	NP8	NP8	H	H	H	H	H	H	H
1-846	CS1	NP11	NP11	H	H	H	H	H	H	H
1-847	CS1	NP13	NP13	H	H	H	H	H	H	H
1-848	CS1	NP14	NP14	H	H	H	H	H	H	H
1-849	CS1	NP15	NP15	H	H	H	H	H	H	H
1-850	CS1	NP16	NP16	H	H	H	H	H	H	H
1-851	CS1	NP17	NP17	H	H	H	H	H	H	H
1-852	CS1	NP18	NP18	H	H	H	H	H	H	H
1-853	CS1	PN1	PN1	H	H	H	H	H	H	H
1-854	CS1	FL1	FL1	H	H	H	H	H	H	H
1-855	CS1	TH3	TH3	H	H	H	H	H	H	H
1-856	CS1	BT1	BT1	H	H	H	H	H	H	H
1-857	CS1	BT3	BT3	H	H	H	H	H	H	H
1-858	CS1	CZ1	CZ1	H	H	H	H	H	H	H
1-859	CS1	CZ6	CZ6	H	H	H	H	H	H	H
1-860	TPL1	P1	P1	H	H	H	H	H	H	H
1-861	TPL1	P2	P2	H	H	H	H	H	H	H
1-862	TPL1	P4	P4	H	H	H	H	H	H	H
1-863	TPL1	P5	P5	H	H	H	H	H	H	H
1-864	TPL1	P8	P8	H	H	H	H	H	H	H
1-865	TPL1	BP1	BP1	H	H	H	H	H	H	H
1-866	TPL1	BP2	BP2	H	H	H	H	H	H	H
1-867	TPL1	BP3	BP3	H	H	H	H	H	H	H
1-868	TPL1	BP4	BP4	H	H	H	H	H	H	H
1-869	TPL1	TP1	TP1	H	H	H	H	H	H	H
1-870	TPL1	TP4	TP4	H	H	H	H	H	H	H
1-871	TPL1	TP12	TP12	H	H	H	H	H	H	H
1-872	TPL1	TP15	TP15	H	H	H	H	H	H	H
1-873	TPL1	TP16	TP16	H	H	H	H	H	H	H
1-874	TPL1	TP17	TP17	H	H	H	H	H	H	H

Table 2-20

1-875	TPL1	TP18	TP18	H	H	H	H	H	H	H
1-876	TPL1	QP38	QP38	H	H	H	H	H	H	H
1-877	TPL1	QP45	QP45	H	H	H	H	H	H	H
1-878	TPL1	QP64	QP64	H	H	H	H	H	H	H
1-879	TPL1	NP1	NP1	H	H	H	H	H	H	H
1-880	TPL1	NP3	NP3	H	H	H	H	H	H	H

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No.	Ar^1	Ar^2	Ar^3	R^1	R^2	R^3	R^4	R^5	R^6	R^7
1-881	TPL1	NP4	NP4	H	H	H	H	H	H	H
1-882	TPL1	NP5	NP5	H	H	H	H	H	H	H
1-883	TPL1	NP6	NP6	H	H	H	H	H	H	H
1-884	TPL1	NP7	NP7	H	H	H	H	H	H	H
1-885	TPL1	NP8	NP8	H	H	H	H	H	H	H
1-886	TPL1	NP11	NP11	H	H	H	H	H	H	H
1-887	TPL1	NP13	NP13	H	H	H	H	H	H	H
1-888	TPL1	NP14	NP14	H	H	H	H	H	H	H
1-889	TPL1	NP15	NP15	H	H	H	H	H	H	H
1-890	TPL1	NP16	NP16	H	H	H	H	H	H	H
1-891	TPL1	NP17	NP17	H	H	H	H	H	H	H
1-892	TPL1	NP18	NP18	H	H	H	H	H	H	H
1-893	TPL1	PN1	PN1	H	H	H	H	H	H	H
1-894	TPL1	FL1	FL1	H	H	H	H	H	H	H
1-895	TPL1	TH3	TH3	H	H	H	H	H	H	H
1-896	TPL1	BT1	BT1	H	H	H	H	H	H	H
1-897	TPL1	BT3	BT3	H	H	H	H	H	H	H
1-898	TPL1	CZ1	CZ1	H	H	H	H	H	H	H
1-899	TPL1	CZ6	CZ6	H	H	H	H	H	H	H
1-900	FL1	P1	P1	H	H	H	H	H	H	H
1-901	FL1	P2	P2	H	H	H	H	H	H	H
1-902	FL1	P4	P4	H	H	H	H	H	H	H
1-903	FL1	P5	P5	H	H	H	H	H	H	H
1-904	FL1	P8	P8	H	H	H	H	H	H	H
1-905	FL1	BP1	BP1	H	H	H	H	H	H	H
1-906	FL1	BP2	BP2	H	H	H	H	H	H	H
1-907	FL1	BP3	BP3	H	H	H	H	H	H	H
1-908	FL1	BP4	BP4	H	H	H	H	H	H	H
1-909	FL1	TP1	TP1	H	H	H	H	H	H	H
1-910	FL1	TP4	TP4	H	H	H	H	H	H	H
1-911	FL1	TP12	TP12	H	H	H	H	H	H	H
1-912	FL1	TP15	TP15	H	H	H	H	H	H	H
1-913	FL1	TP16	TP16	H	H	H	H	H	H	H
1-914	FL1	TP17	TP17	H	H	H	H	H	H	H
1-915	FL1	TP18	TP18	H	H	H	H	H	H	H
1-916	FL1	QP38	QP38	H	H	H	H	H	H	H
1-917	FL1	QP45	QP45	H	H	H	H	H	H	H
1-918	FL1	QP64	QP64	H	H	H	H	H	H	H
1-919	FL1	NP1	NP1	H	H	H	H	H	H	H
1-920	FL1	NP3	NP3	H	H	H	H	H	H	H

Table 2-21

1-921	FL1	NP4	NP4	H	H	H	H	H	H	H
1-922	FL1	NP5	NP5	H	H	H	H	H	H	H
1-923	FL1	NP6	NP6	H	H	H	H	H	H	H
1-924	FL1	NP7	NP7	H	H	H	H	H	H	H
1-925	FL1	NP8	NP8	H	H	H	H	H	H	H
1-926	FL1	NP11	NP11	H	H	H	H	H	H	H
1-927	FL1	NP13	NP13	H	H	H	H	H	H	H
1-928	FL1	NP14	NP14	H	H	H	H	H	H	H
1-929	FL1	NP15	NP15	H	H	H	H	H	H	H
1-930	FL1	NP16	NP16	H	H	H	H	H	H	H
1-931	FL1	NP17	NP17	H	H	H	H	H	H	H
1-932	FL1	NP18	NP18	H	H	H	H	H	H	H
1-933	FL1	PN1	PN1	H	H	H	H	H	H	H
1-934	FL1	FL1	FL1	H	H	H	H	H	H	H
1-935	FL1	TH3	TH3	H	H	H	H	H	H	H
1-936	FL1	BT1	BT1	H	H	H	H	H	H	H
1-937	FL1	BT3	BT3	H	H	H	H	H	H	H
1-938	FL1	CZ1	CZ1	H	H	H	H	H	H	H
1-939	FL1	CZ6	CZ6	H	H	H	H	H	H	H
1-940	TH3	P1	P1	H	H	H	H	H	H	H
1-941	TH3	P2	P2	H	H	H	H	H	H	H
1-942	TH3	P4	P4	H	H	H	H	H	H	H
1-943	TH3	P5	P5	H	H	H	H	H	H	H
1-944	TH3	P8	P8	H	H	H	H	H	H	H
1-945	TH3	BP1	BP1	H	H	H	H	H	H	H
1-946	TH3	BP2	BP2	H	H	H	H	H	H	H
1-947	TH3	BP3	BP3	H	H	H	H	H	H	H
1-948	TH3	BP4	BP4	H	H	H	H	H	H	H
1-949	TH3	TP1	TP1	H	H	H	H	H	H	H
1-950	TH3	TP4	TP4	H	H	H	H	H	H	H
1-951	TH3	TP12	TP12	H	H	H	H	H	H	H
1-952	TH3	TP15	TP15	H	H	H	H	H	H	H

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No.	Ar^1	Ar^2	Ar^3	R^1	R^2	R^3	R^4	R^5	R^6	R^7
1-953	TH3	TP16	TP16	H	H	H	H	H	H	H
1-954	TH3	TP17	TP17	H	H	H	H	H	H	H
1-955	TH3	TP18	TP18	H	H	H	H	H	H	H
1-956	TH3	QP38	QP38	H	H	H	H	H	H	H
1-957	TH3	QP45	QP45	H	H	H	H	H	H	H
1-958	TH3	QP64	QP64	H	H	H	H	H	H	H
1-959	TH3	NP1	NP1	H	H	H	H	H	H	H
1-960	TH3	NP3	NP3	H	H	H	H	H	H	H
1-961	TH3	NP4	NP4	H	H	H	H	H	H	H
1-962	TH3	NP5	NP5	H	H	H	H	H	H	H
1-963	TH3	NP6	NP6	H	H	H	H	H	H	H
1-964	TH3	NP7	NP7	H	H	H	H	H	H	H
1-965	TH3	NP8	NP8	H	H	H	H	H	H	H
1-966	TH3	NP11	NP11	H	H	H	H	H	H	H

Table 2-22

1-967	TH3	NP13	NP13	H	H	H	H	H	H	H
1-968	TH3	NP14	NP14	H	H	H	H	H	H	H
1-969	TH3	NP15	NP15	H	H	H	H	H	H	H
1-970	TH3	NP16	NP16	H	H	H	H	H	H	H
1-971	TH3	NP17	NP17	H	H	H	H	H	H	H
1-972	TH3	NP18	NP18	H	H	H	H	H	H	H
1-973	TH3	PN1	PN1	H	H	H	H	H	H	H
1-974	TH3	FL1	FL1	H	H	H	H	H	H	H
1-975	TH3	TH3	TH3	H	H	H	H	H	H	H
1-976	TH3	BT1	BT1	H	H	H	H	H	H	H
1-977	TH3	BT3	BT3	H	H	H	H	H	H	H
1-978	TH3	CZ1	CZ1	H	H	H	H	H	H	H
1-979	TH3	CZ6	CZ6	H	H	H	H	H	H	H
1-980	BT1	P1	P1	H	H	H	H	H	H	H
1-981	BT1	P2	P2	H	H	H	H	H	H	H
1-982	BT1	P4	P4	H	H	H	H	H	H	H
1-983	BT1	P5	P5	H	H	H	H	H	H	H
1-984	BT1	P8	P8	H	H	H	H	H	H	H
1-985	BT1	BP1	BP1	H	H	H	H	H	H	H
1-986	BT1	BP2	BP2	H	H	H	H	H	H	H
1-987	BT1	BP3	BP3	H	H	H	H	H	H	H
1-988	BT1	BP4	BP4	H	H	H	H	H	H	H
1-989	BT1	TP1	TP1	H	H	H	H	H	H	H
1-990	BT1	TP4	TP4	H	H	H	H	H	H	H
1-991	BT1	TP12	TP12	H	H	H	H	H	H	H
1-992	BT1	TP15	TP15	H	H	H	H	H	H	H
1-993	BT1	TP16	TP16	H	H	H	H	H	H	H
1-994	BT1	TP17	TP17	H	H	H	H	H	H	H
1-995	BT1	TP18	TP18	H	H	H	H	H	H	H
1-996	BT1	QP38	QP38	H	H	H	H	H	H	H
1-997	BT1	QP45	QP45	H	H	H	H	H	H	H
1-998	BT1	QP64	QP64	H	H	H	H	H	H	H
1-999	BT1	NP1	NP1	H	H	H	H	H	H	H
1-1000	BT1	NP3	NP3	H	H	H	H	H	H	H
1-1001	BT1	NP4	NP4	H	H	H	H	H	H	H
1-1002	BT1	NP5	NP5	H	H	H	H	H	H	H
1-1003	BT1	NP6	NP6	H	H	H	H	H	H	H
1-1004	BT1	NP7	NP7	H	H	H	H	H	H	H
1-1005	BT1	NP8	NP8	H	H	H	H	H	H	H
1-1006	BT1	NP11	NP11	H	H	H	H	H	H	H
1-1007	BT1	NP13	NP13	H	H	H	H	H	H	H
1-1008	BT1	NP14	NP14	H	H	H	H	H	H	H
1-1009	BT1	NP15	NP15	H	H	H	H	H	H	H
1-1010	BT1	NP16	NP16	H	H	H	H	H	H	H
1-1011	BT1	NP17	NP17	H	H	H	H	H	H	H
1-1012	BT1	NP18	NP18	H	H	H	H	H	H	H

Table 2-23

1-1013	BT1	PN1	PN1	H	H	H	H	H	H	H
1-1014	BT1	FL1	FL1	H	H	H	H	H	H	H
1-1015	BT1	TH3	TH3	H	H	H	H	H	H	H
1-1016	BT1	BT1	BT1	H	H	H	H	H	H	H
1-1017	BT1	BT3	BT3	H	H	H	H	H	H	H
1-1018	BT1	CZ1	CZ1	H	H	H	H	H	H	H
1-1019	BT1	CZ6	CZ6	H	H	H	H	H	H	H
1-1020	BT3	P1	P1	H	H	H	H	H	H	H
1-1021	BT3	P2	P2	H	H	H	H	H	H	H
1-1022	BT3	P4	P4	H	H	H	H	H	H	H

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No.	Ar^1	Ar^2	Ar^3	R^1	R^2	R^3	R^4	R^5	R^6	R^7
1-1023	BT3	P5	P5	H	H	H	H	H	H	H
1-1024	BT3	P8	P8	H	H	H	H	H	H	H
1-1025	BT3	BP1	BP1	H	H	H	H	H	H	H
1-1026	BT3	BP2	BP2	H	H	H	H	H	H	H
1-1027	BT3	BP3	BP3	H	H	H	H	H	H	H
1-1028	BT3	BP4	BP4	H	H	H	H	H	H	H
1-1029	BT3	TP1	TP1	H	H	H	H	H	H	H
1-1030	BT3	TP4	TP4	H	H	H	H	H	H	H
1-1031	BT3	TP12	TP12	H	H	H	H	H	H	H
1-1032	BT3	TP15	TP15	H	H	H	H	H	H	H
1-1033	BT3	TP16	TP16	H	H	H	H	H	H	H
1-1034	BT3	TP17	TP17	H	H	H	H	H	H	H
1-1035	BT3	TP18	TP18	H	H	H	H	H	H	H
1-1036	BT3	QP38	QP38	H	H	H	H	H	H	H
1-1037	BT3	QP45	QP45	H	H	H	H	H	H	H
1-1038	BT3	QP64	QP64	H	H	H	H	H	H	H
1-1039	BT3	NP1	NP1	H	H	H	H	H	H	H
1-1040	BT3	NP3	NP3	H	H	H	H	H	H	H
1-1041	BT3	NP4	NP4	H	H	H	H	H	H	H
1-1042	BT3	NP5	NP5	H	H	H	H	H	H	H
1-1043	BT3	NP6	NP6	H	H	H	H	H	H	H
1-1044	BT3	NP7	NP7	H	H	H	H	H	H	H
1-1045	BT3	NP8	NP8	H	H	H	H	H	H	H
1-1046	BT3	NP11	NP11	H	H	H	H	H	H	H
1-1047	BT3	NP13	NP13	H	H	H	H	H	H	H
1-1048	BT3	NP14	NP14	H	H	H	H	H	H	H
1-1049	BT3	NP15	NP15	H	H	H	H	H	H	H
1-1050	BT3	NP16	NP16	H	H	H	H	H	H	H
1-1051	BT3	NP17	NP17	H	H	H	H	H	H	H
1-1052	BT3	NP18	NP18	H	H	H	H	H	H	H
1-1053	BT3	PN1	PN1	H	H	H	H	H	H	H
1-1054	BT3	FL1	FL1	H	H	H	H	H	H	H
1-1055	BT3	TH3	TH3	H	H	H	H	H	H	H
1-1056	BT3	BT1	BT1	H	H	H	H	H	H	H
1-1057	BT3	BT3	BT3	H	H	H	H	H	H	H
1-1058	BT3	CZ1	CZ1	H	H	H	H	H	H	H

Table 2-24

1-1059	CZ1	P1	P1	H	H	H	H	H	H	H
1-1060	CZ1	P2	P2	H	H	H	H	H	H	H
1-1061	CZ1	P4	P4	H	H	H	H	H	H	H
1-1062	CZ1	P5	P5	H	H	H	H	H	H	H
1-1063	CZ1	P8	P8	H	H	H	H	H	H	H
1-1064	CZ1	BP1	BP1	H	H	H	H	H	H	H
1-1065	CZ1	BP2	BP2	H	H	H	H	H	H	H
1-1066	CZ1	BP3	BP3	H	H	H	H	H	H	H
1-1067	CZ1	BP4	BP4	H	H	H	H	H	H	H
1-1068	CZ1	TP1	TP1	H	H	H	H	H	H	H
1-1069	CZ1	TP4	TP4	H	H	H	H	H	H	H
1-1070	CZ1	TP12	TP12	H	H	H	H	H	H	H
1-1071	CZ1	TP15	TP15	H	H	H	H	H	H	H
1-1072	CZ1	TP16	TP16	H	H	H	H	H	H	H
1-1073	CZ1	TP17	TP17	H	H	H	H	H	H	H
1-1074	CZ1	TP18	TP18	H	H	H	H	H	H	H
1-1075	CZ1	QP38	QP38	H	H	H	H	H	H	H
1-1076	CZ1	QP45	QP45	H	H	H	H	H	H	H
1-1077	CZ1	QP64	QP64	H	H	H	H	H	H	H
1-1078	CZ1	NP1	NP1	H	H	H	H	H	H	H
1-1079	CZ1	NP3	NP3	H	H	H	H	H	H	H
1-1080	CZ1	NP4	NP4	H	H	H	H	H	H	H
1-1081	CZ1	NP5	NP5	H	H	H	H	H	H	H
1-1082	CZ1	NP6	NP6	H	H	H	H	H	H	H
1-1083	CZ1	NP7	NP7	H	H	H	H	H	H	H
1-1084	CZ1	NP8	NP8	H	H	H	H	H	H	H
1-1085	CZ1	NP11	NP11	H	H	H	H	H	H	H
1-1086	CZ1	NP13	NP13	H	H	H	H	H	H	H
1-1087	CZ1	NP14	NP14	H	H	H	H	H	H	H
1-1088	CZ1	NP15	NP15	H	H	H	H	H	H	H
1-1089	CZ1	NP16	NP16	H	H	H	H	H	H	H
1-1090	CZ1	NP17	NP17	H	H	H	H	H	H	H
1-1091	CZ1	NP18	NP18	H	H	H	H	H	H	H
1-1092	CZ1	PN1	PN1	H	H	H	H	H	H	H
1-1093	CZ1	FL1	FL1	H	H	H	H	H	H	H
1-1094	CZ1	TH3	TH3	H	H	H	H	H	H	H

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No.	Ar^1	Ar^2	Ar^3	R^1	R^2	R^3	R^4	R^5	R^6	R^7
1-1095	CZ1	BT1	BT1	H	H	H	H	H	H	H
1-1096	CZ1	BT3	BT3	H	H	H	H	H	H	H
1-1097	CZ1	CZ1	CZ1	H	H	H	H	H	H	H
1-1098	TP1	P1	P1	H	H	H	H	H	H	Me
1-1099	TP1	P2	P2	H	H	H	H	H	H	Me
1-1100	TP1	P4	P4	H	H	H	H	H	H	Me
1-1101	TP1	P5	P5	H	H	H	H	H	H	Me
1-1102	TP1	P8	P8	H	H	H	H	H	H	Me
1-1103	TP1	BP1	BP1	H	H	H	H	H	H	Me
1-1104	TP1	BP2	BP2	H	H	H	H	H	H	Me

Table 2-25

1-1105	TP1	BP3	BP3	H	H	H	H	H	H	Me
1-1106	TP1	BP4	BP4	H	H	H	H	H	H	Me
1-1107	TP1	BP7	BP7	H	H	H	H	H	H	Me
1-1108	TP1	TP1	TP1	H	H	H	H	H	H	Me
1-1109	TP1	TP4	TP4	H	H	H	H	H	H	Me
1-1110	TP1	TP12	TP12	H	H	H	H	H	H	Me
1-1111	TP1	TP15	TP15	H	H	H	H	H	H	Me
1-1112	TP1	TP16	TP16	H	H	H	H	H	H	Me
1-1113	TP1	TP17	TP17	H	H	H	H	H	H	Me
1-1114	TP1	TP18	TP18	H	H	H	H	H	H	Me
1-1115	TP1	QP38	QP38	H	H	H	H	H	H	Me
1-1116	TP1	QP44	QP44	H	H	H	H	H	H	Me
1-1117	TP1	QP64	QP64	H	H	H	H	H	H	Me
1-1118	TP1	NP1	NP1	H	H	H	H	H	H	Me
1-1119	TP1	NP3	NP3	H	H	H	H	H	H	Me
1-1120	TP1	NP4	NP4	H	H	H	H	H	H	Me
1-1121	TP1	NP5	NP5	H	H	H	H	H	H	Me
1-1122	TP1	NP6	NP6	H	H	H	H	H	H	Me
1-1123	TP1	NP7	NP7	H	H	H	H	H	H	Me
1-1124	TP1	NP8	NP8	H	H	H	H	H	H	Me
1-1125	TP1	NP11	NP11	H	H	H	H	H	H	Me
1-1126	TP1	NP13	NP13	H	H	H	H	H	H	Me
1-1127	TP1	NP14	NP14	H	H	H	H	H	H	Me
1-1128	TP1	NP15	NP15	H	H	H	H	H	H	Me
1-1129	TP1	NP16	NP16	H	H	H	H	H	H	Me
1-1130	TP1	NP17	NP17	H	H	H	H	H	H	Me
1-1131	TP1	NP18	NP18	H	H	H	H	H	H	Me
1-1132	TP1	PN1	PN1	H	H	H	H	H	H	Me
1-1133	TP1	FL1	FL1	H	H	H	H	H	H	Me
1-1134	TP1	TH3	TH3	H	H	H	H	H	H	Me
1-1135	TP1	BT1	BT1	H	H	H	H	H	H	Me
1-1136	TP1	BT3	BT3	H	H	H	H	H	H	Me
1-1137	TP1	BT6	BT6	H	H	H	H	H	H	Me
1-1138	TP1	BT7	BT7	H	H	H	H	H	H	Me
1-1139	TP1	CZ1	CZ1	H	H	H	H	H	H	Me
1-1140	TP16	P1	P1	H	H	H	H	H	H	Me
1-1141	TP16	P2	P2	H	H	H	H	H	H	Me
1-1142	TP16	P4	P4	H	H	H	H	H	H	Me
1-1143	TP16	P5	P5	H	H	H	H	H	H	Me
1-1144	TP16	P8	P8	H	H	H	H	H	H	Me
1-1145	TP16	BP1	BP1	H	H	H	H	H	H	Me
1-1146	TP16	BP2	BP2	H	H	H	H	H	H	Me
1-1147	TP16	BP3	BP3	H	H	H	H	H	H	Me
1-1148	TP16	BP4	BP4	H	H	H	H	H	H	Me
1-1149	TP16	BP7	BP7	H	H	H	H	H	H	Me
1-1150	TP16	TP1	TP1	H	H	H	H	H	H	Me

Table 2-26

1-1151	TP16	TP4	TP4	H	H	H	H	H	H	Me
1-1152	TP16	TP12	TP12	H	H	H	H	H	H	Me
1-1153	TP16	TP15	TP15	H	H	H	H	H	H	Me
1-1154	TP16	TP16	TP16	H	H	H	H	H	H	Me
1-1155	TP16	TP17	TP17	H	H	H	H	H	H	Me
1-1156	TP16	TP18	TP18	H	H	H	H	H	H	Me
1-1157	TP16	QP38	QP38	H	H	H	H	H	H	Me
1-1158	TP16	QP44	QP44	H	H	H	H	H	H	Me
1-1159	TP16	QP64	QP64	H	H	H	H	H	H	Me
1-1160	TP16	NP1	NP1	H	H	H	H	H	H	Me
1-1161	TP16	NP3	NP3	H	H	H	H	H	H	Me
1-1162	TP16	NP4	NP4	H	H	H	H	H	H	Me
1-1163	TP16	NP5	NP5	H	H	H	H	H	H	Me
1-1164	TP16	NP6	NP6	H	H	H	H	H	H	Me

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No.	Ar^1	Ar^2	Ar^3	R^1	R^2	R^3	R^4	R^5	R^6	R^7
1-1165	TP16	NP7	NP7	H	H	H	H	H	H	Me
1-1166	TP16	NP8	NP8	H	H	H	H	H	H	Me
1-1167	TP16	NP11	NP11	H	H	H	H	H	H	Me
1-1168	TP16	NP13	NP13	H	H	H	H	H	H	Me
1-1169	TP16	NP14	NP14	H	H	H	H	H	H	Me
1-1170	TP16	NP15	NP15	H	H	H	H	H	H	Me
1-1171	TP16	NP16	NP16	H	H	H	H	H	H	Me
1-1172	TP16	NP17	NP17	H	H	H	H	H	H	Me
1-1173	TP16	NP18	NP18	H	H	H	H	H	H	Me
1-1174	TP16	PN1	PN1	H	H	H	H	H	H	Me
1-1175	TP16	FL1	FL1	H	H	H	H	H	H	Me
1-1176	TP16	TH3	TH3	H	H	H	H	H	H	Me
1-1177	TP16	BT1	BT1	H	H	H	H	H	H	Me
1-1178	TP16	BT3	BT3	H	H	H	H	H	H	Me
1-1179	TP16	BT6	BT6	H	H	H	H	H	H	Me
1-1180	TP16	BT7	BT7	H	H	H	H	H	H	Me
1-1181	TP16	CZ1	CZ1	H	H	H	H	H	H	Me
1-1182	NP11	P1	P1	H	H	H	H	H	H	Me
1-1183	NP11	P2	P2	H	H	H	H	H	H	Me
1-1184	NP11	P4	P4	H	H	H	H	H	H	Me
1-1185	NP11	P5	P5	H	H	H	H	H	H	Me
1-1186	NP11	P8	P8	H	H	H	H	H	H	Me
1-1187	NP11	BP1	BP1	H	H	H	H	H	H	Me
1-1188	NP11	BP2	BP2	H	H	H	H	H	H	Me
1-1189	NP11	BP3	BP3	H	H	H	H	H	H	Me
1-1190	NP11	BP4	BP4	H	H	H	H	H	H	Me
1-1191	NP11	BP7	BP7	H	H	H	H	H	H	Me
1-1192	NP11	TP1	TP1	H	H	H	H	H	H	Me
1-1193	NP11	TP4	TP4	H	H	H	H	H	H	Me
1-1194	NP11	TP12	TP12	H	H	H	H	H	H	Me
1-1195	NP11	TP15	TP15	H	H	H	H	H	H	Me
1-1196	NP11	TP16	TP16	H	H	H	H	H	H	Me

Table 2-27

1-1197	NP11	TP17	TP17	H	H	H	H	H	H	Me
1-1198	NP11	TP18	TP18	H	H	H	H	H	H	Me
1-1199	NP11	QP38	QP38	H	H	H	H	H	H	Me
1-1200	NP11	QP44	QP44	H	H	H	H	H	H	Me
1-1201	NP11	QP64	QP64	H	H	H	H	H	H	Me
1-1202	NP11	NP1	NP1	H	H	H	H	H	H	Me
1-1203	NP11	NP3	NP3	H	H	H	H	H	H	Me
1-1204	NP11	NP4	NP4	H	H	H	H	H	H	Me
1-1205	NP11	NP5	NP5	H	H	H	H	H	H	Me
1-1206	NP11	NP6	NP6	H	H	H	H	H	H	Me
1-1207	NP11	NP7	NP7	H	H	H	H	H	H	Me
1-1208	NP11	NP8	NP8	H	H	H	H	H	H	Me
1-1209	NP11	NP11	NP11	H	H	H	H	H	H	Me
1-1210	NP11	NP13	NP13	H	H	H	H	H	H	Me
1-1211	NP11	NP14	NP14	H	H	H	H	H	H	Me
1-1212	NP11	NP15	NP15	H	H	H	H	H	H	Me
1-1213	NP11	NP16	NP16	H	H	H	H	H	H	Me
1-1214	NP11	NP17	NP17	H	H	H	H	H	H	Me
1-1215	NP11	NP18	NP18	H	H	H	H	H	H	Me
1-1216	NP11	PN1	PN1	H	H	H	H	H	H	Me
1-1217	NP11	FL1	FL1	H	H	H	H	H	H	Me
1-1218	NP11	TH3	TH3	H	H	H	H	H	H	Me
1-1219	NP11	BT1	BT1	H	H	H	H	H	H	Me
1-1220	NP11	BT3	BT3	H	H	H	H	H	H	Me
1-1221	NP11	BT6	BT6	H	H	H	H	H	H	Me
1-1222	NP11	BT7	BT7	H	H	H	H	H	H	Me
1-1223	NP11	CZ1	CZ1	H	H	H	H	H	H	Me
1-1224	BT1	P1	P1	H	H	H	H	H	H	Me
1-1225	BT1	P2	P2	H	H	H	H	H	H	Me
1-1226	BT1	P4	P4	H	H	H	H	H	H	Me
1-1227	BT1	P5	P5	H	H	H	H	H	H	Me
1-1228	BT1	P8	P8	H	H	H	H	H	H	Me
1-1229	BT1	BP1	BP1	H	H	H	H	H	H	Me
1-1230	BT1	BP2	BP2	H	H	H	H	H	H	Me
1-1231	BT1	BP3	BP3	H	H	H	H	H	H	Me
1-1232	BT1	BP4	BP4	H	H	H	H	H	H	Me
1-1233	BT1	BP7	BP7	H	H	H	H	H	H	Me
1-1234	BT1	TP1	TP1	H	H	H	H	H	H	Me
1-1235	BT1	TP4	TP4	H	H	H	H	H	H	Me
1-1236	BT1	TP12	TP12	H	H	H	H	H	H	Me

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No.	Ar^1	Ar^2	Ar^3	R^1	R^2	R^3	R^4	R^5	R^6	R^7
1-1237	BT1	TP15	TP15	H	H	H	H	H	H	Me
1-1238	BT1	TP16	TP16	H	H	H	H	H	H	Me
1-1239	BT1	TP17	TP17	H	H	H	H	H	H	Me
1-1240	BT1	TP18	TP18	H	H	H	H	H	H	Me
1-1241	BT1	QP38	QP38	H	H	H	H	H	H	Me
1-1242	BT1	QP44	QP44	H	H	H	H	H	H	Me

Table 2-28

1-1243	BT1	QP64	QP64	H	H	H	H	H	H	Me
1-1244	BT1	NP1	NP1	H	H	H	H	H	H	Me
1-1245	BT1	NP3	NP3	H	H	H	H	H	H	Me
1-1246	BT1	NP4	NP4	H	H	H	H	H	H	Me
1-1247	BT1	NP5	NP5	H	H	H	H	H	H	Me
1-1248	BT1	NP6	NP6	H	H	H	H	H	H	Me
1-1249	BT1	NP7	NP7	H	H	H	H	H	H	Me
1-1250	BT1	NP8	NP8	H	H	H	H	H	H	Me
1-1251	BT1	NP11	NP11	H	H	H	H	H	H	Me
1-1252	BT1	NP13	NP13	H	H	H	H	H	H	Me
1-1253	BT1	NP14	NP14	H	H	H	H	H	H	Me
1-1254	BT1	NP15	NP15	H	H	H	H	H	H	Me
1-1255	BT1	NP16	NP16	H	H	H	H	H	H	Me
1-1256	BT1	NP17	NP17	H	H	H	H	H	H	Me
1-1257	BT1	NP18	NP18	H	H	H	H	H	H	Me
1-1258	BT1	PN1	PN1	H	H	H	H	H	H	Me
1-1259	BT1	FL1	FL1	H	H	H	H	H	H	Me
1-1260	BT1	TH3	TH3	H	H	H	H	H	H	Me
1-1261	BT1	BT1	BT1	H	H	H	H	H	H	Me
1-1262	BT1	BT3	BT3	H	H	H	H	H	H	Me
1-1263	BT1	BT6	BT6	H	H	H	H	H	H	Me
1-1264	BT1	BT7	BT7	H	H	H	H	H	H	Me
1-1265	BT1	CZ1	CZ1	H	H	H	H	H	H	Me
1-1266	BT3	P1	P1	H	H	H	H	H	H	Me
1-1267	BT3	P2	P2	H	H	H	H	H	H	Me
1-1268	BT3	P4	P4	H	H	H	H	H	H	Me
1-1269	BT3	P5	P5	H	H	H	H	H	H	Me
1-1270	BT3	P8	P8	H	H	H	H	H	H	Me
1-1271	BT3	BP1	BP1	H	H	H	H	H	H	Me
1-1272	BT3	BP2	BP2	H	H	H	H	H	H	Me
1-1273	BT3	BP3	BP3	H	H	H	H	H	H	Me
1-1274	BT3	BP4	BP4	H	H	H	H	H	H	Me
1-1275	BT3	BP7	BP7	H	H	H	H	H	H	Me
1-1276	BT3	TP1	TP1	H	H	H	H	H	H	Me
1-1277	BT3	TP4	TP4	H	H	H	H	H	H	Me
1-1278	BT3	TP12	TP12	H	H	H	H	H	H	Me
1-1279	BT3	TP15	TP15	H	H	H	H	H	H	Me
1-1280	BT3	TP16	TP16	H	H	H	H	H	H	Me
1-1281	BT3	TP17	TP17	H	H	H	H	H	H	Me
1-1282	BT3	TP18	TP18	H	H	H	H	H	H	Me
1-1283	BT3	QP38	QP38	H	H	H	H	H	H	Me
1-1284	BT3	QP44	QP44	H	H	H	H	H	H	Me
1-1285	BT3	QP64	QP64	H	H	H	H	H	H	Me
1-1286	BT3	NP1	NP1	H	H	H	H	H	H	Me
1-1287	BT3	NP3	NP3	H	H	H	H	H	H	Me
1-1288	BT3	NP4	NP4	H	H	H	H	H	H	Me

Table 2-29

1-1289	BT3	NP5	NP5	H	H	H	H	H	H	Me
1-1290	BT3	NP6	NP6	H	H	H	H	H	H	Me
1-1291	BT3	NP7	NP7	H	H	H	H	H	H	Me
1-1292	BT3	NP8	NP8	H	H	H	H	H	H	Me
1-1293	BT3	NP11	NP11	H	H	H	H	H	H	Me
1-1294	BT3	NP13	NP13	H	H	H	H	H	H	Me
1-1295	BT3	NP14	NP14	H	H	H	H	H	H	Me
1-1296	BT3	NP15	NP15	H	H	H	H	H	H	Me
1-1297	BT3	NP16	NP16	H	H	H	H	H	H	Me
1-1298	BT3	NP17	NP17	H	H	H	H	H	H	Me
1-1299	BT3	NP18	NP18	H	H	H	H	H	H	Me
1-1300	BT3	PN1	PN1	H	H	H	H	H	H	Me
1-1301	BT3	FL1	FL1	H	H	H	H	H	H	Me
1-1302	BT3	TH3	TH3	H	H	H	H	H	H	Me
1-1303	BT3	BT1	BT1	H	H	H	H	H	H	Me
1-1304	BT3	BT3	BT3	H	H	H	H	H	H	Me
1-1305	BT3	BT6	BT6	H	H	H	H	H	H	Me
1-1306	BT3	BT7	BT7	H	H	H	H	H	H	Me

-continued

No.	Ar^1	Ar^2	Ar^3	R^1	R^2	R^3	R^4	R^5	R^6	R^7
1-1307	BT3	CZ1	CZ1	H	H	H	H	H	H	Me
1-1308	CZ1	P2	P2	H	H	H	H	H	H	Me
1-1309	CZ1	P4	P4	H	H	H	H	H	H	Me
1-1310	CZ1	P5	P5	H	H	H	H	H	H	Me
1-1311	CZ1	P8	P8	H	H	H	H	H	H	Me
1-1312	CZ1	BP1	BP1	H	H	H	H	H	H	Me
1-1313	CZ1	BP2	BP2	H	H	H	H	H	H	Me
1-1314	CZ1	BP3	BP3	H	H	H	H	H	H	Me
1-1315	CZ1	BP4	BP4	H	H	H	H	H	H	Me
1-1316	CZ1	BP7	BP7	H	H	H	H	H	H	Me
1-1317	CZ1	TP1	TP1	H	H	H	H	H	H	Me
1-1318	CZ1	TP4	TP4	H	H	H	H	H	H	Me
1-1319	CZ1	TP12	TP12	H	H	H	H	H	H	Me
1-1320	CZ1	TP15	TP15	H	H	H	H	H	H	Me
1-1321	CZ1	TP16	TP16	H	H	H	H	H	H	Me
1-1322	CZ1	TP17	TP17	H	H	H	H	H	H	Me
1-1323	CZ1	TP18	TP18	H	H	H	H	H	H	Me
1-1324	CZ1	QP38	QP38	H	H	H	H	H	H	Me
1-1325	CZ1	QP44	QP44	H	H	H	H	H	H	Me
1-1326	CZ1	QP64	QP64	H	H	H	H	H	H	Me
1-1327	CZ1	NP1	NP1	H	H	H	H	H	H	Me
1-1328	CZ1	NP3	NP3	H	H	H	H	H	H	Me
1-1329	CZ1	NP4	NP4	H	H	H	H	H	H	Me
1-1330	CZ1	NP5	NP5	H	H	H	H	H	H	Me
1-1331	CZ1	NP6	NP6	H	H	H	H	H	H	Me
1-1332	CZ1	NP7	NP7	H	H	H	H	H	H	Me
1-1333	CZ1	NP8	NP8	H	H	H	H	H	H	Me
1-1334	CZ1	NP11	NP11	H	H	H	H	H	H	Me

Table 2-30

1-1335	CZ1	NP13	NP13	H	H	H	H	H	H	Me
1-1336	CZ1	NP14	NP14	H	H	H	H	H	H	Me
1-1337	CZ1	NP15	NP15	H	H	H	H	H	H	Me
1-1338	CZ1	NP16	NP16	H	H	H	H	H	H	Me
1-1339	CZ1	NP17	NP17	H	H	H	H	H	H	Me
1-1340	CZ1	NP18	NP18	H	H	H	H	H	H	Me
1-1341	CZ1	PN1	PN1	H	H	H	H	H	H	Me
1-1342	CZ1	FL1	FL1	H	H	H	H	H	H	Me
1-1343	CZ1	TH3	TH3	H	H	H	H	H	H	Me
1-1344	CZ1	BT1	BT1	H	H	H	H	H	H	Me
1-1345	CZ1	BT3	BT3	H	H	H	H	H	H	Me
1-1346	CZ1	BT6	BT6	H	H	H	H	H	H	Me
1-1347	CZ1	BT7	BT7	H	H	H	H	H	H	Me
1-1348	CZ1	CZ1	CZ1	H	H	H	H	H	H	Me
1-1349	P2	P2	P2	H	H	H	H	H	H	Me
1-1350	P2	P4	P4	H	H	H	H	H	H	Me
1-1351	P2	P5	P5	H	H	H	H	H	H	Me
1-1352	P2	P8	P8	H	H	H	H	H	H	Me
1-1353	P2	BP1	BP1	H	H	H	H	H	H	Me
1-1354	P2	BP2	BP2	H	H	H	H	H	H	Me
1-1355	P2	BP3	BP3	H	H	H	H	H	H	Me
1-1356	P2	BP4	BP4	H	H	H	H	H	H	Me
1-1357	P2	BP7	BP7	H	H	H	H	H	H	Me
1-1358	P2	TP1	TP1	H	H	H	H	H	H	Me
1-1359	P2	TP4	TP4	H	H	H	H	H	H	Me
1-1360	P2	TP12	TP12	H	H	H	H	H	H	Me
1-1361	P2	TP15	TP15	H	H	H	H	H	H	Me
1-1362	P2	TP16	TP16	H	H	H	H	H	H	Me
1-1363	P2	TP17	TP17	H	H	H	H	H	H	Me
1-1364	P2	TP18	TP18	H	H	H	H	H	H	Me
1-1365	P2	QP38	QP38	H	H	H	H	H	H	Me
1-1366	P2	QP44	QP44	H	H	H	H	H	H	Me
1-1367	P2	QP64	QP64	H	H	H	H	H	H	Me
1-1368	P2	NP1	NP1	H	H	H	H	H	H	Me
1-1369	P2	NP3	NP3	H	H	H	H	H	H	Me
1-1370	P2	NP4	NP4	H	H	H	H	H	H	Me
1-1371	P2	NP5	NP5	H	H	H	H	H	H	Me
1-1372	P2	NP6	NP6	H	H	H	H	H	H	Me
1-1373	P2	NP7	NP7	H	H	H	H	H	H	Me
1-1374	P2	NP8	NP8	H	H	H	H	H	H	Me
1-1375	P2	NP11	NP11	H	H	H	H	H	H	Me
1-1376	P2	NP13	NP13	H	H	H	H	H	H	Me
1-1377	P2	NP14	NP14	H	H	H	H	H	H	Me
1-1378	P2	NP15	NP15	H	H	H	H	H	H	Me

-continued

No.	Ar^1	Ar^2	Ar^3	R^1	R^2	R^3	R^4	R^5	R^6	R^7
1-1379	P2	NP16	NP16	H	H	H	H	H	H	Me
1-1380	P2	NP17	NP17	H	H	H	H	H	H	Me

Table 2-31

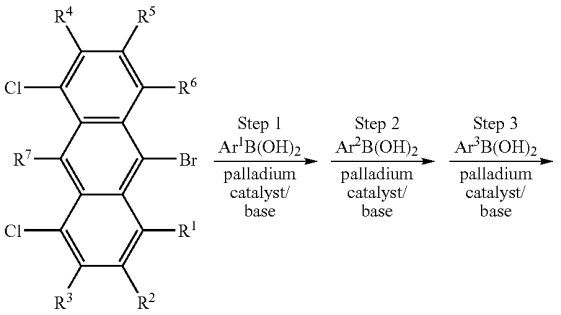
1-1381	P2	NP18	NP18	H	H	H	H	H	H	Me
1-1382	P2	PN1	PN1	H	H	H	H	H	H	Me
1-1383	P2	FL1	FL1	H	H	H	H	H	H	Me
1-1384	P2	TH3	TH3	H	H	H	H	H	H	Me
1-1385	P2	BT1	BT1	H	H	H	H	H	H	Me
1-1386	P2	BT3	BT3	H	H	H	H	H	H	Me
1-1387	P2	BT6	BT6	H	H	H	H	H	H	Me
1-1388	P2	BT7	BT7	H	H	H	H	H	H	Me
1-1389	P2	CZ1	CZ1	H	H	H	H	H	H	Me
1-1390	TP1	IN1	IN1	H	H	H	H	H	H	H
1-1391	TP1	PY1	PY1	H	H	H	H	H	H	H
1-1392	TP1	PY2	PY2	H	H	H	H	H	H	H
1-1393	TP1	PY3	PY3	H	H	H	H	H	H	H
1-1394	TP1	QN1	QN1	H	H	H	H	H	H	H
1-1395	TP1	QN2	QN2	H	H	H	H	H	H	H
1-1396	TP1	QN3	QN3	H	H	H	H	H	H	H
1-1397	NP11	IN1	IN1	H	H	H	H	H	H	H
1-1398	NP11	PY1	PY1	H	H	H	H	H	H	H
1-1399	NP11	PY2	PY2	H	H	H	H	H	H	H
1-1400	NP11	PY3	PY3	H	H	H	H	H	H	H
1-1401	NP11	QN1	QN1	H	H	H	H	H	H	H
1-1402	NP11	QN2	QN2	H	H	H	H	H	H	H
1-1403	NP11	QN3	QN3	H	H	H	H	H	H	H
1-1404	TP1	P1	NP1	H	H	H	H	H	H	H
1-1405	TP1	P1	NP11	H	H	H	H	H	H	H
1-1406	TP1	BP2	NP1	H	H	H	H	H	H	H
1-1407	TP1	BP2	NP11	H	H	H	H	H	H	H
1-1408	NP11	P1	NP1	H	H	H	H	H	H	H
1-1409	NP11	P1	NP11	H	H	H	H	H	H	H
1-1410	NP11	BP2	NP1	H	H	H	H	H	H	H
1-1411	NP11	BP2	NP11	H	H	H	H	H	H	H
1-1412	TP1	P1	NP1	H	H	H	H	H	H	Me
1-1413	TP1	P1	NP11	H	H	H	H	H	H	Me
1-1414	TP1	BP2	NP1	H	H	H	H	H	H	Me
1-1415	TP1	BP2	NP11	H	H	H	H	H	H	Me
1-1416	NP11	P1	NP1	H	H	H	H	H	H	Me
1-1417	NP11	P1	NP11	H	H	H	H	H	H	Me
1-1418	NP11	BP2	NP1	H	H	H	H	H	H	Me
1-1419	NP11	BP2	NP11	H	H	H	H	H	H	Me
1-1420	NP11	TP1	TP1	H	t-Bu	H	H	H	H	H
1-1421	NP11	TP1	TP1	H	Me	H	H	H	H	H
1-1422	NP11	TP1	TP1	H	TPM	H	H	H	H	H
1-1423	NP11	TP1	TP1	H	PO	H	H	H	H	H
1-1424	NP11	TP1	TP1	H	CY	H	H	H	H	H
1-1425	NP11	TP1	TP1	H	Me	H	H	Me	H	H
1-1426	NP11	TP1	TP1	H	t-Bu	H	H	t-Bu	H	H

[0077] Among the specific examples described above, the preferred emission materials are compounds represented by (1-1), (1-15), (1-38), (1-102), (1-107), (1-113), (1-115), (1-153), (1-157), (1-158), (1-159), (1-163), (1-179), (1-185), (1-193), (1-206), (1-215), (1-216), (1-220), (1-221), (1-222), (1-225), (1-240), (1-246), (1-254), (1-259), (1-267), (1-268), (1-277), (1-295), (1-303), (1-310), (1-314), (1-315), (1-324), (1-331), (1-344), (1-351), (1-367), (1-372), (1-373), (1-376), (1-412), (1-413), (1-414), (1-418), (1-419), (1-422), (1-426), (1-435), (1-442), (1-459), (1-460), (1-464), (1-465), (1-468), (1-481), (1-488), (1-495), (1-505), (1-506), (1-510), (1-527), (1-534), (1-551), (1-552), (1-556), (1-573), (1-580), (1-597), (1-598), (1-601), (1-602), (1-603), (1-606), (1-619), (1-625), (1-626), (1-630), (1-636), (1-637), (1-642), (1-643), (1-644), (1-648), (1-649), (1-665), (1-672), (1-689), (1-690), (1-694), (1-695), (1-698), (1-711), (1-718), (1-735), (1-736), (1-740), (1-741), (1-757), (1-764), (1-781), (1-782), (1-786), (1-789), (1-799), (1-806), (1-981), (1-982), (1-989), (1-999), (1-1006), (1-1022), (1-1029), (1-1039), (1-1046), (1-1060), (1-1061), (1-1065), (1-1068), (1-1078), (1-1085), (1-1095), (1-1096), (1-1099), (1-1100), (1-1108), (1-1125), (1-1141), (1-1142), (1-1167), (1-1183), (1-1184), (1-1192), (1-1209), (1-1225), (1-1226), (1-1251), (1-1267), (1-1268), (1-1293), (1-1308), (1-1309), (1-1327), (1-1334), (1-1349), (1-1350), (1-1358), (1-1368), and (1-1375).

[0078] The more preferred emission materials are compounds represented by (1-15), (1-163), (1-179), (1-185), (1-193), (1-221), (1-277), (1-295), (1-303), (1-331), (1-372), (1-373), (1-376), (1-412), (1-413), (1-418), (1-419), (1-422), (1-426), (1-435), (1-442), (1-459), (1-464), (1-468), (1-488), (1-510), (1-534), (1-556), (1-580), (1-597), (1-601), (1-602), (1-603), (1-606), (1-625), (1-626), (1-630), (1-643), (1-648), (1-665), (1-698), (1-718), (1-735), (1-740), (1-741), (1-764), (1-1060), (1-1065), (1-1068), (1-1078), (1-1085), (1-1099), (1-1108), (1-1183), (1-1192), (1-1209), (1-1308), (1-1334), (1-1349), (1-1358) and (1-1375).

[0079] Further preferred emission materials are compounds represented by (1-163), (1-179), (1-331), (1-376), (1-412), (1-413), (1-418), (1-419), (1-422), (1-459), (1-464), (1-468), (1-556), (1-597), (1-606), (1-626), (1-648), (1-764), (1-1060), (1-1068), (1-1085), (1-1108), (1-1192), (1-1209), (1-1308), (1-1334), (1-1358) and (1-1375).

[0080] The emission material of the present invention can be synthesized by making use of known synthetic processes such as Suzuki coupling reaction. The Suzuki coupling reaction is a process in which aromatic halide is subjected to coupling with aromatic boric acid using a palladium catalyst in the presence of a base. A reaction route for obtaining the emission material (1) by the above process is shown in the following example:



(1)

In the above formula, the codes of R^1 to R^7 and Ar^1 to Ar^3 are defined in the manners described above.

[0081] The examples of the palladium catalyst used in the above reaction are $Pd(PPh_3)_4$, $PdCl_2(PPh_3)_2$, $Pd(OAc)_2$, tris (dibenzylideneacetone)dipalladium (0) and tris(dibenzylideneacetone)dipalladium chloroform complex (0). A phosphine compound may be added, if necessary, to the above palladium compounds in order to accelerate the reaction. The examples of the phosphine compound are tri(tert-butyl)phosphine, tricyclohexyl phosphine, 1-(N,N-dimethylaminomethyl)-2-(di-tert-butylphosphino)ferrocene, 1-(N,N-dibutylaminomethyl)-2-(di-tert-butylphosphino)-ferrocene, 1-(methoxymethyl)-2-(di-tert-butylphosphino)ferrocene, 1,1'-bis(di-tert-butylphosphino)ferrocene, 2,2'-bis(di-tert-butylphosphino)-1,1'-binaphthyl, 2-methoxy-2'-(di-tert-bu-

tylphosphino)-1,1'-binaphthyl and 2-dicyclohexylphosphino-2',6'-dimethoxybiphenyl. The examples of the base used in the above reaction are sodium carbonate, potassium carbonate, cesium carbonate, sodium hydrogencarbonate, sodium hydroxide, potassium hydroxide, barium hydroxide, sodium ethoxide, sodium tert-butoxide, sodium acetate, tripotassium phosphate and potassium fluoride. Further, the examples of the solvent used in the above reaction are benzene, toluene, xylene, N,N-dimethylformamide, tetrahydrofuran, diethyl ether, tert-butyl methyl ether, 1,4-dioxane, methanol, ethanol and isopropyl alcohol. The above solvents can suitably be selected according to the structures of the aromatic halide and the aromatic boric acid which are reacted. The solvents may be used alone or in the form of a mixed solvent.

[0082] The emission material of the present invention is a compound having strong fluorescent color in a solid state and can be used for emission of various colors, and it is particularly suited for emission of blue color. The emission material of the present invention has asymmetric molecular structure, and therefore it is liable to form an amorphous state in producing an organic EL device. The emission material of the present invention is excellent in heat resistance and stable as well in applying an electric field. Because of the reasons described above, the emission material of the present invention is excellent as an emission material for a field emission type device.

[0083] The emission material of the present invention has emission wavelength falling in wide range from short blue color extending to pure blue color, and therefore it is effective as a blue color host or a blue color dopant. Further, it can be used for a host emission material other than those of blue color. In particular, the emission material of the present invention is excellent as a blue color host. If the emission material of the present invention is used as a host material, energy transfer is efficiently carried out, and an emission device having high efficiency and long life is obtained.

[0084] The second present invention is an organic EL device in which an emission layer comprises the emission material of the present invention represented by Formula (1). The organic EL device of the present invention not only has high efficiency and long life but also has low drive voltage and high durability in storing and driving.

[0085] The organic EL device of the present invention has structures of various modes. Fundamentally, it comprises multilayer structure in which at least a hole transport layer, an emission layer and an electron transport layer are sandwiched between an anode and a cathode. The examples of the specific constitutions of the device are (1) anode/hole transport layer/emission layer/electron transport layer/cathode, (2) anode/hole injection layer/hole transport layer/emission layer/electron transport layer/cathode and (3) anode/hole injection layer/hole transport layer/emission layer/electron transport layer/electron injection layer/cathode.

[0086] The emission material of the present invention has high quantum efficiency, hole injection ability, hole transport ability, electron injection ability and electron transport ability, and therefore it can effectively be used as an emission material for an emission layer. In the organic EL device of the present invention, an emission layer can be formed from the emission material alone of the present invention. In the organic EL device of the present invention, combination of the emission material of the present invention with other emission materials makes it possible to improve emission luminance and emission efficiency and obtain emission of blue color, green color, red color and white color. In this case, the organic EL device of the present invention can contain the emission material of the present invention not only as a host but also as a dopant.

[0087] Other emission materials which can be used for the emission layer together with the emission material of the present invention are emission materials described in "Forefront in Full-scale Practical Use of Organic EL Display" (2002), p. 125 to 132, edited by Investigation and Research Section of Toray Research Center and published by Asahi High-Speed Print Co., Ltd. and emission materials described in p. 153 to 156 and triplet materials described in p. 170 to 172 of "Organic EL Materials and Displays" (2001), supervised by J. Kido and published by CMC Co., Ltd.

[0088] Compounds which can be used as the other emission materials are polycyclic aromatic compounds, hetero aromatic compounds, organic metal complexes, coloring matters, polymeric emission materials, styryl derivatives, coumarin derivatives, borane derivatives, oxazine derivatives, compounds having a spiro ring, oxadiazole derivatives and fluorene derivatives. The examples of the polycyclic aromatic compounds are anthracene derivatives, phenanthrene derivatives, naphthacene derivatives, pyrene derivatives, chrysene derivatives, perylene derivatives, coronene derivatives and rubrene derivatives. The examples of the heteroaromatic compounds are oxadiazole derivatives having a dialkylamino group or a diarylamino group, pyrazoloquinoline derivatives, pyridine derivatives, pyran derivatives, phenanthroline derivatives, silole derivatives, thiophene derivatives having a triphenylamine group and quinacridone derivatives. The examples of the organic metal complexes are complexes of zinc, aluminum, beryllium, europium, terbium, dysprosium, iridium and platinum with quinolinol derivatives, benzoxazole derivatives, benzothiazole derivatives, oxadiazole derivatives, thiadiazole derivatives, phenylpyridine derivatives, phenylbenzimidazole derivatives, pyrrole derivatives, pyridine derivatives and phenanthroline derivatives. The examples of the coloring matters include coloring matters such as xanthene derivatives, polymethine derivatives, porphyrin derivatives, coumarin derivatives, dicyanomethylenepyran derivatives, dicyanomethylenethiopyran derivatives, oxobenzanthracene derivatives, carbostyryl derivatives, perylene derivatives, benzoxazole derivatives, benzothiazole derivatives and benzimiazole derivatives. The examples of the polymeric emission materials are polyparaphenylvinylene derivatives, polythiophene derivatives, polyvinylcarbazole derivatives, polysilane derivatives, polyfluorene derivatives and polyparaphenylene derivatives. The examples of the styryl derivatives are amine-containing styryl derivatives and styrylarylene derivatives.

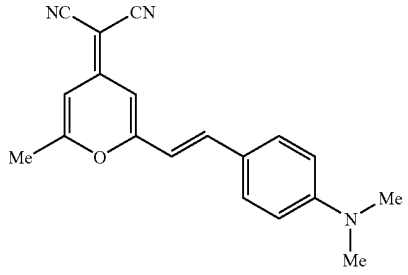
[0089] A dopant in using the emission material of the present invention as a blue color host is preferably perylene derivatives, amine-containing styryl derivatives, coumarin derivatives, borane derivatives, pyran derivatives, iridium complexes or platinum complexes. The examples of the perylene derivative are 3,10-bis(2,6-dimethylphenyl) perylene, 3,10-bis(2,4,6-trimethylphenyl)perylene, 3,10-diphenylperylene, 3,4-diphenylperylene, 2,5,8,11-tetra-tert-butylperylene, 3,4,9,10-tetraphenylperylene, 3-(1'-pyrenyl)-8,11-di(tert-butyl)perylene, 3-(9'-anthryl)-8,11-di(tert-butyl) perylene and 3,3'-bis(8,11-di(tert-butyl)perylenyl). The examples of the borane derivative are 1,8-diphenyl-10-(di-

mesitylboryl)anthracene, 9-phenyl-10-(dimethylboryl)anthracene, 4-(9'-anthryl)dimesitylborylnaphthalne, 4-(10'-phenyl-9'-anthryl)dimesitylborylnaphthalne, 9-(dimesitylboryl)anthracene, 9-(4'-biphenylyl)-10-(dimesitylboryl)anthracene and 9-(4'-(N-carbazolyl)phenyl)-10-(dimesitylboryl)anthracene. The examples of the coumarin derivative are coumarin-6 and coumarin-334.

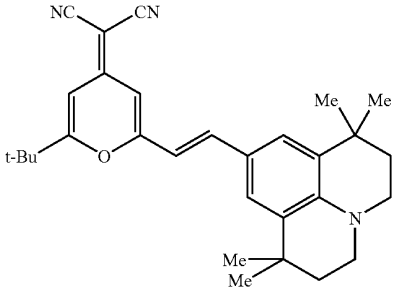
[0090] The examples of the amine-containing styryl derivative are N,N,N',N'-tetra(4-biphenylyl)-4,4'-diaminostilbene, N,N,N',N'-tetra(1-naphthyl)-4,4'-diaminostilbene, N,N,N',N'-tetra(2-naphthyl)-4,4'-diaminostilbene, N,N'-di(2-naphthyl)-N,N'-diphenyl-4,4'-diaminostilbene, N,N'-di(9-phenanthryl)-N,N'-diphenyl-4,4'-diaminostilbene, 4,4'-bis[4"-bis(diphenylamino)styryl]-biphenyl, 1,4-bis[4'-bis(diphenylamino)styryl]-benzene, 2,7-bis[4'-bis(diphenylamino)styryl]-9,9-dimethylfluorene, 4,4'-bis(9-ethyl-3-carbazovinylene)-biphenyl and 4,4'-bis(9-phenyl-3-carbazovinylene)-biphenyl.

[0091] The examples of the pyran derivative are DCM and DCJTB shown below:

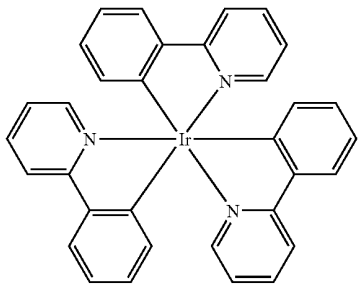
DCM



DCJTB

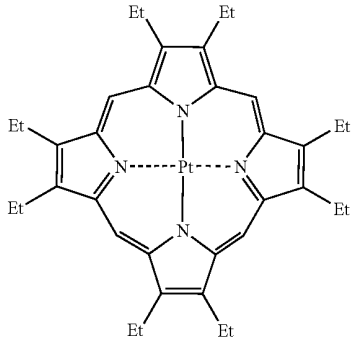


[0092] The examples of the iridium complex are $Ir(ppy)_3$ shown below and the like:



$Ir(ppy)_3$

[0093] The examples of the platinum complex are PtOEP shown below and the like:



PtOEP

[0094] A host in using the emission material of the present invention as a blue color dopant is preferably anthracene derivatives, distyrylarylene derivatives, pyrene derivatives or fluorene derivatives. The examples of the anthracene derivative are 9-(2-naphthyl)-10-(3,5-diphenylphenyl)anthracene, 9-(1-naphthyl)-10-(3,5-diphenylphenyl)anthracene, 9-(2-naphthyl)-10-[3,5-di(2-naphthyl)phenyl]anthracene, 9-(2-naphthyl)-10-[3,5-di(1-naphthyl)phenyl]anthracene, 9-(1-naphthyl)-10-[3,5-di(2-naphthyl)phenyl]anthracene, 9-(1-naphthyl)-10-[3,5-di(1-naphthyl)phenyl]anthracene, 9,10-di(2-naphthyl)anthracene, 9,10-di(1-naphthyl)anthracene, 9,10-di(9-phenanthryl)anthracene, 9,10-bis(9,9-dimethyl-2-fluorenyl)anthracene, 2,3,6,7-tetramethyl-9,10-di(2-naphthyl)anthracene, 2,3,6,7-tetramethyl-9,10-di(1-naphthyl)anthracene, 2-tert-butyl-9,10-di(2-naphthyl)anthracene, 2-tert-butyl-9,10-di(1-naphthyl)anthracene, 9,10-bis[2-(2-naphthyl)phenyl]anthracene, 9,10-bis[2-(1-naphthyl)phenyl]anthracene, 9,10-bis[3,5-di(2-naphthyl)phenyl]anthracene, 9,10-bis[3,5-di(1-naphthyl)phenyl]anthracene, 9,10-bis(3,5-diphenylphenyl)anthracene, 9,10-bis[4-(3,5-diphenylphenyl)phenyl]anthracene, 9,10-bis[4-(2-naphthyl)phenyl]anthracene, 9,10-bis[4-(2,2-diphenylvinyl)phenyl]anthracene, 10,10'-bis(3,5-diphenylphenyl)-[9,9']-bianthryl, 9,9',10,10'-tetraphenyl-[2,2']-bianthryl, 9,9',10,10'-tetra(2-biphenylyl)-[2,2']-bianthryl, 9,9',10,10'-tetra(3-biphenylyl)-[2,2']-bianthryl, 9,9',10,10'-tetra(4-biphenylyl)-[2,2']-bianthryl, 9,9',10,10'-tetra(2-naphthyl)-[2,2']-bianthryl and 9,9',10,10'-tetra(1-naphthyl)-[2,2']-bianthryl.

[0095] The examples of the distyrylarylene derivative are 4,4'-bis(2,2-diphenylvinyl)-biphenyl, 4,4'-bis[2,2-di(m-tolyl)vinyl]-biphenyl, 4,4'-bis(triphenylvinyl)-biphenyl, 4,4'-bis[2,2-bis-(4-tert-butylphenyl)vinyl]-biphenyl, 4,4'-bis[2-(4-tert-butylphenyl)-2-phenylvinyl]-biphenyl, 4,4'-bis[2,2-di(2-naphthyl)vinyl]-biphenyl, 4,4'-bis[2,2-di(1-naphthyl)vinyl]-biphenyl and 4,4'-bis(2,2-diphenylvinyl)-[1,1']binaphthyl.

[0096] The examples of the pyrene derivative are 1-[3,5-di(2-naphthyl)phenyl]pyrene, 1,4-di(1-pyrenyl)benzene, 1,3,5-tri(1-pyrenyl)benzene, 1,4-di(1-pyrenyl)naphthalene and 2,6-di(1-pyrenyl)naphthalene.

[0097] The examples of the fluorene derivative are 1,3,5-tris(9,9-dimethyl-2-fluorenyl)benzene, 1,2,4,5-tetrakis(9,9-

dimethyl-2-fluorenyl)benzene, 1,4-bis(9,9-dimethyl-2-fluorenyl)naphthalene and 2,6-bis(9,9-dimethyl-2-fluorenyl) naphthalene.

[0098] Those optionally selected from compounds which can be used as an electron transport compound in a photoconductive material and compounds which can be used for an electron injection layer and an electron transport layer in an organic EL device can be used as an electron transport material and an electron injection material which are used for the organic EL device of the present invention.

[0099] The examples of the above electron transport compound are quinolinol base metal complexes, pyridine derivatives, phenanthroline derivatives, diphenylquinone derivatives, perylene derivatives, oxadiazole derivatives, thiophene derivatives, triazole derivatives, thiadiazole derivatives, metal complexes of oxine derivatives, quinoxaline derivatives, polymers of quinoxaline derivatives, benzoxazole compounds, gallium complexes, pyrazole derivatives, perfluorinated phenylene derivatives, triazine derivatives, pyrazine derivatives, benzoquinoline derivatives, imidazopyridine derivatives and borane derivatives.

[0100] The preferred examples of the electron transport compound are quinolinol base metal complexes, pyridine derivatives or phenanthroline derivatives. The examples of the quinolinol base metal complexes are tris(8-hydroxyquinoline)aluminum (hereinafter abbreviated as ALQ), bis (10-hydroxybenzo[h]quinoline)beryllium, tris(4-methyl-8-hydroxyquinoline)aluminum and bis(2-methyl-8-hydroxyquinoline)-(4-phenylphenol)aluminum. The examples of the pyridine derivatives are 2,5-bis(6'-(2',2"-bipyridyl)-1,1-dimethyl-3,4-diphenylsilol (hereinafter abbreviated as PyPySPyPy), 9,10-di(2',2"-bipyridyl)anthracene, 2,5-di(2',2"-bipyridyl)thiophene and 2,5-di(31,2"-bipyridyl) thiophene and 6',6"-di(2-pyridyl)2,2':4':,3":2",2"'-quaterpyridine. The examples of the phenanthroline derivatives are 4,7-diphenyl-1,10-phenanthroline, 2,9-dimethyl-4,7-diphenyl-1,10-phenanthroline, 9,10-di(1,10-phenanthroline-2-yl) anthracene, 2,6-di(1,10-phenanthroline-5-yl)pyridine, 1,3,5-tri(1,10-phenanthroline-5-yl)benzene and 9,9'-bis(1,10-phenanthroline-5-yl). In particular, use of the phenanthroline derivatives for the electron transport layer or the electron injection layer makes it possible to realize the low voltage and the high efficiency.

[0101] Optional compounds selected from compounds which have so far conventionally been used as an electron transport material for a hole in a photoconductive material and publicly known compounds which are used for a hole injection layer and a hole transport layer in an organic EL device can be used as a hole injection material and a hole transport material which are used for the organic EL device of the present invention. The examples thereof are carbazole derivatives, triarylamine derivatives and phthalocyanine derivatives. The examples of the carbazole derivatives are N-phenylcarbazole and polyvinylcarbazole. The examples of the triarylamine derivatives are polymers having aromatic tertiary amine in a principal chain or a side chain, 1,1-bis(4-di-p-tolylaminophenyl)cyclohexane, N,N'-diphenyl-N,N'-di (3-methylphenyl)-4,4'-diaminobiphenyl, N,N'-diphenyl-N, N'-dinaphthyl-4,4'-diaminobiphenyl (hereinafter abbreviated as NPD), 4,4',4"-tris{N-(3-methylphenyl)-N-phenylamino}triphenylamine and star burst amine derivatives. The examples of the phthalocyanine derivatives are non-metal phthalocyanine and copper phthalocyanine.

[0102] The respective layers constituting the organic EL device of the present invention can be formed by making thin films from materials to constitute the respective layers by a vapor deposition method, a spin cast method or a cast method. A film thickness of the respective layers thus formed shall not specifically be restricted and can suitably be set up according to the properties, and it falls in range of usually 2 nm to 5000 nm. The vapor deposition method is preferably adopted as a method for forming a thin film from the emission material in terms of the points that a homogeneous film is liable to be obtained and that pinholes are less liable to be formed. When the vapor deposition method is used to form a thin film, the vapor deposition conditions are varied depending on the kind of the emission material and a crystal structure and an aggregate structure which are targeted by a molecular cumulative film. The vapor deposition conditions are preferably set up in the ranges of usually boat heating temperature of 50 to 400° C., vacuum degree of 10^{-6} to 10^{-3} Pa, deposition speed of 0.01 to 50 nm/second, substrate temperature of −150 to +300° C. and film thickness of 5 nm to 5 μm.

[0103] The organic EL device of the present invention is preferably supported by a substrate in any of the structures described above. The substrate may be any one as long as it has mechanical strength, heat stability and transparency, and glass and transparent plastic film can be used. Metals, alloys, electroconductive compounds and mixtures thereof each having work function of larger than 4 eV can be used for the anode material. The examples thereof are metals such as Au and the like, CuI, indium tin oxide (hereinafter abbreviated as ITO), SnO_2 and ZnO.

[0104] Metals, alloys, electroconductive compounds and mixtures thereof each having work function of smaller than 4 eV can be used for the cathode material. The examples thereof are aluminum, calcium, magnesium, lithium, magnesium alloys and aluminum alloys. The examples of the alloys are aluminum/lithium fluoride, aluminum/lithium, magnesium/silver and magnesium/indium. At least one of the electrodes has preferably a light transmittance set to 10% or more in order to efficiently take out emission from the organic EL device. The electrodes are preferably controlled to sheet resistance of several hundred O/square or less. The film thickness is set, though depending on the properties of the electrode material, in range of usually 10 nm to 1 μm, preferably 10 to 400 nm. Such electrodes can be produced by forming thin films from the electrode substances described above by vapor deposition and sputtering.

[0105] Next, a method for preparing an organic EL device comprising anode/hole injection layer/hole transport layer/emission material of the present invention+dopant (emission layer)/electron transport layer/cathode each described above shall be explained as one example of methods for preparing an organic EL device using the emission material of the present invention. A thin film of an anode material is formed on a suitable substrate by a vapor deposition method to prepare an anode, and then the thin films of a hole injection layer and a hole transport layer are formed on the above anode. The emission material of the present invention and a dopant are codeposited thereon to form a thin film to thereby obtain an emission layer, and an electron transport layer is formed on the above emission layer. Further, a thin film comprising a material for a cathode is formed thereon by a vapor deposition method to prepare a cathode, whereby the intended organic EL device is obtained. In preparing the organic EL device described above, it can be prepared in the order of a cathode,

an electron transport layer, an emission layer, a hole transport layer, a hole injection layer and an anode by upsetting the preparing order.

[0106] The emission material and the dopant are co-deposited by known method. That is, the substrate is mounted at an upper part of a vacuum bath, and two evaporation sources are mounted at a lower part thereof. The materials are evaporated from two evaporation sources at the same time, whereby both materials are deposited on the substrate while mixing. In this case, a partition board is disposed between two evaporation sources, and film thickness monitors are installed respectively in the vicinity of the substrate and the vicinity of the respective evaporation sources. A film having a desired mixed proportion can be obtained by evaporating the respective materials at a determined evaporation rate at the same time. Since the partition board is present between the evaporation sources, the film thickness monitors installed in the vicinity of the respective evaporation sources do not detect molecules evaporated from the other evaporation source, and therefore this is used to detect the respective evaporation rates. The film thickness monitor installed in the vicinity of the substrate detects molecules evaporated from both evaporation sources, and therefore this is used to always detect the piled film thickness, whereby the film having a desired film thickness can be formed on the substrate. Co-deposition in the present invention shall not be restricted to the method described above and can be carried out by known methods. The principle of co-deposition is disclosed as dual source deposition method in, for example, chapter 9.2 (p. 153) of Optical Technique Series II, Optical Thin Film (second edition), published on Oct. 10, 1986, Kyoritsu Shuppan Co., Ltd. The outline of practical apparatus is disclosed as an organic polymer deposition synthetic apparatus in, for example, third part, chapter 1, clause 1 (FIG. 8 at page 125) of Light-Thin Film Technical Manual (enlarged and revised edition), published on Aug. 31, 1992, The Optronics Co., Ltd. Further, a production method for an organic co-deposited film is disclosed in JP H14-76027 A/2002. Application to production of an organic EL device is disclosed in, for example, C. W. Tang, S. A. Van Slyke and C. H. Chen, J. Appl. Phys. 65 (9), 3610 to 3616, (1989).

[0107] When applying DC voltage to the organic +EL device thus obtained, it is applied with the polarity of the anode set to + and that of the cathode set to −, and when applying voltage of 2 to 40 V, emission can be observed from the transparent or translucent electrode sides (anode or cathode and both). Also, when applying AC voltage to the above organic EL device, emission is observed as well. The waveform of the alternating current applied may be optional.

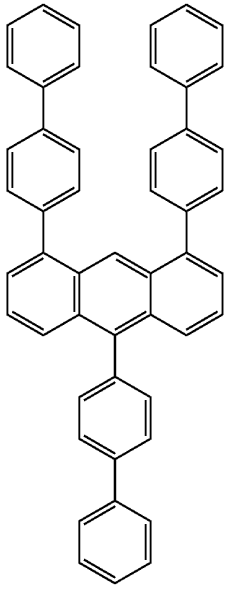
[0108] The present invention shall be explained in further details with reference to examples.

Example 1

Synthesis of Compound (1-277)

[0109] 10-Bromo-1,8-dichloroanthracene 3.26 g and 4-biphenylboronic acid 14.9 g were dissolved in 100 ml of N,N-dimethylformamide under nitrogen atmosphere, and $Pd(OAc)_2$ 0.34 g and 2-dicyclohexylphosphino-2',6'-dimethoxybiphenyl 1.2 g were added thereto and stirred for one minute. Then, 19.1 g of tripotassium phosphate was added thereto and heated at 100° C. for 6 hours. After finishing heating, the reaction liquid was cooled down, and 200 ml of water was added thereto. A solid matter was filtered off and washed with water and methanol to obtain 6.2 g of a crude product. Then, it was extracted by Soxhlet method using 300 ml of toluene to obtain 4.5 g of the targeted product. The structure of the compound (1-277) was confirmed by MS spectrum and NMR measurement. Melting point: 351° C. (measuring equipment: Diamond DSC (manufactured by Perkin-Elmer Co., Ltd.); measuring conditions: cooling rate 200° C./min. and heating rate 10° C./min.)

(1-277)



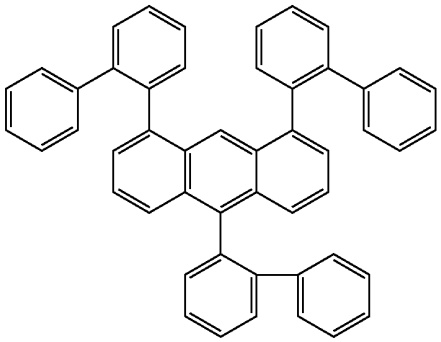
Example 2

Synthesis of Compound (1-373)

[0110] 10-Bromo-1,8-dichloroanthracene 3.26 g and 2-biphenylboronic acid 14.9 g were dissolved in 100 ml of N,N-dimethylformamide under nitrogen atmosphere, and $Pd(OAc)_2$ 0.34 g and 2-dicyclohexylphosphino-2',6'-dimethoxybiphenyl 1.2 g were added thereto and stirred for one minute. Then, 19.1 g of tripotassium phosphate was added thereto and heated at 100° C. for 12 hours. After finishing heating, the reaction liquid was cooled down, and 200 ml of water was added thereto. A solid matter was filtered off and washed with water and methanol to obtain 5.9 g of crude product. Then, it was subjected to column refining (solvent: heptane/toluene=3/1) with silica gel, and then 1.8 g of the targeted compound was obtained. The structure of the compound (1-373) was confirmed by an MS spectrum and NMR measurement. The other physical properties are shown below.

Glass transition temperature: 91° C.; melting point: 229° C. (measuring equipment: Diamond DSC (manufactured by Perkin-Elmer Co., Ltd.); measuring conditions: cooling rate 200° C./min. and heating rate 10° C./min.)

(1-373)



Example 3

Synthesis of Compound (1-412)

[0111] 10-Bromo-1,8-dichloroanthracene 3.26 g and m-terphenyl-5'-boronic acid 2.74 g were dissolved in 100 ml of mixed solvent of toluene and ethanol (toluene/ethanol=4/1) under nitrogen atmosphere, and 0.58 g of tetrakis(triphenylphosphine)palladium (0) was added thereto and stirred for 5 minutes. Then, 10 ml of 2M sodium carbonate aqueous solution was added thereto, and the solution was refluxed for 8 hours. After finishing heating, the reaction liquid was cooled to separate an organic layer, and it was washed with saturated brine and then dried on anhydrous magnesium sulfate. A solid matter obtained by removing the drying agent and distilling the solvent off under reduced pressure was subjected to column refining (solvent: heptane/toluene=3/1) with silica gel, and then 4.6 g of an intermediate compound 1,8-dichloro-10-(m-terphenyl-5'-yl)anthracene was obtained.

[0112] Tris(dibenzylideneacetone)dipalladium (0) 0.266 g and tri-tert-butylphosphine 0.117 g were dissolved in 50 ml of 1,4-dioxane, and 4.6 g of 1,8-dichloro-10-(m-terphenyl-5'-yl)anthracene described above, 3.54 g of phenylboronic acid and 3.7 g of potassium fluoride each were added thereto, followed by heating the mixture at 90° C. for 90 hours. After finishing heating, the reaction liquid was cooled down and subjected to short column with silica gel (solvent:toluene). Thereafter, it was subjected to column refining (solvent:heptane/toluene=2/1) with silica gel, and then 3.6 g of the targeted compound was obtained. The structure of the compound (1-412) was confirmed by MS spectrum and NMR measurement. The other physical properties are shown below. Glass transition temperature (Tg): 108° C.; melting point: 257° C. (measuring equipment: Diamond DSC (manufactured by Perkin-Elmer Co., Ltd.); measuring conditions: cooling rate 200° C./min. and heating rate 10° C./min.)

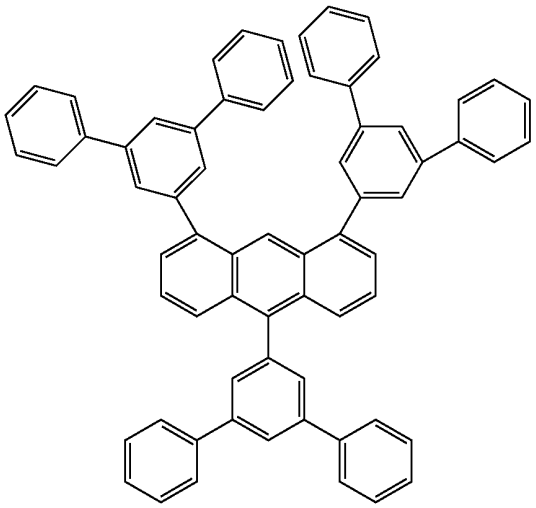
Example 4

Synthesis of Compound (1-422)

[0113] 10-Bromo-1,8-dichloroanthracene 3.26 g and m-terphenyl-5'-boronic acid 20.56 g were dissolved in 100 ml of N,N-dimethylformamide under nitrogen atmosphere, and $Pd(OAc)_2$ 0.34 g and 2-dicyclohexylphosphino-2',6'-dimethoxybiphenyl 1.2 g were added thereto and stirred for one minute. Then, 19.1 g of tripotassium phosphate was added thereto and heated at 100° C. for 8 hours. After finishing heating, the reaction liquid was cooled down, and 200 ml of water was added thereto. A solid matter was filtered off and washed with water and methanol to obtain 8.5 g of a crude product. Thereafter, it was subjected to column refining (solvent: heptane/toluene=2/1) with silica gel, and then 6.2 g of the targeted compound was obtained. The structure of the compound (1-422) was confirmed by MS spectrum and NMR measurement. The other physical properties are shown below.

Glass transition temperature: 145° C.; melting point: 307° C. (measuring equipment: Diamond DSC (manufactured by Perkin-Elmer Co., Ltd.); measuring conditions: cooling rate 200° C./min. and heating rate 10° C./min.)

(1-422)



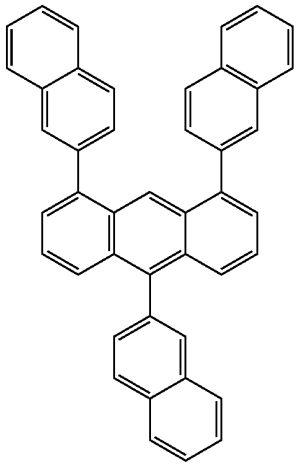
Example 5

Synthesis of Compound (1-626)

[0114] 10-Bromo-1,8-dichloroanthracene 3.26 g and 2-naphthaleneboronic acid 12.9 g were dissolved in 100 ml of N,N-dimethylformamide under nitrogen atmosphere, and $Pd(OAc)_2$ 0.34 g and 2-dicyclohexylphosphino-2',6'-dimethoxybiphenyl 1.2 g were added thereto and stirred for one minute. Then, 19.1 g of tripotassium phosphate was added thereto and heated at 100° C. for 4 hours. After finishing heating, the reaction liquid was cooled down, and 200 ml of water was added thereto. A solid matter was filtered off and washed with water and methanol to obtain 5.5 g of a crude product. Thereafter, it was subjected to column refining (solvent: heptane/toluene=2/1) with silica gel, and then 4.2 g of the targeted compound was obtained. The structure of the compound (1-626) was confirmed by an MS spectrum and NMR measurement. The other physical properties are shown below.

Glass transition temperature: 109° C.; melting point: 277° C. (measuring equipment: Diamond DSC (manufactured by Perkin-Elmer Co., Ltd.); measuring conditions: cooling rate 200° C./min. and heating rate 10° C./min.)

(1-626)



[0115] Suited selection of the compounds which are the raw materials makes it possible to synthesize the other emission materials of the present invention by a method corresponding to the synthetic example described above.

Example 6

[0116] A glass substrate (manufactured by Tokyo Sanyo Vacuum Co., Ltd.) of 26 mm×28 mm×0.7 mm on which ITO was deposited in a thickness of 150 nm was used for a transparent supporting substrate. This transparent supporting substrate was fixed on a substrate holder of a commercial vacuum deposition apparatus (manufactured by ULVAC KIKO Inc.), and installed therein were a molybdenum-made boat source for deposition containing copper phthalocyanine, a molybdenum-made boat source for deposition containing NPD, a molybdenum-made boat source for deposition containing the compound (1-412), a molybdenum-made boat source for deposition containing ALQ, a molybdenum-made boat source for deposition containing lithium fluoride and a tungsten-made boat source for deposition containing aluminum. A pressure of the vacuum chamber was reduced down to 1×10^{-3} Pa, and the boat source for deposition containing copper phthalocyanine was heated to deposit copper phthalocyanine so that a film thickness of 20 nm was obtained to thereby form a hole injection layer. Then, the boat source for deposition containing NDP was heated to deposit NDP so that a film thickness of 30 nm was obtained to thereby form a hole transport layer. Next, the molybdenum-made boat source for deposition containing the compound (1-412) was heated to deposit the compound (1-412) so that a film thickness of 35 nm was obtained to thereby form an emission layer. Then, the boat source for deposition containing ALQ was heated to deposit ALQ so that a film thickness of 15 nm was obtained to thereby form an electron transport layer. The above deposit rates were 0.1 to 0.2 nm/second. Thereafter, the boat source for deposition containing lithium fluoride was heated to deposit lithium fluoride at a deposit rate of 0.003 to 0.01 nm/second so that a film thickness of 0.5 nm was obtained, and then the boat source for deposition containing aluminum was heated to deposit aluminum at a deposit rate of 0.2 to 0.5 nm/second so that a film thickness of 100 nm was obtained, whereby an organic EL device was obtained. A DC voltage of about 4.8 V was applied with the ITO electrode set to an anode and the lithium fluoride/aluminum electrode set to a cathode, and a current of about 4 mA/cm^2 passed to obtain emission of blue color having emission efficiency of 2.5 μm/W and wavelength of 434 nm. Further, the half lifetime of the device was 200 hours at an initial luminance of 1000 cd/m^2 when it was driven at a constant current of 50 mA/cm^2.

Example 7

[0117] An organic EL device was obtained by a method corresponding to Example 6, except that ALQ used for the electron transport layer in Example 6 was changed to PyPySPyPy. A DC voltage of about 3 V was applied with the ITO electrode set to an anode and the lithium fluoride/aluminum electrode set to a cathode, and a current of about 3 mA/cm^2 passed to obtain emission of blue color having emission efficiency of 3.6 μm/W and wavelength of 436 nm. Further, the half lifetime of the device was 160 hours at an initial luminance of 1500 cd/m^2 when it was driven at a constant current of 50 mA/cm^2.

Example 8

[0118] A glass substrate (manufactured by Tokyo Sanyo Vacuum Co., Ltd.) of 26 mm×28 mm×0.7 mm on which ITO was deposited in a thickness of 150 nm was used for a transparent supporting substrate. This transparent supporting substrate was fixed on a substrate holder of a commercial vacuum deposition apparatus (manufactured by ULVAC KIKO, Inc.), and installed therein were a molybdenum-made boat source for deposition containing copper phthalocyanine, a molybdenum-made boat source for deposition containing NPD, a molybdenum-made boat source for deposition containing the compound (1-412), a molybdenum-made boat source for deposition containing 3,10-bis(2,6-dimethylphenyl) perylene, a molybdenum-made boat source for deposition containing ALQ, a molybdenum-made boat source for deposition containing lithium fluoride and a tungsten-made boat source for deposition containing aluminum. A pressure of the vacuum chamber was reduced down to 1×10^{-3} Pa, and the boat source for deposition containing copper phthalocyanine was heated to deposit copper phthalocyanine so that a film thickness of 20 nm was obtained to thereby form a hole injection layer. Then, the boat source for deposition containing NDP was heated to deposit NDP so that a film thickness of 30 nm was obtained to thereby form a hole transport layer. Next, the molybdenum-made boat source for deposition containing the compound (1-412) and the molybdenum-made boat source for deposition containing 3,10-bis(2,6-dimethylphenyl)perylene were heated to codeposit both compounds so that a film thickness of 35 nm was obtained to thereby form an emission layer. In this case, a doping concentration of 3,10-bis(2,6-dimethylphenyl)perylene was about 1% by weight. Then, the boat source for deposition containing ALQ was heated to deposit ALQ so that a film thickness of 15 nm was obtained to thereby form an electron transport layer. The above deposit rates were 0.1 to 0.2 nm/second. Thereafter, the boat source for deposition containing lithium fluoride was heated to deposit lithium fluoride at a deposit rate of 0.003 to 0.01 nm/second so that a film thickness of 0.5 nm was obtained, and then the boat source for deposition containing aluminum was heated to deposit aluminum at a deposit rate of 0.2 to 0.5 nm/second so that a film thickness of 100 nm was obtained, whereby an organic EL device was obtained. A DC

voltage of about 4.5 V was applied with the ITO electrode set to an anode and the lithium fluoride/aluminum electrode set to a cathode, and a current of about 1.9 mA/cm^2 passed to obtain emission of blue color having emission efficiency of 4 μm/W and wavelength of 469 nm. Further, the half lifetime of the device was 350 hours at an initial luminance of 1850 cd/m^2 when it was driven at a constant current of 50 mA/cm^2.

Example 9

[0119] An organic EL device was obtained by a method corresponding to Example 8, except that 3,10-bis(2,6-dimethylphenyl)perylene used for the dopant in Example 8 was changed to N,N,N',N'-tetra(4-biphenylyl)-4,4'-diaminostilbene. A DC voltage of about 4.5 V was applied with the ITO electrode set to an anode and the lithium fluoride/aluminum electrode set to a cathode, and a current of about 1.3 mA/cm^2 passed to obtain emission of blue color having emission efficiency of 5.3 μm/W and wavelength of 480 nm. Further, the half lifetime of the device was 300 hours at an initial luminance of 3100 cd/m^2 when it was driven at a constant current of 50 mA/cm^2.

Example 10

[0120] An organic EL device was obtained by a method corresponding to Example 9, except that the compound (1-412) used in Example 9 was changed to the compound (1-422). A DC voltage of about 4.7 V was applied with the ITO electrode set to an anode and the lithium fluoride/aluminum electrode set to a cathode, and a current of about 1.7 mA/cm^2 passed to obtain emission of blue color having emission efficiency of 5.0 μm/W and wavelength of 479 nm. Further, the half lifetime of the device was 280 hours at an initial luminance of 3000 cd/m^2 when it was driven at a constant current of 50 mA/cm^2.

Example 11

[0121] An organic EL device was obtained by a method corresponding to Example 8, except that ALQ used for the electron transport layer in Example 8 was changed to PyPySPyPy. A DC voltage of about 3 V was applied with the ITO electrode set to an anode and the lithium fluoride/aluminum electrode set to a cathode, and a current of about 1 mA/cm^2 passed to obtain emission of blue color having emission efficiency of 6 μm/W and wavelength of 468 nm. Further, the half lifetime of the device was 250 hours at an initial luminance of 2600 cd/m^2 when it was driven at a constant current of 50 mA/cm^2.

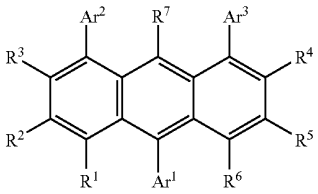
Example 12

[0122] A glass substrate (manufactured by Tokyo Sanyo Vacuum Co., Ltd.) of 26 mm×28 mm×0.7 mm on which ITO was deposited in a thickness of 150 nm was used for a transparent supporting substrate. This transparent supporting substrate was fixed on a substrate holder of a commercial vacuum deposition apparatus (manufactured by ULVAC KIKO, Inc.), and installed therein were a molybdenum-made boat source for deposition containing copper phthalocyanine, a molybdenum-made boat source for deposition containing NPD, a molybdenum-made boat source for deposition containing 9-(2-naphthyl)-10-(3,5-diphenylphenyl)anthracene, a molybdenum-made boat source for deposition containing the compound (1-412), a molybdenum-made boat source for deposition containing ALQ, a molybdenum-made boat source for deposition containing lithium fluoride and a tungsten-made boat source for deposition containing aluminum. A pressure of the vacuum chamber was reduced down to 1×10^{-3} Pa, and the boat source for deposition containing copper phthalocyanine was heated to deposit copper phthalocyanine so that a film thickness of 20 nm was obtained to thereby form a hole injection layer. Then, the boat source for deposition containing NDP was heated to deposit NDP so that a film thickness of 30 nm was obtained to thereby form a hole transport layer. Next, the molybdenum-made boat source for deposition containing 9-(2-naphthyl)-10-(3,5-diphenylphenyl)anthracene and the molybdenum-made boat source for deposition containing the compound (1-412) were heated to codeposit both compounds so that a film thickness of 35 nm was obtained to thereby form an emission layer. In this case, a doping concentration of the compound (1-412) was about 1% by weight. Then, the boat source for deposition containing ALQ was heated to deposit ALQ so that a film thickness of 15 nm was obtained to thereby form an electron transport layer. The above deposit rates were 0.1 to 0.2 nm/second. Thereafter, the boat source for deposition containing lithium fluoride was heated to deposit lithium fluoride at a deposit rate of 0.003 to 0.01 nm/second so that a film thickness of 0.5 nm was obtained, and then the boat source for deposition containing aluminum was heated to deposit aluminum at a deposit rate of 0.2 to 0.5 nm/second so that a film thickness of 100 nm was obtained, whereby an organic EL device was obtained. A DC voltage of about 4.7 V was applied with the ITO electrode set to an anode and the lithium fluoride/aluminum electrode set to a cathode, and a current of about 3.9 mA/cm^2 passed to obtain emission of blue color having emission efficiency of 3 μm/W and wavelength of 435 nm. Further, the half lifetime of the device was 210 hours at an initial luminance of 1300 cd/m^2 when it was driven at a constant current of 50 mA/cm^2.

INDUSTRIAL APPLICABILITY

[0123] The emission material of the present invention is excellent in emission of blue color. Use of this emission material makes it possible to obtain an organic EL device having high emission efficiency, low drive voltage, excellent heat resistance and long life. A display unit having high performance such as display of full color can be prepared by using the organic EL device of the present invention.

1. An emission material represented by the following Formula (1):



(1)

wherein R^1 to R^7 are independently hydrogen, alkyl having 1 to 24 carbon atoms or cycloalkyl having 3 to 24 carbon atoms; optional —CH_2— in the above alkyl having 1 to 24 carbon atoms may be replaced by —O—, and

optional —CH_2— other than —CH_2— directly bonded to the anthracene ring may be replaced by arylene having 6 to 24 carbon atoms;

optional hydrogens in the above cycloalkyl having 3 to 24 carbon atoms may be replaced by alkyl having 1 to 24 carbon atoms or aryl having 6 to 50 carbon atoms;

Ar^1 is one selected from the group consisting of non-condensed aryl having 6 to 50 carbon atoms, 2-naphthyl, 9-phenanthryl, 6-chrysenyl, 2-triphenylenyl, 2-fluorenyl, 9-carbazolyl, 2-thienyl and 2-benzothienyl;

optional hydrogens in the above groups may be replaced by alkyl having 1 to 24 carbon atoms, cycloalkyl having 3 to 12 carbon atoms, aryl having 6 to 24 carbon atoms or heteroaryl; optional —CH_2— in the above alkyl having 1 to 24 carbon atoms may be replaced by —O—, and optional —CH_2— other than —CH_2— directly bonded to the above groups may be replaced by arylene having 6 to 24 carbon atoms; optional hydrogens in the above cycloalkyl having 3 to 24 carbon atoms may be replaced by alkyl having 1 to 24 carbon atoms or aryl having 6 to 24 carbon atoms; optional hydrogens in the above aryl having 6 to 24 carbon atoms may be replaced by alkyl having 1 to 12 carbon atoms, cycloalkyl having 3 to 12 carbon atoms or aryl having 6 to 24 carbon atoms, and optional hydrogens in the above heteroaryl may be replaced by alkyl having 1 to 12 carbon atoms, cycloalkyl having 3 to 12 carbon atoms or aryl having 6 to 24 carbon atoms; and

Ar^2 and Ar^3 are independently non-condensed aryl having 6 to 50 carbon atoms, condensed aryl having 10 to 50 carbon atoms or heteroaryl.

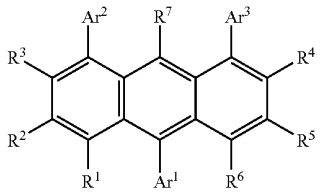
2. The emission material as described in claim **1**, wherein R^1 to R^7 are independently hydrogen, methyl or tert-butyl, and Ar^1 is non-condensed aryl having 6 to 50 carbon atoms.

3. The emission material as described in claim **1**, wherein R^1 to R^7 are independently hydrogen, methyl or tert-butyl, and Ar^1 is phenyl, biphenylyl, terphenylyl or quaterphenylyl.

4. The emission material as described in claim **1**, wherein R^1 to R^7 are independently hydrogen, methyl or tert-butyl, and Ar^1 is 2-naphthyl, 9-phenanthryl, 6-chrysenyl, 2-triphenylenyl, 2-fluorenyl, 9-carbazolyl, 2-thienyl or 2-benzothienyl.

5. An emission material represented by the following Formula (1):

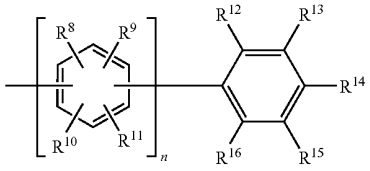
(1)



wherein R^1 to R^7 are independently hydrogen, methyl or tert-butyl, and Ar^1 is non-condensed aryl represented by Formula (2);

Ar^2 and Ar^3 are independently phenyl, 4-tert-butylphenyl, 4-(9-carbazolyl)phenyl, 2-biphenylyl, 3-biphenylyl, 4-biphenylyl, m-terphenyl-5'-yl, 3,5-di(2-naphthyl) phenyl, p-quaterphenyl-3'-yl, m-quaterphenyl-3-yl, o-quaterphenyl-2-yl, 1-naphthyl, 4-phenyl-1-naphthyl, 4-(9-carbazolyl)-1-naphthyl, 2-naphthyl, 6-(m-terphenyl-5'-yl)-2-naphthyl, 6-(2-naphthyl)-2-naphthyl, 9-phenanthryl, 2-benzothienyl or 3-phenyl-2-benzothienyl;

(2)



wherein n is an integer of 0 to 8;

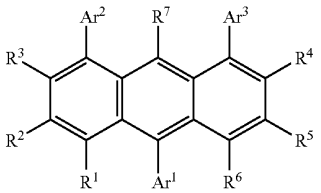
R^8 to R^{16} are independently hydrogen, alkyl having 1 to 24 carbon atoms, cycloalkyl having 3 to 24 carbon atoms, aryl having 6 to 24 carbon atoms or heteroaryl; optional —CH_2— in the above alkyl having 1 to 24 carbon atoms may be replaced by —O—, and optional —CH_2— other than —CH_2— directly bonded to the benzene ring may be replaced by arylene having 6 to 24 carbon atoms; optional hydrogens in the above cycloalkyl having 3 to 24 carbon atoms may be replaced by alkyl having 1 to 24 carbon atoms or aryl having 6 to 24 carbon atoms; optional hydrogens in the above aryl having 6 to 24 carbon atoms may be replaced by alkyl having 1 to 24 carbon atoms, cycloalkyl having 3 to 24 carbon atoms or aryl having 6 to 24 carbon atoms; and optional hydrogens in the above heteroaryl may be replaced by alkyl having 1 to 12 carbon atoms, cycloalkyl having 3 to 12 carbon atoms or aryl having 6 to 24 carbon atoms.

6. The emission material as described in claim **5**, wherein Ar^1 is phenyl, biphenylyl, terphenylyl or quaterphenylyl in which optional hydrogens may be replaced by methyl, tert-butyl, phenyl, 2-naphthyl, 1-naphthyl, 2-benzothienyl, 3-phenyl-2-benzothienyl or 9-carbazolyl.

7. The emission material as described in claim **5**, wherein Ar^1 is phenyl, 2-biphenylyl, 3-biphenylyl, 4-biphenylyl, m-terphenyl-5'-yl, m-quaterphenyl-3-yl or o-quaterphenyl-3-yl in which optional hydrogens may be replaced by methyl, tert-butyl, phenyl, 2-naphthyl, 1-naphthyl, 2-benzothienyl, 3-phenyl-2-benzothienyl or 9-carbazolyl.

8. An emission material represented by the following Formula (1):

(1)



wherein R^1 to R^7 are independently hydrogen, methyl or tert-butyl;

Ar^1 is 2-naphthyl, 9-phenanthryl, 6-chrysenyl, 2-triphenylenyl, 2-fluorenyl, 9-carbazolyl, 2-thienyl or 2-benzothienyl in which optional hydrogens may be replaced by methyl, tert-butyl, phenyl, m-terphenyl-5'-yl, 2-naphthyl, 1-naphthyl, 2-benzothienyl, 3-phenyl-2-benzothienyl or 9-carbazolyl; and

Ar^2 and Ar^3 are independently phenyl, 4-tert-butylphenyl, 4-(9-carbazolyl)phenyl, 2-biphenylyl, 3-biphenylyl, 4-biphenylyl, m-terphenyl-5'-yl, 3,5-di(2-naphthyl) phenyl, p-quaterphenyl-3'-yl, m-quaterphenyl-3-yl, o-quaterphenyl-2-yl, 1-naphthyl, 4-phenyl-1-naphthyl, 4-(9-carbazolyl)-1-naphthyl, 2-naphthyl, 6-(m-terphenyl-5'-yl)-2-naphthyl, 6-(2-naphthyl)-2-naphthyl, 9-phenanthryl, 2-benzothienyl or 3-phenyl-2-benzothienyl.

9. The emission material as described in claim **5**, wherein Ar^1 is one selected from phenyl, 4-tert-butylphenyl and 4-(9-carbazolyl)phenyl.

10. The emission material as described in claim **5**, wherein Ar^1 is one selected from 2-biphenylyl, 3-biphenylyl and 4-biphenylyl.

11. The emission material as described in claim **5**, wherein Ar^1 is m-terphenyl-5'-yl.

12. The emission material as described in claim **5**, wherein Ar^1 is 3,5-di(2-naphthyl)phenyl.

13. The emission material as described in claim **5**, wherein Ar^1 is m-quaterphenyl-3-yl or o-quaterphenyl-3-yl.

14. The emission material as described in claim **8**, wherein Ar^1 is one selected from 2-naphthyl, 6-(m-terphenyl-5'-yl)-2-naphthyl, 6-(2-naphthyl)-2-naphthyl and 6-(9-carbazolyl)-2-naphthyl.

15. The emission material as described in claim **8**, wherein Ar^1 is 9-phenanthryl.

16. The emission material as described in claim **8**, wherein Ar^1 is 9-carbazolyl.

17. The emission material as described in claim **8**, wherein Ar^1 is 2-benzothienyl or 3-phenyl-2-benzothienyl.

18. The emission material as described in any of claims **9** to **17**, wherein R^1 to R^6 are hydrogens; R^7 is hydrogen or methyl; and Ar^2 and Ar^3 are one selected from phenyl, 4-tert-butylphenyl and 4-(9-carbazolyl)phenyl.

19. The emission material as described in any of claims **9** to **17**, wherein R^1 to R^6 are hydrogens; R^7 is hydrogen or methyl; and Ar^2 and Ar^3 are one selected from 2-biphenylyl, 3-biphenylyl and 4-biphenylyl.

20. The emission material as described in any of claims **9** to **17**, wherein R^1 to R^6 are hydrogens; R^7 is hydrogen or methyl; and Ar^2 and Ar^3 are m-terphenyl-5'-yl.

21. The emission material as described in any of claims **9** to **17**, wherein R^1 to R^6 are hydrogens; R^7 is hydrogen or methyl; and Ar^2 and Ar^3 are 3,5-di(2-naphthyl)phenyl.

22. The emission material as described in any of claims **9** to **17**, wherein R^1 to R^6 are hydrogens; R^7 is hydrogen or methyl; and Ar^2 and Ar^3 are one selected from p-quaterphenyl-3'-yl, m-quaterphenyl-3-yl and o-quaterphenyl-2-yl.

23. The emission material as described in any of claims **9** to **17**, wherein R^1 to R^6 are hydrogens; R^7 is hydrogen or methyl; and Ar^2 and Ar^3 are one selected from 1-naphthyl, 4-phenyl-1-naphthyl and 4-(9-carbazolyl)-1-naphthyl.

24. The emission material as described in any of claims **9** to **17**, wherein R^1 to R^6 are hydrogens; R^7 is hydrogen or methyl; and Ar^2 and Ar^3 are one selected from 2-naphthyl, 6-(m-terphenyl-5'-yl)-2-naphthyl and 6-(2-naphthyl)-2-naphthyl.

25. The emission material as described in any of claims **9** to **17**, wherein R^1 to R^6 are hydrogens; R^7 is hydrogen or methyl; and Ar^2 and Ar^3 are 9-phenanthryl.

26. The emission material as described in any of claims **9** to **17**, wherein R^1 to R^6 are hydrogens; R^7 is hydrogen or methyl; and Ar^2 and Ar^3 are 2-benzothienyl or 3-phenyl-2-benzothienyl.

27. An organic electroluminescent device comprising a substrate and provided thereon at least a hole transport layer, an emission layer and an electron transport layer which are sandwiched between an anode and a cathode, wherein the above emission layer comprises the emission material as described in any of claims **1** to **17**.

* * * * *

专利名称(译)	发光材料和使用其的有机电致发光器件		
公开(公告)号	US20100025661A1	公开(公告)日	2010-02-04
申请号	US11/631421	申请日	2005-06-24
[标]申请(专利权)人(译)	王国芳 内田MANABU ONO幽黑		
申请(专利权)人(译)	王国芳 内田MANABU ONO幽黑		
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外部链接	Espacenet USPTO		

摘要(译)

本发明的主题是提供一种有助于有机电致发光器件中的高发光效率，低驱动电压，优异的耐热性和长寿命的发光材料，特别是蓝色发光性优异的发光材料。此外，本发明的目的是提供使用上述发光材料的有机电致发光器件。上述主题可以通过由式（1）表示的发光材料和包含该发光材料的有机电致发光器件来实现。 其中R1-R7独立地为氢，烷基或环烷基; Ar 1是选自由具有6至50个碳原子的非稠合芳基，2-萘基，9-菲基，6-苯基，2-三苯基，2-芴基，9-咔唑基，2-噻吩基和2-基团组成的组中的一种。苯并噻吩基; Ar 2和Ar 3分别独立地为具有6至50个碳原子的非稠合芳基，具有10至50个碳原子的稠合芳基或具有2至50个碳原子的杂芳基。

(1)