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(54) **CONDENSED POLYCYCLIC COMPOUND AND ORGANIC LIGHT-EMITTING DEVICE USING THE SAME**

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H01L 51/54 (2006.01)
C09K 11/06 (2006.01)
C07C 13/567 (2006.01)

(52) **U.S. Cl.** **428/690**; 428/917; 313/504; 313/506; 257/40; 257/E51.049; 585/26; 585/27

(58) **Field of Classification Search** 585/26, 585/27
See application file for complete search history.

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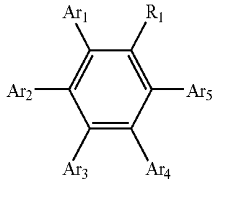
(74) *Attorney, Agent, or Firm*—Fitzpatrick, Cella, Harper & Scinto

(57) **ABSTRACT**

A new condensed polycyclic compound represented by general formula [1]:



[1]

wherein R_1 is hydrogen, halogen, cyano, a substituted amino or a group selected from the group consisting of alkyl, aralkyl, aryl, heterocyclic, each having no substituent or a substituent; and Ar_1 to Ar_5 are the same or different and are each independently a condensed polycyclic aromatic group or a condensed polycyclic heterocyclic group, each having no substituent or a substituent is used for an organic light-emitting device that is extremely efficient in a light output with high luminance and is extremely durable.

10 Claims, 3 Drawing Sheets

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FIG. 1

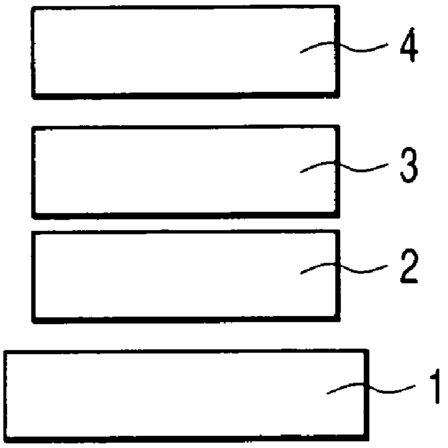


FIG. 2

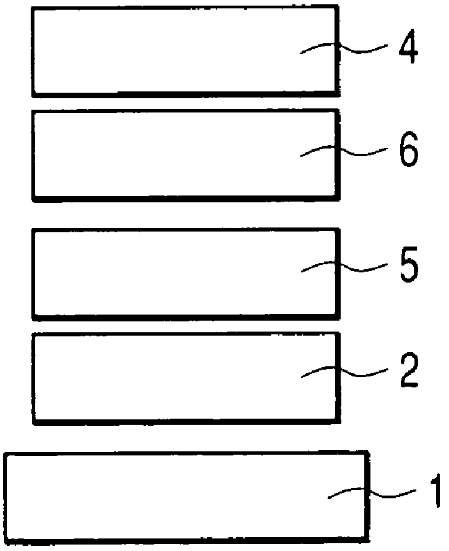


FIG. 3

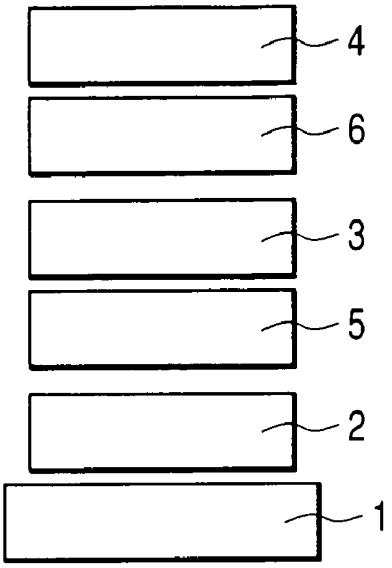


FIG. 4

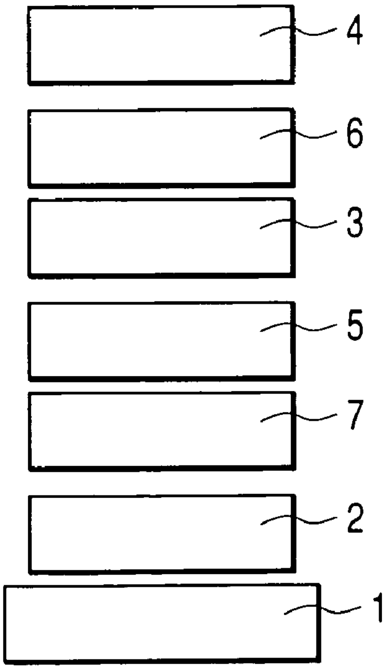


FIG. 5

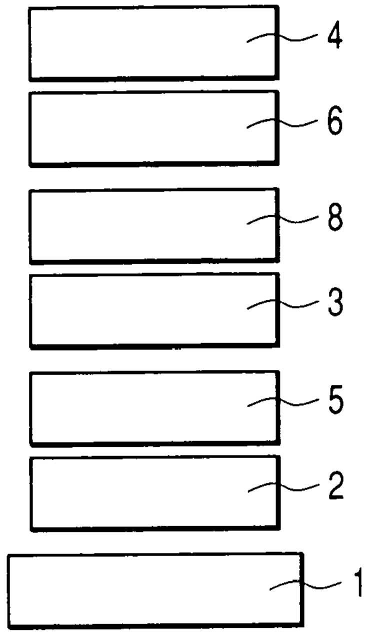
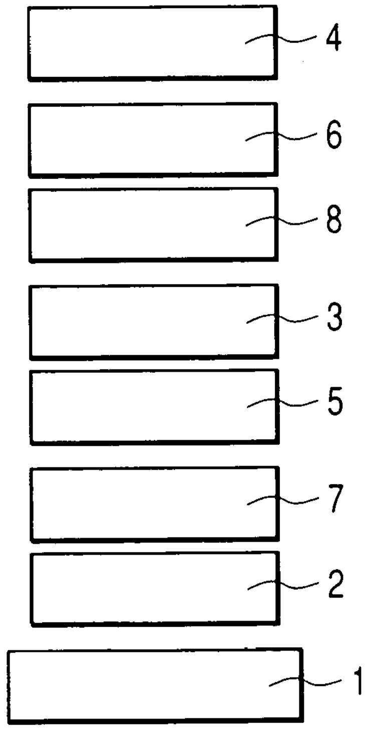


FIG. 6



CONDENSED POLYCYCLIC COMPOUND AND ORGANIC LIGHT-EMITTING DEVICE USING THE SAME

TECHNICAL FIELD

The present invention relates to a new organic compound and an organic light-emitting device using the same.

BACKGROUND ART

An organic light-emitting device is a device in which a thin film containing a fluorescent organic compound or a phosphorescent organic compound is sandwiched between an anode and a cathode; an exciton of the fluorescent compound or the phosphorescent compound is produced by injecting an electron or a hole from each of the electrodes and the light radiated when the exciton returns to the ground state is utilized.

In a research by Eastman Kodak Company in 1987 (Appl. Phys. Lett. 51, 913 (1987)), there is reported a light emission of about 1,000 cd/m^2 at an applied voltage of about 10 V for a device of separated-function two-layered structure using ITO for anode and a magnesium-silver alloy for cathode, respectively, an aluminum-quinolinol complex as an electron-transporting material and a light-emitting material and a triphenylamine derivative as a hole transporting material. Related patents include U.S. Pat. No. 4,539,507; U.S. Pat. No. 4,720,432 and U.S. Pat. No. 4,885,211.

In addition, light-emission from ultraviolet to infrared is possible by changing the type of fluorescent organic compounds and researches of various compounds have been conducted actively recently. For example, they are described in U.S. Pat. Nos. 5,151,629; 5,409,783; 5,382,477; 5,130,603; 6,093,864; 5,227,252; Japanese Patent Application Laid-Open No. H05-202356; Japanese Patent Application Laid-Open No. H09-202878 and Japanese Patent Application Laid-Open No. H09-227576.

In recent years, there have been a number of studies in which phosphorescent compounds are used as a light-emitting material and the energy in a triplet state is used for an EL emission. A group of Princeton University has reported that an organic light-emitting device using an iridium complex as a light-emitting material exhibits a high light-emitting efficiency (Nature 395, 151 (1998)).

Moreover, a group of Cambridge University has reported (Nature 347, 539 (1990)) an organic light-emitting device using a conjugated polymer other than the organic light-emitting device using monomeric materials as described above. In this report the light-emission in a monolayer is confirmed by forming a film of polyphenylenevinylene (PPV) in a coating system.

The related patents on organic light-emitting devices using conjugated polymers include U.S. Pat. Nos. 5,247,190; 5,514,878; 5,672,678; 5,317,169; 5,726,457 and Japanese Patent Application Laid-Open No. H05-247460.

Thus, recent progress in organic light-emitting devices is remarkable, and possibilities for a wide range of applications are indicated since it is characterized in that a thin and light-weight light-emitting device having high luminance at a low applied-voltage, diversity of light-emitting wavelength and high-speed response can be prepared.

However, a higher-luminance light output or high conversion efficiency is required under present circumstances. In addition, there are numbers of problems in terms of durability such as the variation with time during use for a long period of time and the deterioration due to an atmospheric gas containing oxygen or humidity. Moreover, the light-emission of blue, green and red having a good color purity is required for applications such as a full-color display, but these issues are not sufficiently satisfied.

Aromatic compounds and condensed polycyclic aromatic compounds have been studied in great numbers as fluorescent organic compounds to be used for an electron-transporting layer or a light-emitting layer. These include, for example, Japanese Patent Application Laid-Open No. H04-68076; Japanese Patent Application Laid-Open No. H05-32966; Japanese Patent Application Laid-Open No. H06-228552; Japanese Patent Application Laid-Open No. H06-240244; Japanese Patent Application Laid-Open No. H07-109454; U.S. Pat. No. 6,203,933; Japanese Patent Application Laid-Open No. H09-241629; U.S. Pat. No. 6,387,547; U.S. Pat. No. 6,399,223 and Japanese Patent Application Laid-Open No. 2000-268964. However, nothing that sufficiently satisfies light-emission luminance and durability has been obtained so far.

DISCLOSURE OF THE INVENTION

It is an object of the present invention to provide a new condensed polycyclic compound.

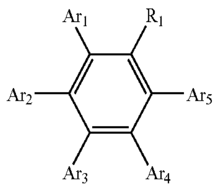
It is a further object of the present invention to provide an organic light-emitting device having a light output with an extremely high efficiency and high luminance using a specific condensed polycyclic compound.

It is a further object of the present invention to provide an extremely durable organic light-emitting device.

It is a further object of the present invention to provide an organic light-emitting device that is easily produced and can be prepared at a relatively low cost.

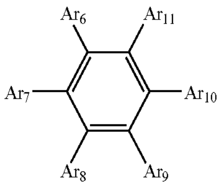
Specifically, the present invention provides a condensed polycyclic compound represented by general formula [I] or [II]:

[I]



wherein R_1 is hydrogen, halogen, cyano, a substituted amino or a group selected from the group consisting of alkyl, aralkyl, aryl, heterocyclic, each having no substituent or a substituent; and Ar_1 to Ar_5 are the same or different and are each independently a condensed polycyclic aromatic group or a condensed polycyclic heterocyclic group, each having no substituent or a substituent; and

[II]



wherein Ar_6 to Ar_{11} are the same or different and are each independently a group selected from the group consisting of condensed polycyclic aromatic groups and condensed polycyclic heterocyclic groups, each having no substituent or a substituent.

The present invention further provides an organic light-emitting device comprising a pair of electrodes consisting of an anode and a cathode and organic compound-containing layers sandwiched between the pair of electrodes, wherein at least one layer of the organic compound-containing layers contains at least one compound selected from the group consisting of the condensed polycyclic compounds.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a sectional view illustrating one example of the organic light-emitting device according to the present invention;

FIG. **2** is a sectional view illustrating another example of the organic light-emitting device according to the present invention;

FIG. **3** is a sectional view illustrating another example of the organic light-emitting device according to the present invention;

FIG. **4** is a sectional view illustrating another example of the organic light-emitting device according to the present invention;

FIG. **5** is a sectional view illustrating another example of the organic light-emitting device according to the present invention; and

FIG. **6** is a sectional view illustrating another example of the organic light-emitting device according to the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

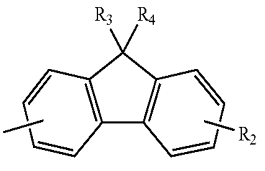
The present invention will now be described in detail.

The condensed polycyclic compounds of the present invention will be first described.

The condensed polycyclic compounds of the present invention are represented by the above general formula [I] or [II].

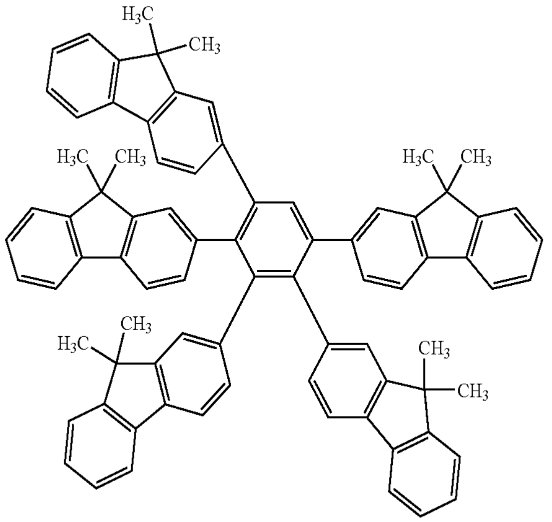
Herein, at least one of Ar_1 to Ar_5 or at least one of Ar_6 to Ar_{11} is preferably a condensed polycyclic aromatic group represented by general formula [III]:

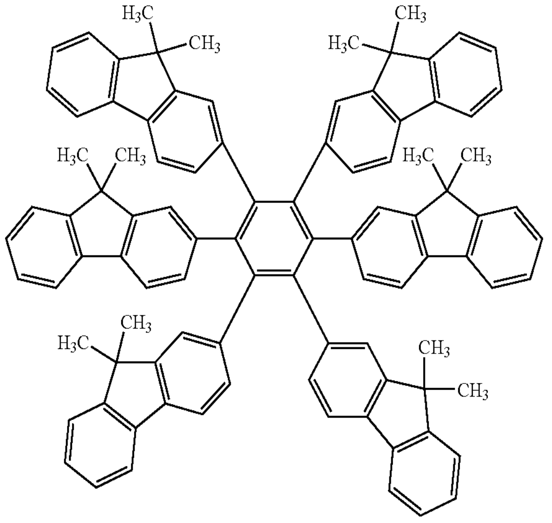
[III]



wherein R_2 is hydrogen, halogen, cyano, a substituted amino or a group selected from the group consisting of alkyl, aralkyl, aryl and heterocyclic, each having no substituent or a substituent; and R_3 and R_4 are the same or different and are each independently hydrogen or a group selected from the group consisting of alkyl, aralkyl, aryl and heterocyclic, each having no substituent or a substituent.

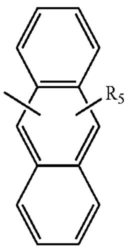
Further, the condensed polycyclic compounds of the present invention are more preferably represented by any of general formulas.



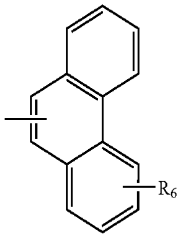


Furthermore, at least one of Ar_1 to Ar_5 or at least one of Ar_6 to Ar_{11} preferably denotes a condensed polycyclic aromatic group represented by any of general formulas [IV] to [VII]:

[IV]



[V]



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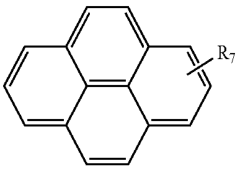
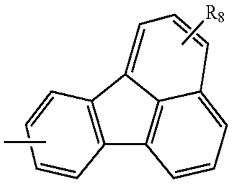


[VI]



[VII]

wherein R_5 to R_8 are hydrogen, halogen, cyano, a substituted amino or a group selected from the group consisting of alkyl, aralkyl, aryl and heterocyclic, each having no substituent or a substituent.

Specific examples for the substituent groups in the above general formulas [I] to [VII] are shown below.

The alkyl group includes methyl, ethyl, n-propyl, isopropyl, n-butyl, ter-butyl, octyl or the like.

The aralkyl group includes benzyl, phenethyl or the like.

The aryl group includes phenyl, biphenyl, terphenyl or the like.

The heterocyclic group includes thienyl, pyrolyl, pyridyl, oxazolyl, oxadiazolyl, thiazolyl, thidiazolyl, terthienyl or the like.

The substituted amino group includes dimethylamino, diehtylamino, dibenzylamino, diphenylamino, ditolylamino, dianisolylamino or the like.

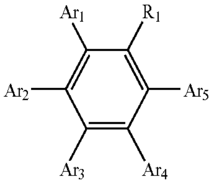
The halogen atom includes fluorine, chlorine, bromine, iodine or the like.

The condensed polycyclic aromatic group includes fluorenyl, naphthyl, fluoranthenyl, anthryl, phenathryl, pyrenyl, tetracenyl, pentacenyl or the like.

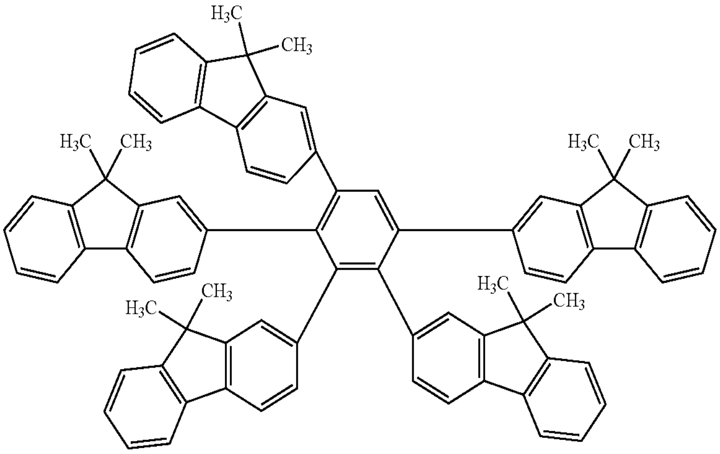
The condensed polycyclic heterocyclic group includes quinolyl, diazafluorenyl, acrydinyl, phenanthrolyl or the like.

The substituent groups that the above substituent groups may have include alkyl groups such as methyl, ethyl and propyl; aralkyl groups such as benzyl and phenethyl; aryl groups such as phenyl and biphenyl; heterocyclic groups such as thienyl, pyrolyl and pyridyl; amino groups such as dimethylamino, diethylamino, dibenzylamino, diphenylamino, ditolylamino and dianisolylamino; alkoxyl groups such as methoxyl, ethoxyl, propoxyl and phenoxyl; cyano group and halogen atoms such as fluorine, chlorine, bromine and iodine.

The followings are typical examples of the condensed polycyclic compounds of the present invention, but the present invention is not limited thereto:



[I]



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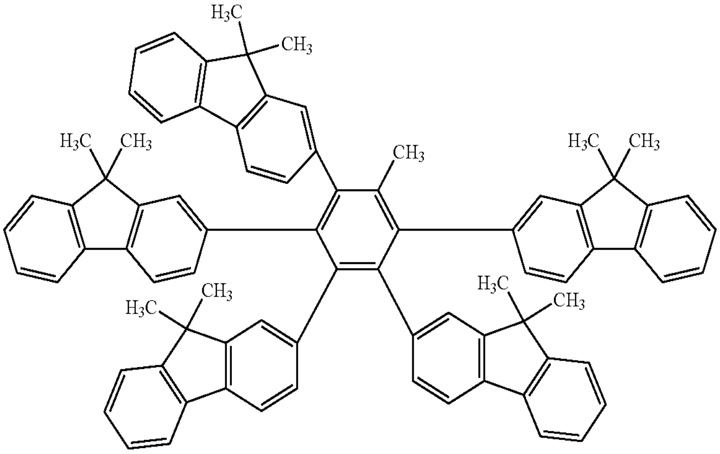

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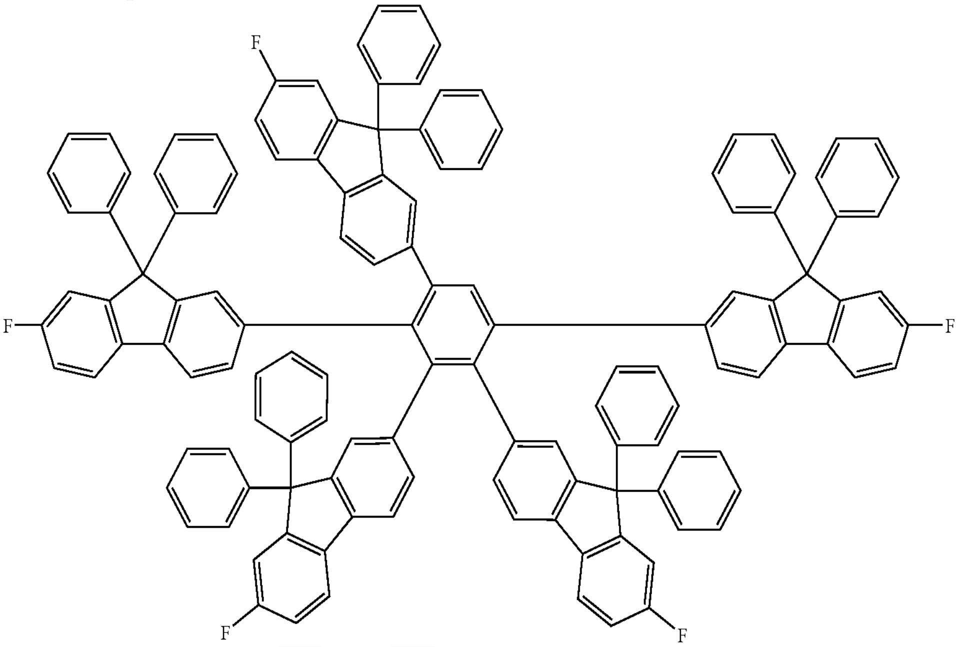

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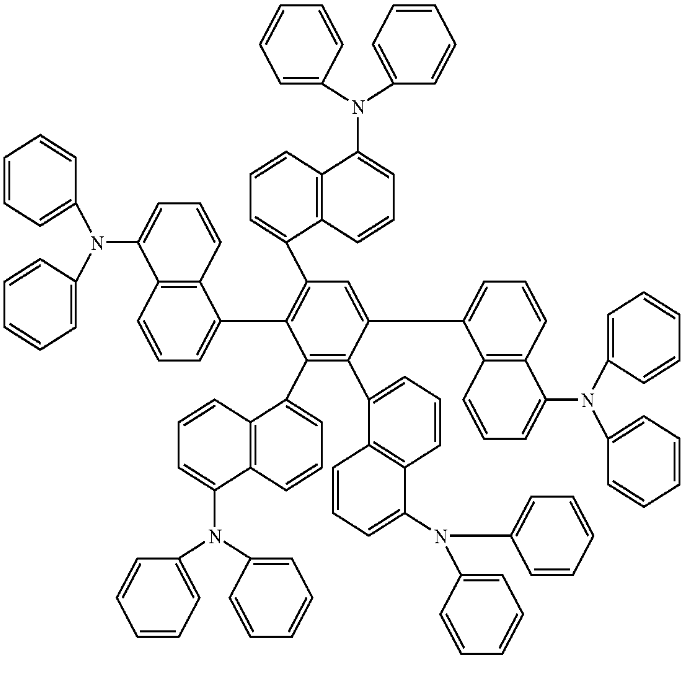

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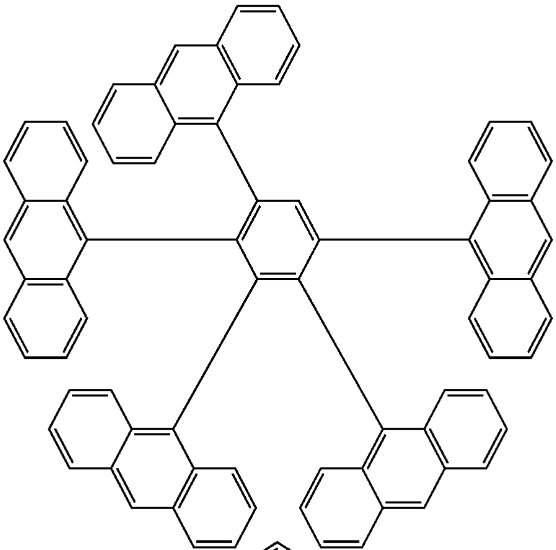

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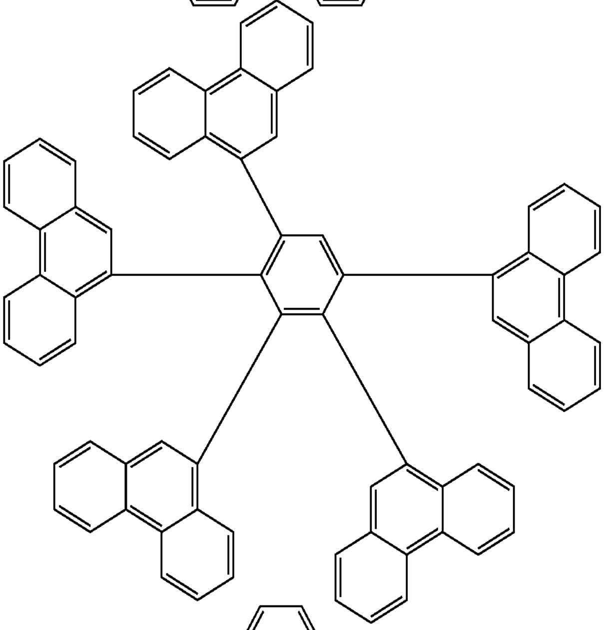

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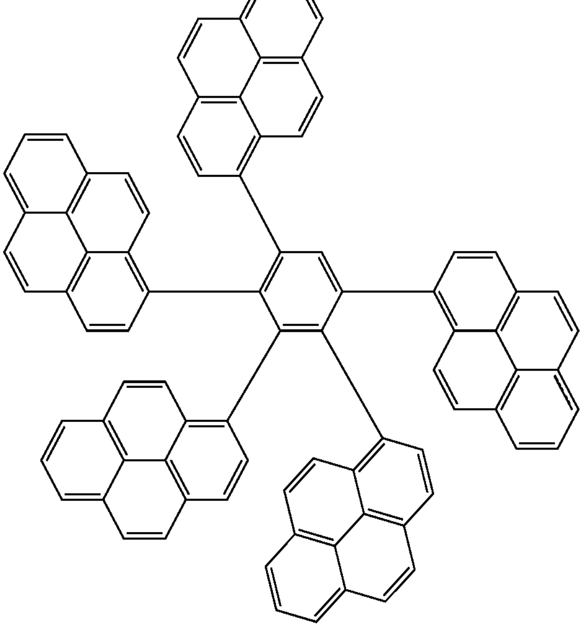

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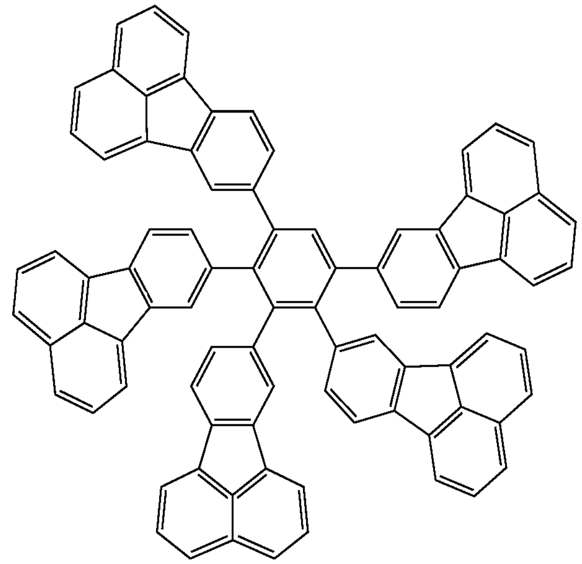

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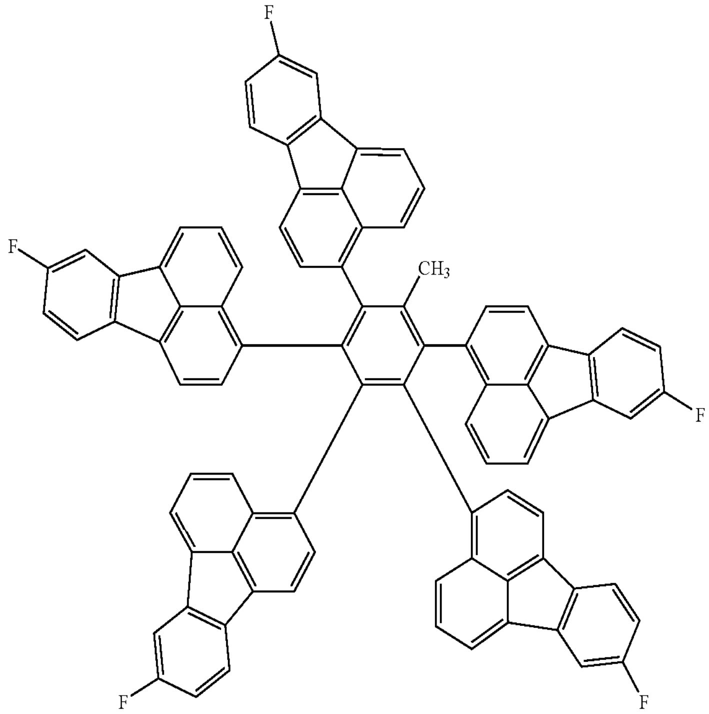

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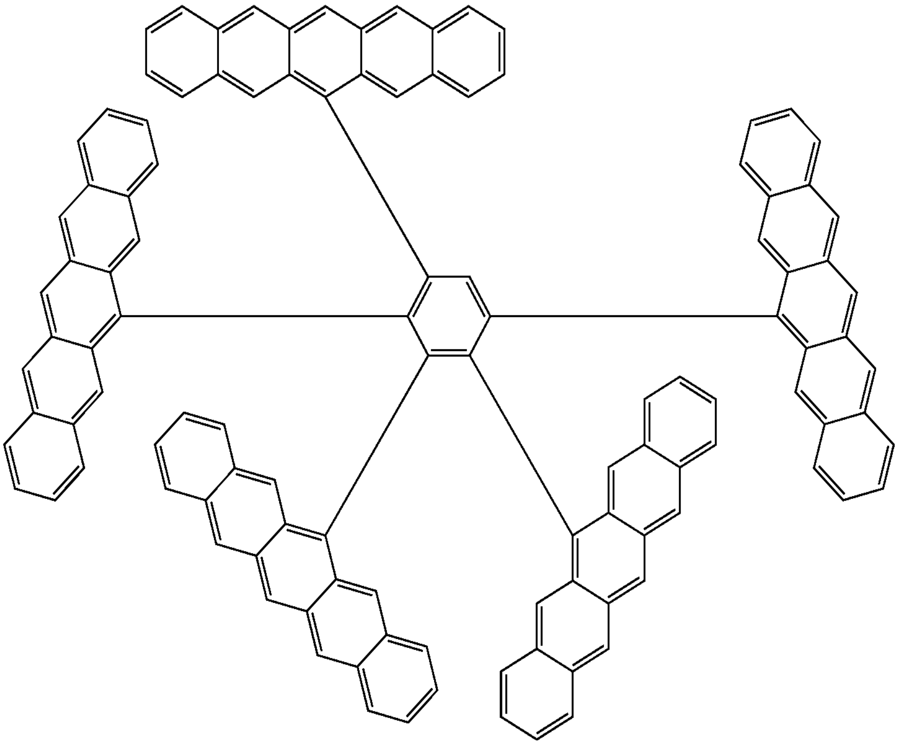
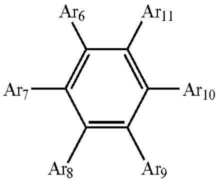


[II]



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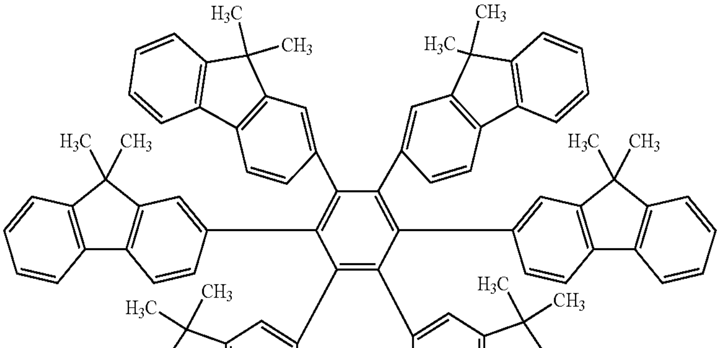

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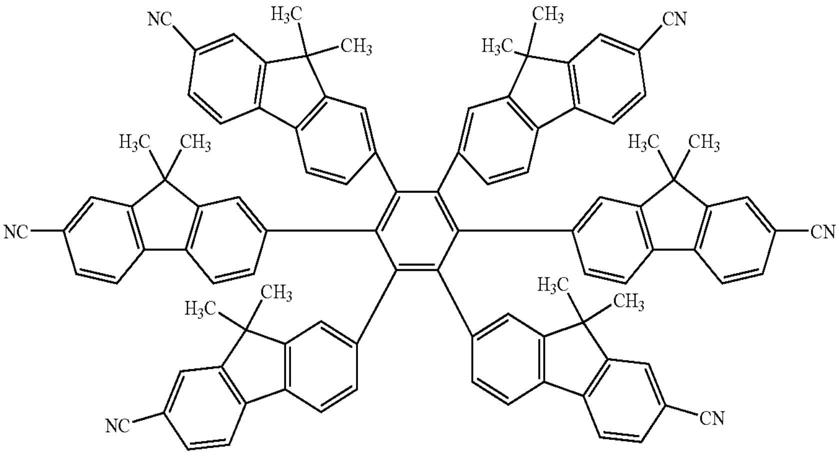

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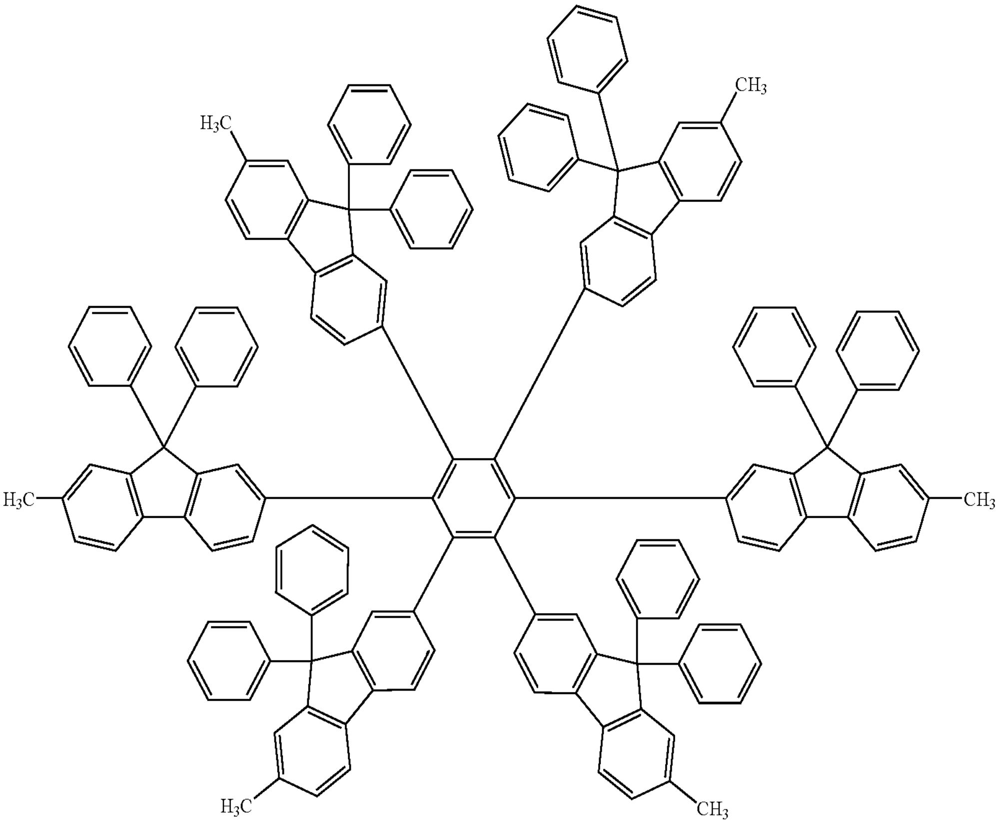

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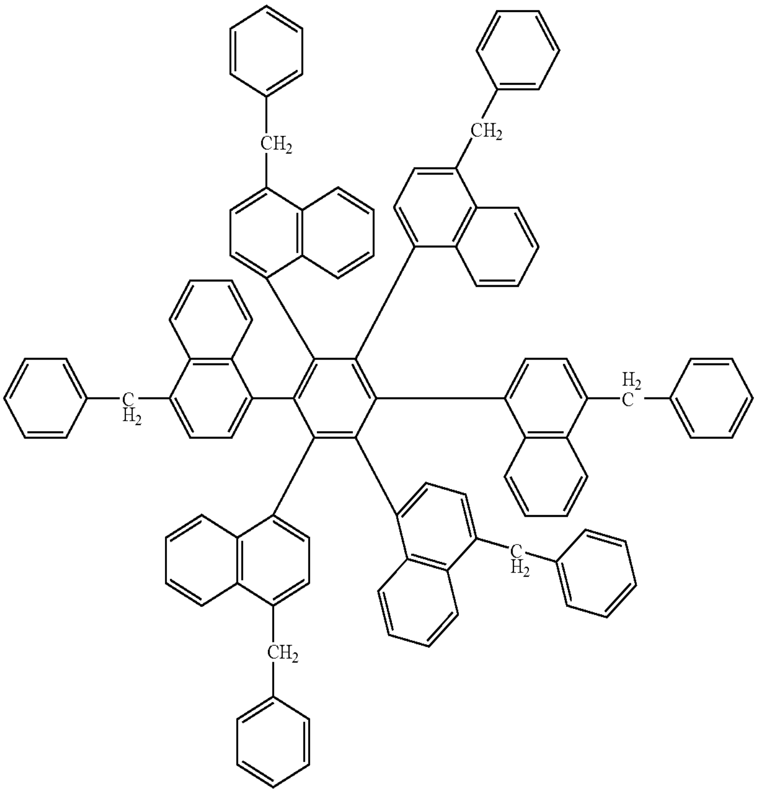

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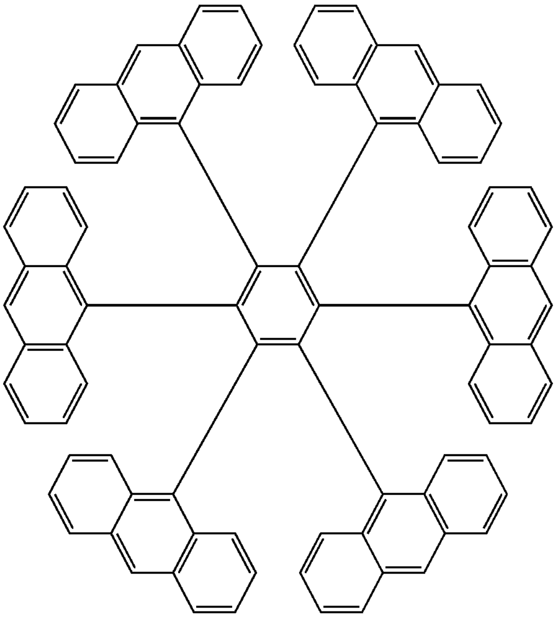

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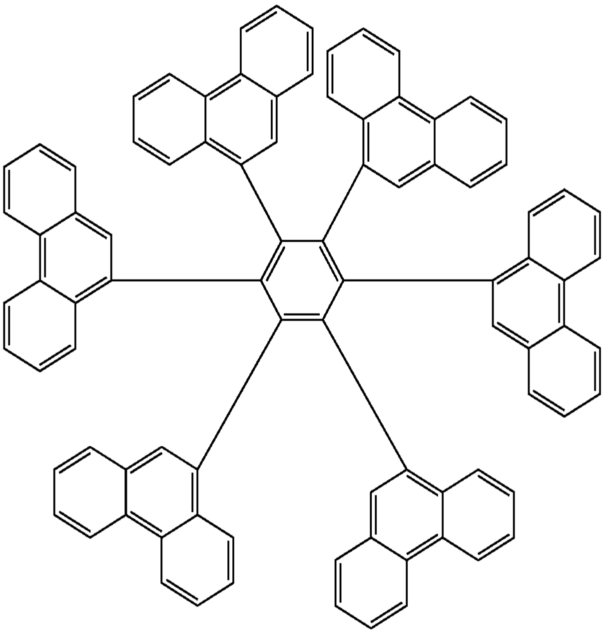

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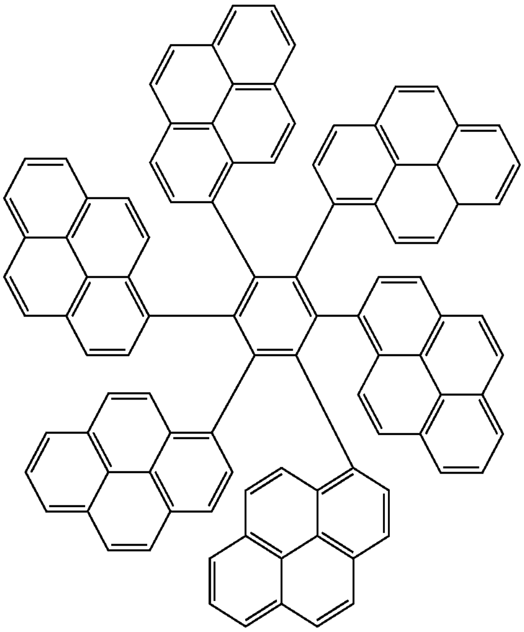

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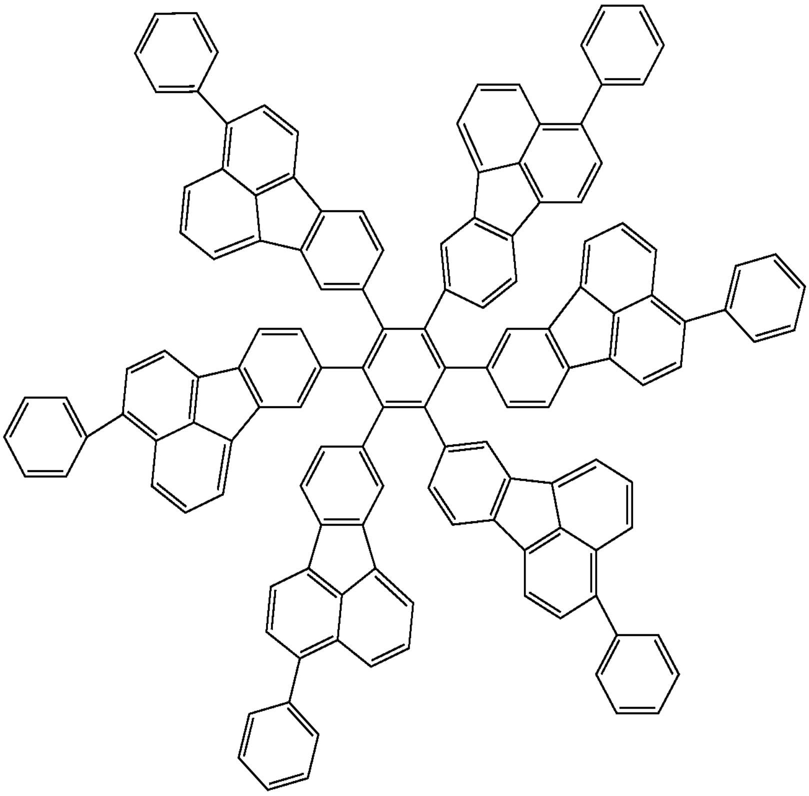

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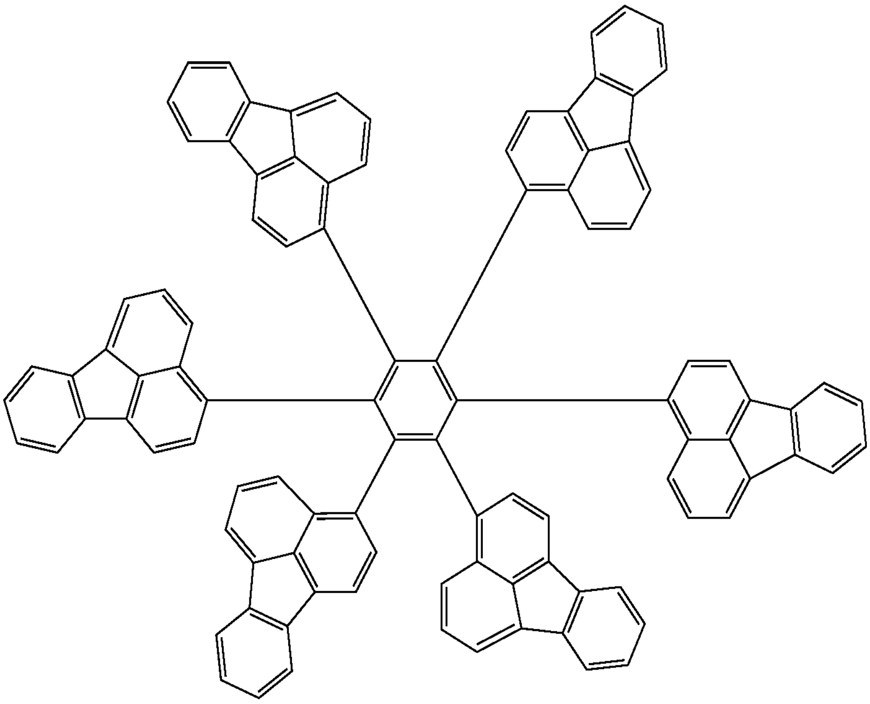

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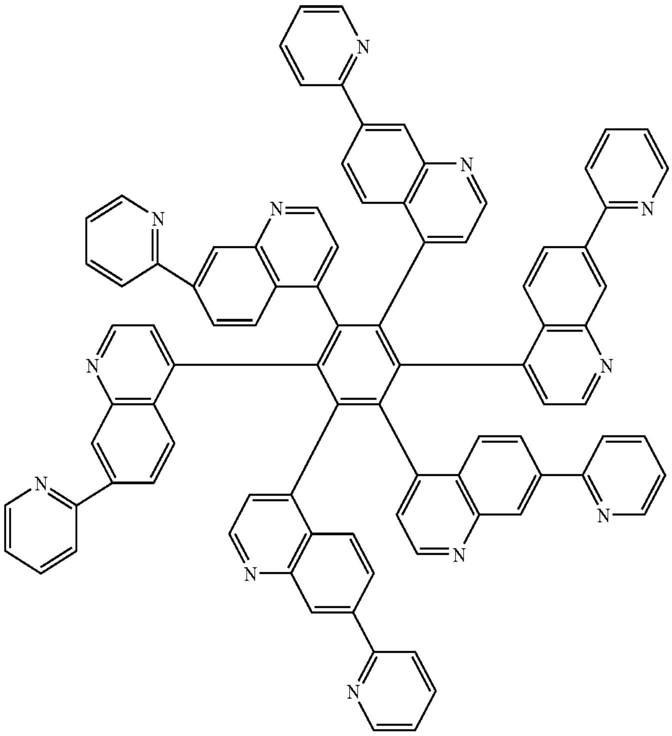

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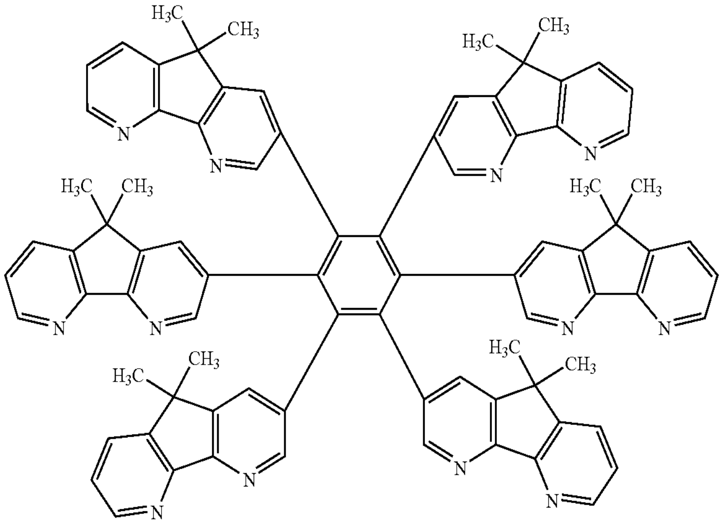

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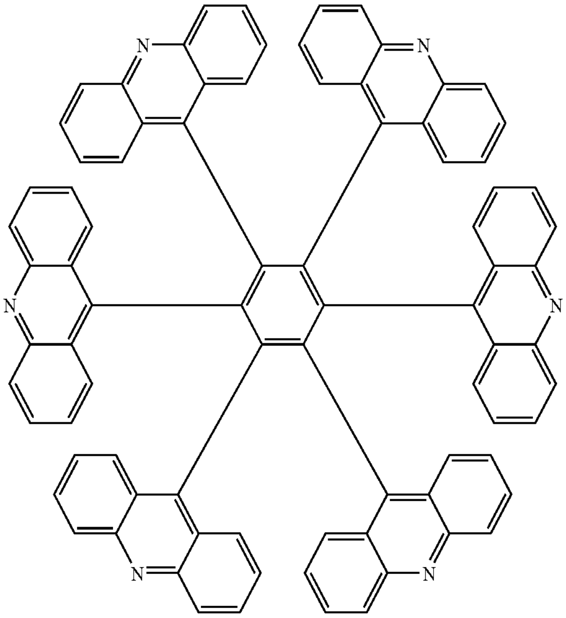


22

The condensed polycyclic compounds of the present invention can be synthesized by generally known methods, and can be obtained by synthesis methods such as, for example, Suzuki coupling method using a palladium catalyst (e.g., Chem. Rev. 1995, 95, 2457-2483); Yamamoto method using a nickel catalyst (e.g., Bull. Chem. Soc. Jpn. 51, 2091, 1978) and a synthesizing method using aryltin compounds (e.g., J. Org. Chem., 52, 4296, 1987).

The condensed polycyclic compounds of the present invention are excellent in an electron-transporting property, a light-emitting property and durability compared with conventional compounds, and are useful for an organic compound-containing layer, in particular, an electron-transporting layer and a light-emitting layer in an organic light-emitting device. In addition, the layer formed by a vacuum deposition process or a solution coating process hardly causes crystallization or the like and is excellent in the stability with time.

The organic light-emitting device of the present invention will now be described in detail.

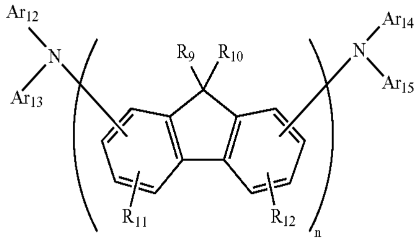
The organic light-emitting device of the present invention at least comprises a pair of electrodes consisting of an anode and a cathode and one or a plurality of organic compound-containing layers sandwiched between the pair of electrodes, wherein at least one layer of the above-described organic compound-containing layers contains at least one compound selected from the group consisting of the condensed polycyclic compounds represented by the above general formula [I] or general formula [II].

In the organic light-emitting device of the present invention, at least the electron transporting layer or the light-emitting layer among the organic compound-containing layers preferably contains at least one selected from the group consisting of the above-described condensed polycyclic compounds.

In the organic light-emitting device of the present invention, the condensed polycyclic compounds represented by the above general formula [I] or general formula [II] are formed between the anode and the cathode by a vacuum deposition process or a solution coating process. The organic layer is preferably formed in a thin film having a thickness of less than 10 μm, preferably 0.5 μm or less, more preferably from 0.01 to 0.5 μm.

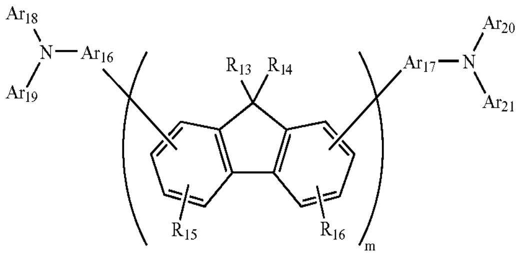
The organic light-emitting device of the present invention comprises a preferred embodiment that at least the light-emitting layer of the organic compound-containing layers contains at least one selected from the group consisting of the condensed polycyclic compounds and a fluorene compound represented by general formula [VIII] or [IX]:

[VIII]



wherein R_9 and R_{10} are the same or different and are each independently hydrogen or a group selected from the group consisting of alkyl, aralkyl, aryl and heterocyclic, each having no substituent or a substituent; any pair of R_9 combined to their respective fluorene structures are the same or different to each other; any pair of R_{10} combined to their respective fluorene structures are the same or different to each other; R_{11} and R_{12} are the same or different and are each independently hydrogen, halogen, cyano or a group selected from the group consisting of alkyl, aralkyl, aryl and heterocyclic, each having no substituent or a substituent; any pair of R_{11} combined to their respective fluorene structures are the same or different to each other; any pair of R_{12} combined to their respective fluorene structures are the same or different to each other; Ar_{12}, Ar_{13}, Ar_{14} and Ar_{15} are the same or different and are each independently a group selected from the group consisting of aromatic, heterocyclic, condensed polycyclic aromatic and condensed polycyclic heterocyclic, each having no substituent or a substituent, and Ar_{12} and Ar_{14} can be bonded to Ar_{13} and Ar_{15} respectively to form a ring; and n is an integer from 1 to 10, and

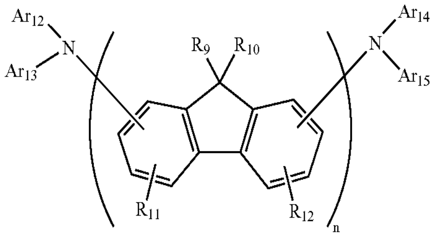
[IX]



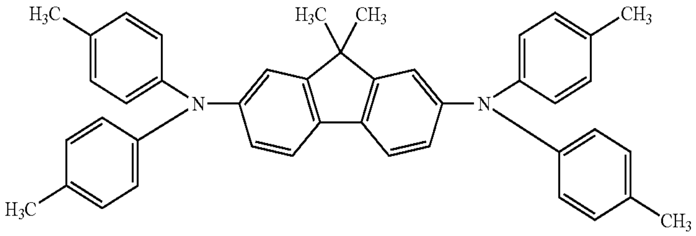
wherein R_{13} and R_{14} are the same or different and are each independently hydrogen or a group selected from the group consisting of alkyl, aralkyl, aryl and heterocyclic, each having no substituent or a substituent; any pair of R_{13} combined to their respective fluorene structures are the same or different to each other; any pair of R_{14} combined to their respective fluorene structures are the same or different to each other; R_{15} and R_{16} are the same or different and are each independently hydrogen, halogen, cyano or a group selected from the group consisting of alkyl, aralkyl, aryl and heterocyclic, each having no substituent or a substituent; any pair of R_{15} combined to their respective fluorene structures are the same or different to each other; any pair of R_{16} combined to their respective fluorene structures are the same or different to each other; Ar_{16} and Ar_{17} are the same or different and are each independently a divalent group selected from the group consisting of divalent aromatic and divalent heterocyclic, each having no substituent or a substituent; Ar_{18}, Ar_{19}, Ar_{20} and Ar_{21} are the same or different and are each independently a group selected from the group consisting of aromatic, heterocyclic, condensed polycyclic aromatic and condensed polycyclic heterocyclic, each having no substituent or a substituent, and Ar_{18} and Ar_{20} can be bonded to Ar_{19} and Ar_{21} respectively to form a ring; and m is an integer from 1 to 10.

Examples of the substituent groups in the general formulas [VIII] and [IX] are similar to those in the above general formulas [I] to [VII]. The followings are typical examples of the fluorene compounds represented by the general formula [VIII] or [IX], but the present invention is not limited thereto:

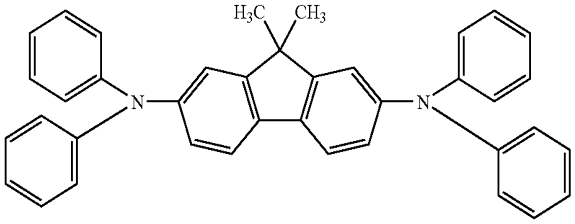
[VIII]



FL-1



FL-2



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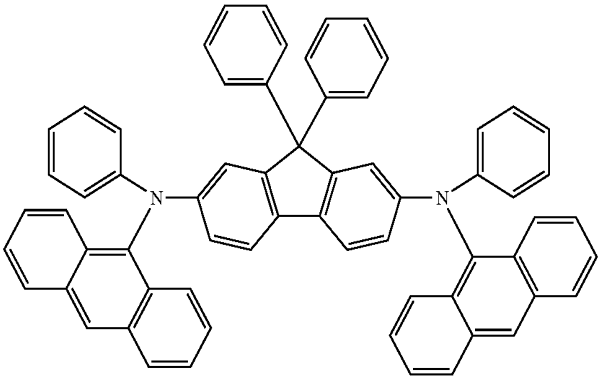
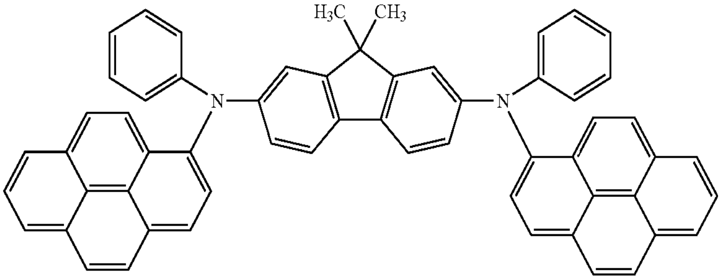
FL-3



FL-4



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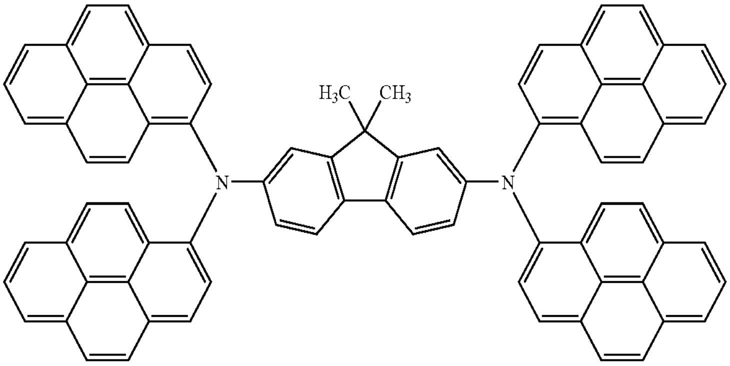

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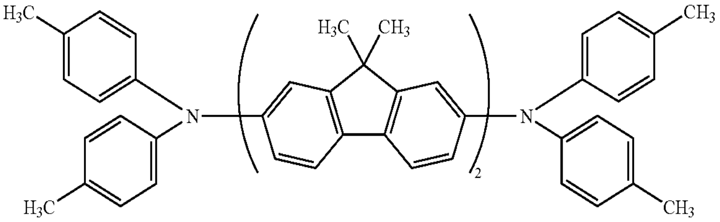

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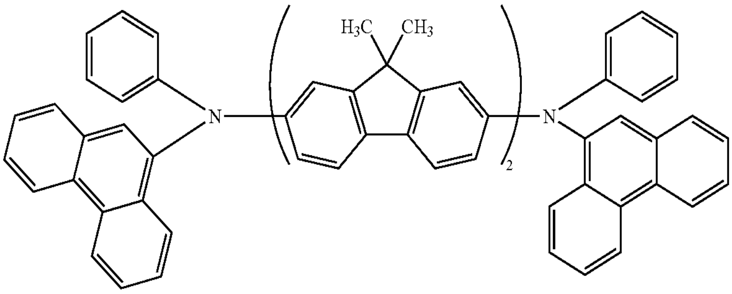

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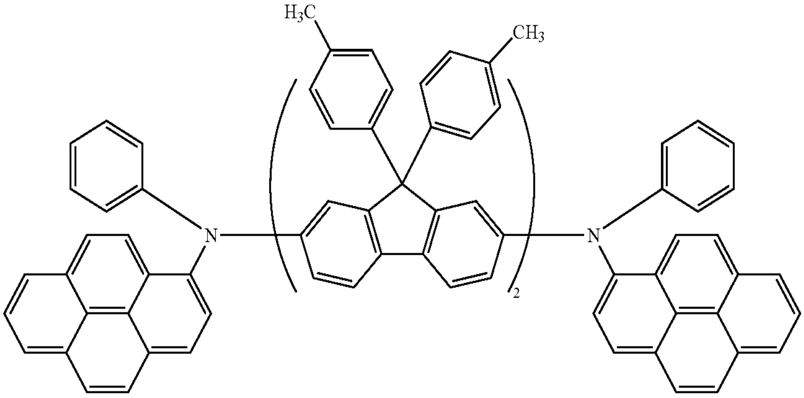
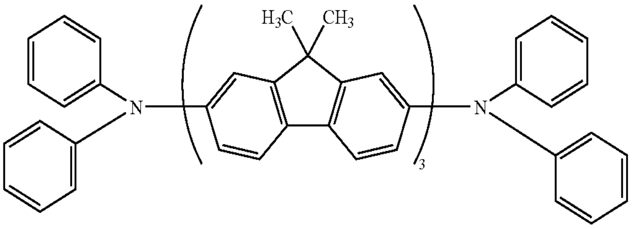
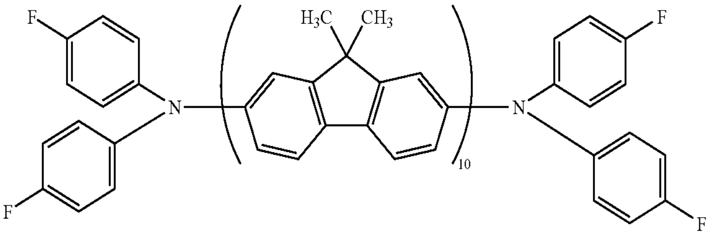
FL-8



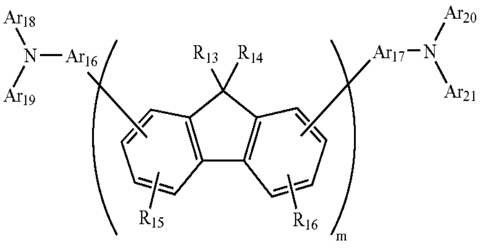
FL-9



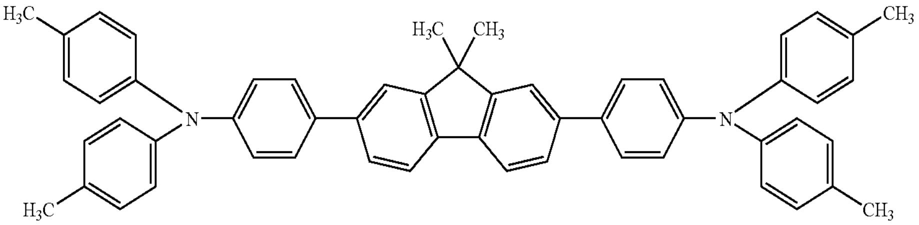
FL-10



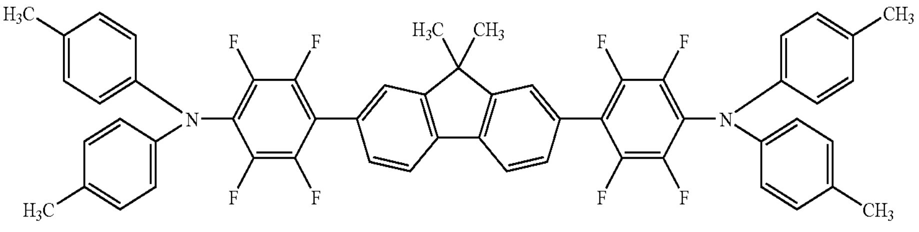
[IX]



FL-11



FL-12



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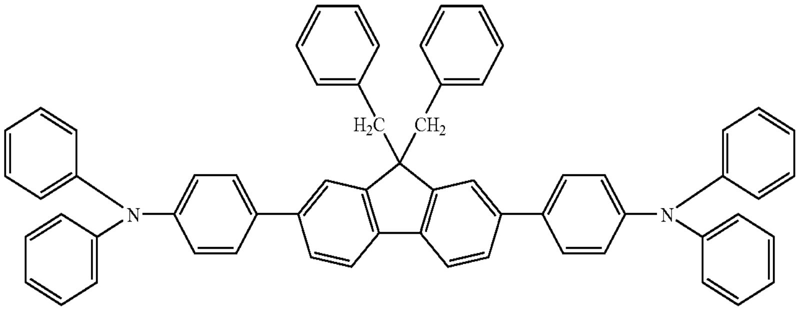

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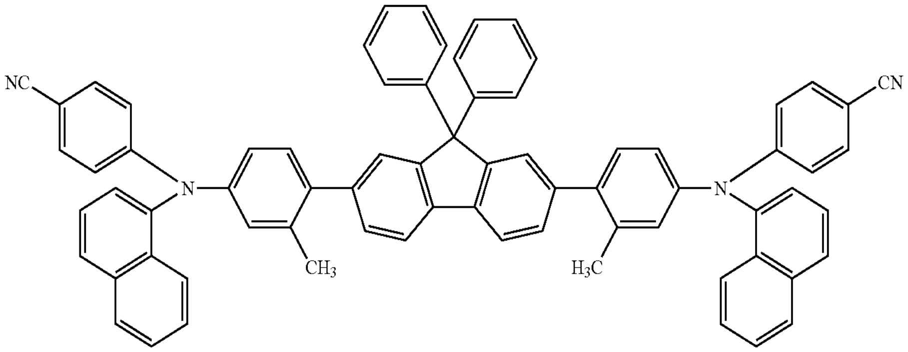

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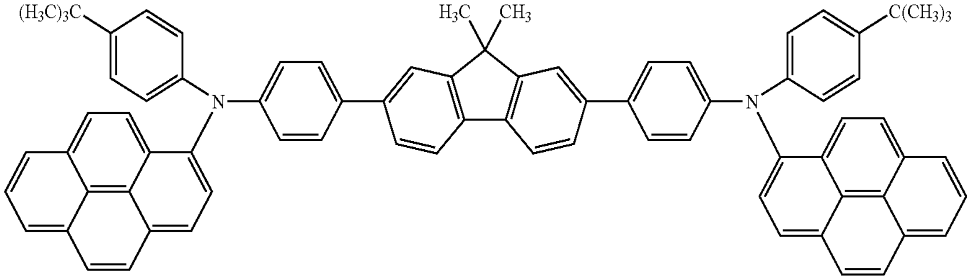
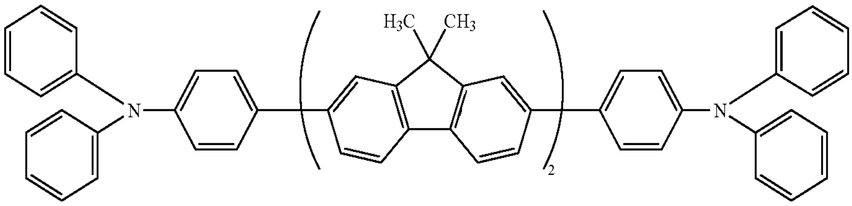
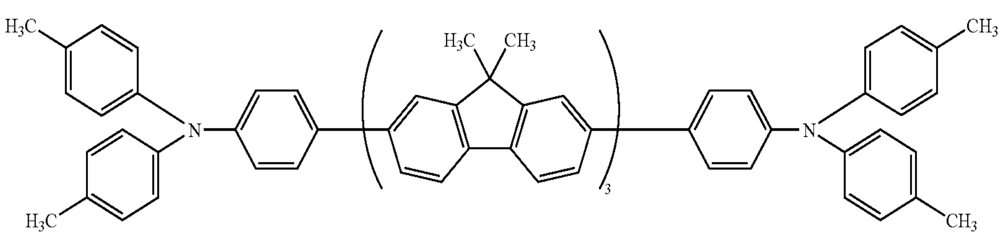


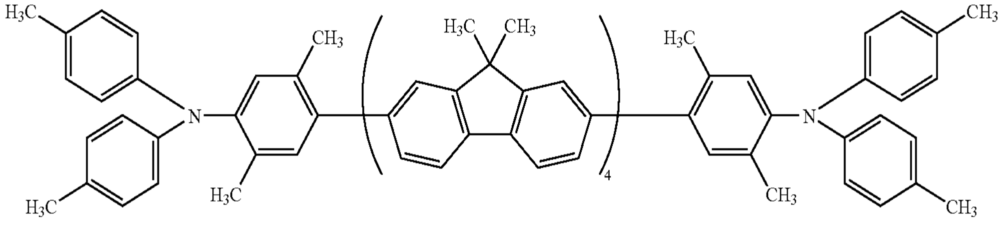
FL-16



FL-17



FL-18



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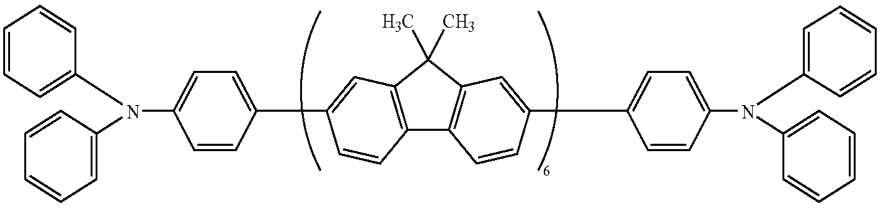
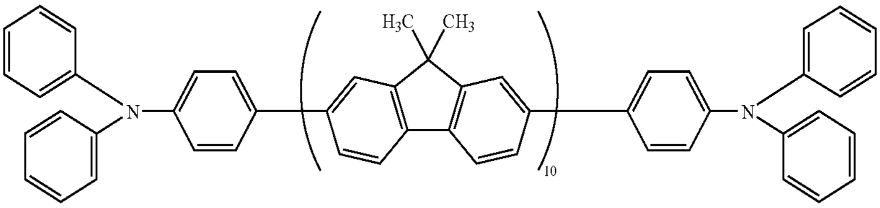
FL-19



FL-20



FIGS. **1** to **6** illustrate preferred examples of the organic light-emitting devices of the present invention.

The example of FIG. **1** has the structure in which an anode **2**, a light-emitting layer **3** and a cathode **4** are provided on a substrate **1** in this order. The light-emitting device herein used is useful when it has a hole-transporting capability, an electron-transporting capability and light-emitting performance singly within itself, or when compounds having respective characteristics are mixed for use.

The example of FIG. **2** has the structure in which an anode **2**, a hole-transporting layer **5**, an electron-transporting layer **6** and a cathode **4** are provided on a substrate **1** in this order. This example is useful when a material having a hole-transporting capability and/or an electron-transporting capability is used for respective layers as a light-emitting substance in combination with a mere hole-transporting substance or an electron-transporting substance having no light-emitting property. In this case, the light-emitting layer comprises the hole-transporting layer **5** or the electron-transporting layer **6**.

The example of FIG. **3** has the structure in which an anode **2**, a hole-transporting layer **5**, a light-emitting layer **3**, an electron-transporting layer **6** and a cathode **4** are provided on a substrate **1** in this order, a carrier-transporting function and a light-emitting function being separated. The separation of the light-emitting layer from the charge-transporting layer extremely increases the freedom of material selection since a compound having each property such as a hole-transporting property, an electron-transporting property or a light-emitting property can be used in a suitable combination. For example, various compounds having different light-emitting wavelengths can be used to allow diversification of the hue of light emission. Further, it is also possible to try to improve the efficiency of light emission by effectively confining each carrier or exciton in the central light-emitting layer **3**.

The example of FIG. **4** has the structure in which a hole-injecting layer **7** is inserted between the anode **2** and the hole-transporting layer **5** in the form of FIG. **3**, which is effective for improving adhesiveness of the anode **2** to the hole-transporting layer **5** or to improve a hole-injecting property, being effective to reduce voltage.

Examples of FIGS. **5** and **6** have the structure in which a layer for blocking a hole or an exciton from passing through to the side of the cathode **4** (hole-blocking layer **8**) is inserted between the light-emitting layer **3** and the electron-transporting layer **6** in the forms of FIGS. **3** and **4**. The use of a compound having a very high ionization potential as the hole-blocking layer **8** is effective for improving the efficiency of light-emission.

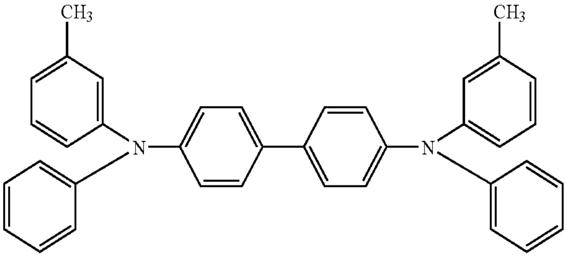
FIGS. **1** to **6** are very basic device structures, and the structures of the organic light-emitting device using the compounds of the present invention are not limited to these. It is possible to take the structure of diversified layers, for example, to provide an insulating layer to the interface between the electrodes and the organic layers, to provide an adhesion layer or an interference layer or to compose a hole-transporting layer from two layers having different ionization potentials.

The condensed polycyclic compounds represented by the general formula [I] or the general formula [II] used in the present invention are excellent in an electron-transporting property, a light-emitting property and durability compared with conventional compounds, and can be used in any forms shown in FIGS. **1** to **6**.

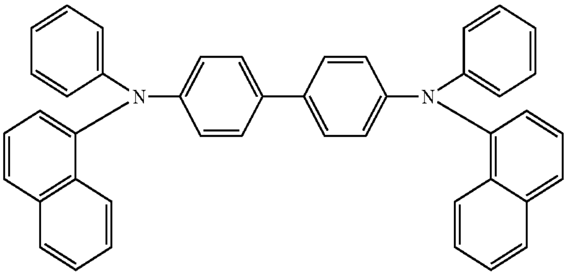
Although the present invention uses the condensed polycyclic compounds represented by the general formula [I] or the general formula [II] as constituent components for the electron-transporting layer or the light-emitting layer, already known hole-transporting compounds, light-emitting compounds or electron-transporting compounds can also be used together as necessary.

Examples of these compounds include the followings:

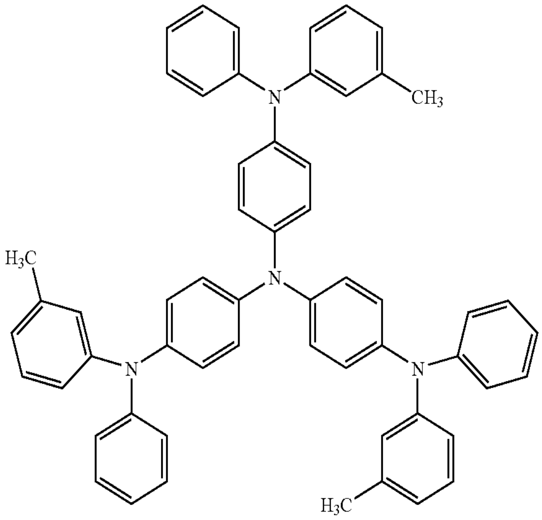
Hole-Transporting Compounds



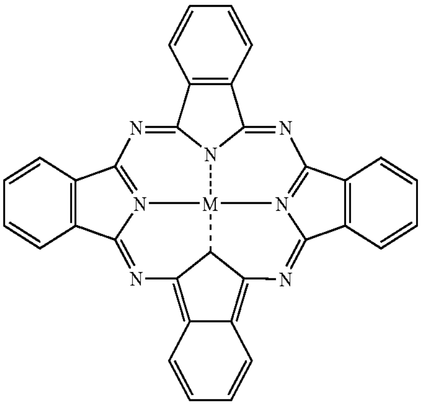
TPD



α-NPD



m-MTDATA



Pc-M
M: Cu, Mg, AlCl, TiO, $SiCl_2$, Zn, Sn,
MnCl, GaCl, etc

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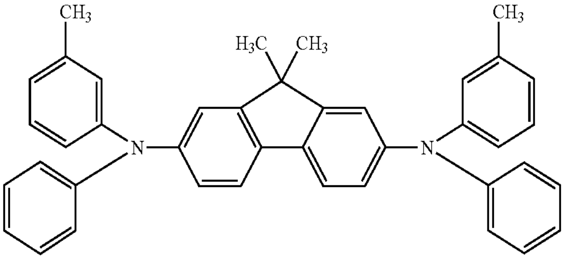
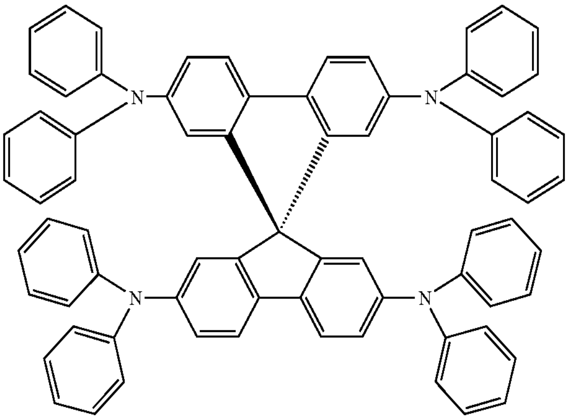
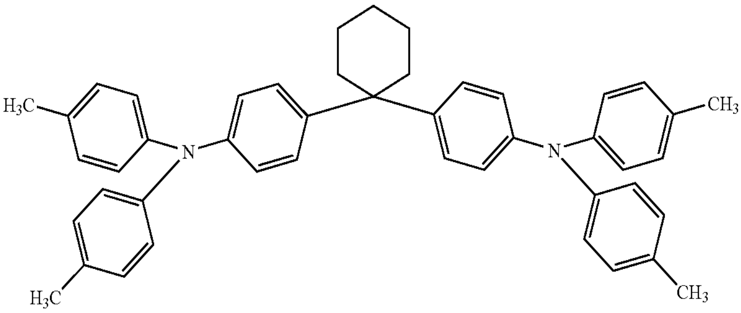


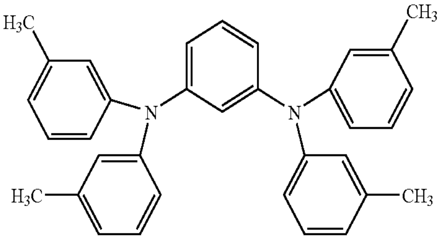
DTDPFL



spiro-TPD

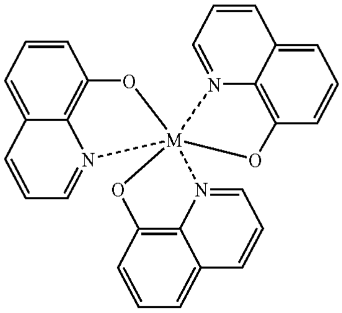


TPAC

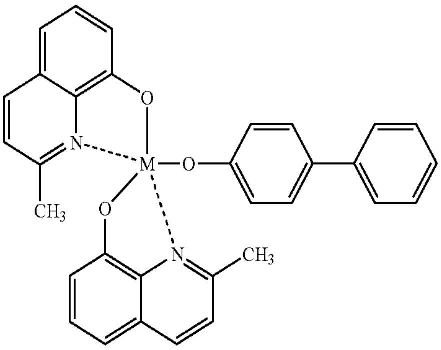


PDA

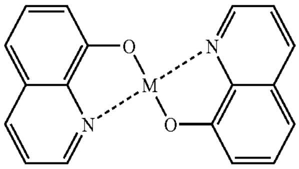
Electron-Transporting Light-Emitting Materials



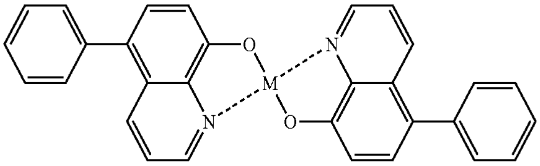
M: Al, Ga



M: Al, Ga



M: Zn, Mg, Be



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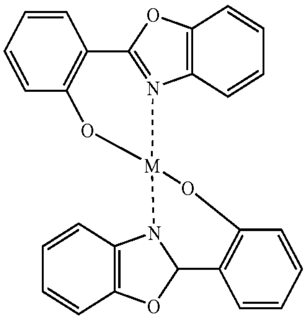

M: Zn, Mg, Be

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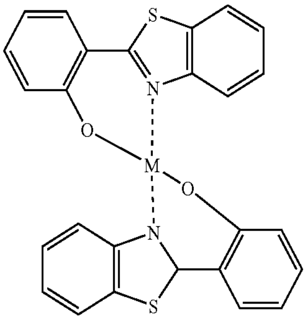
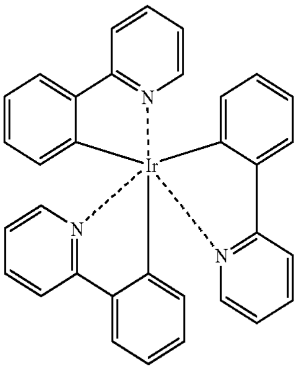
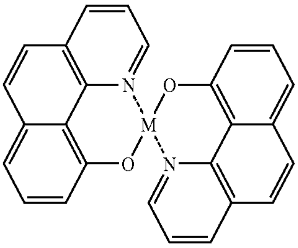
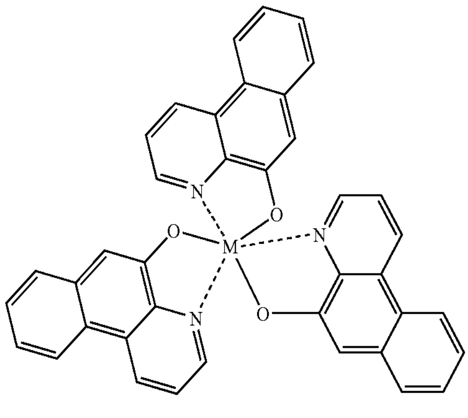


M: Zn, Mg, Be



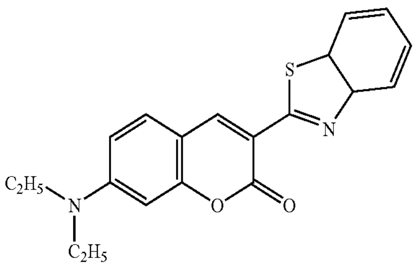


M: Zn, Mg, Be

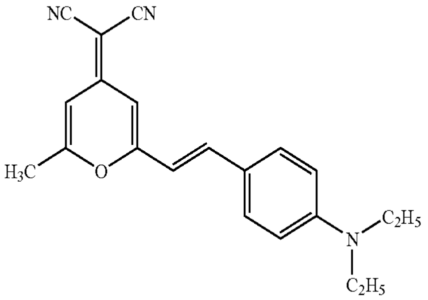


M: Al, Ga

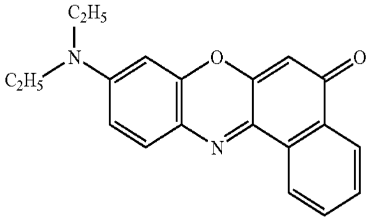
Light-Emitting Materials



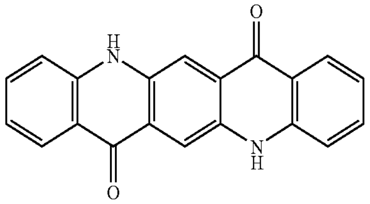
Coumarin6



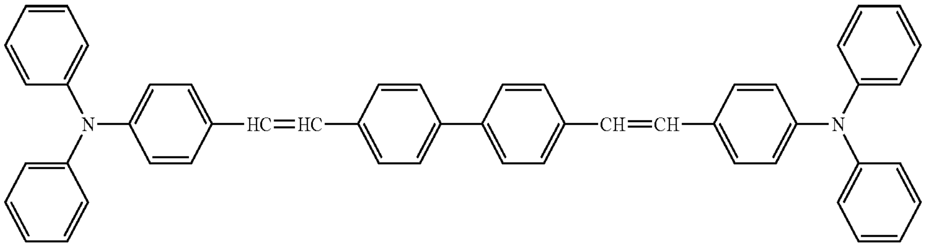
DCM-1



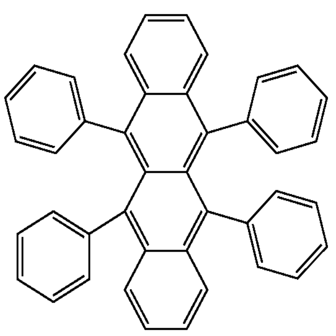
Nile red



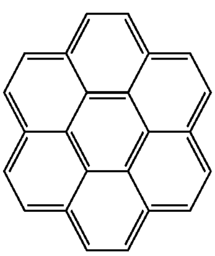
Quinacridone



DTPABVi

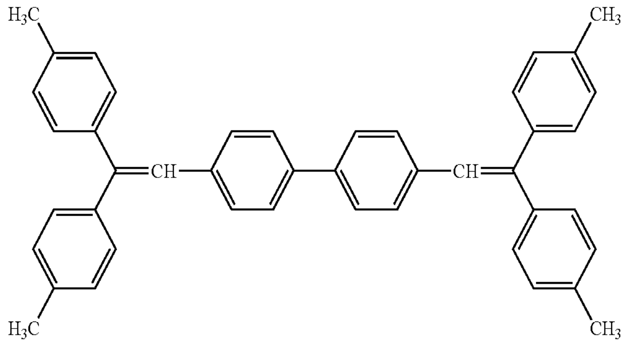


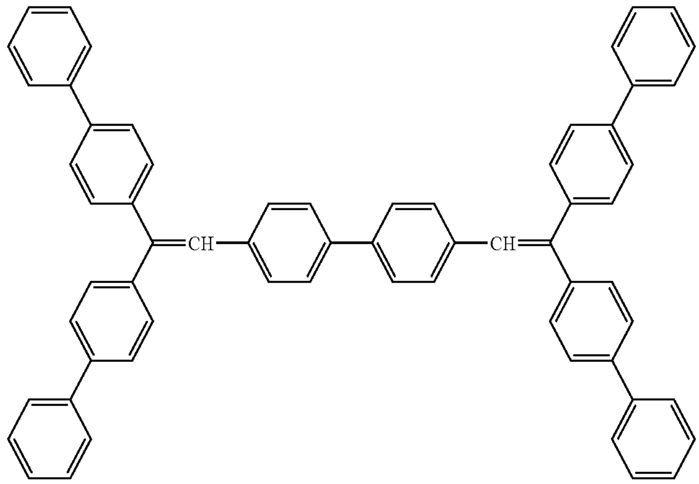
Rubrene

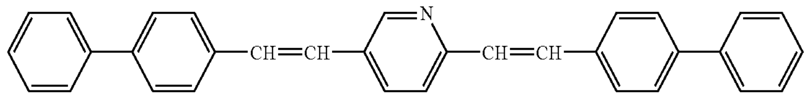


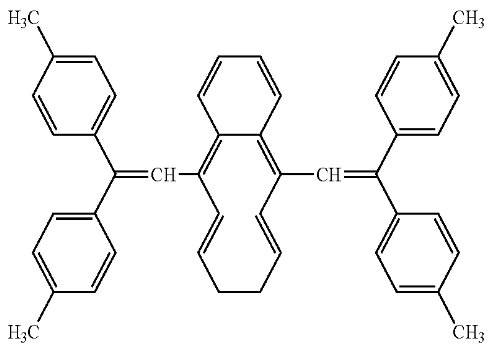
Coronene

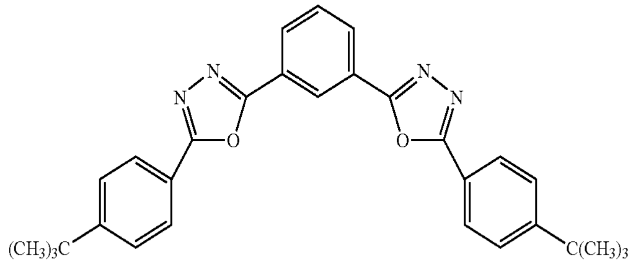
Light-Emitting Layer Matrix Materials and Electron-Transporting Materials











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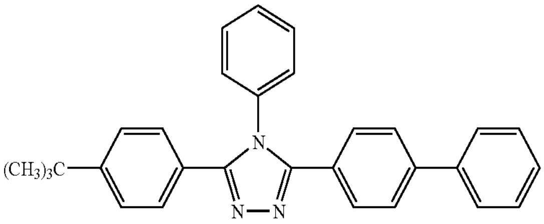
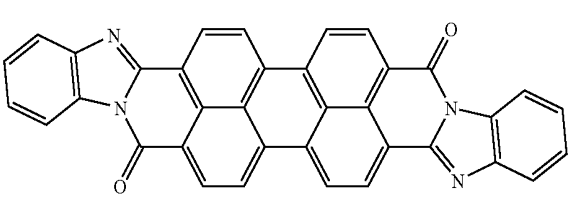
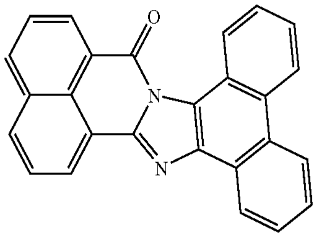
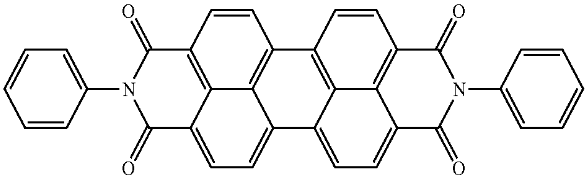
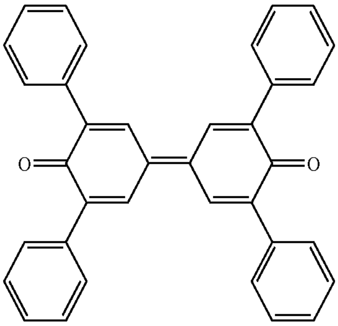


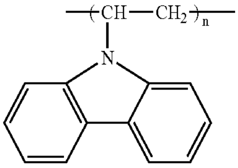








Polymer-Based Hole-Transporting Materials



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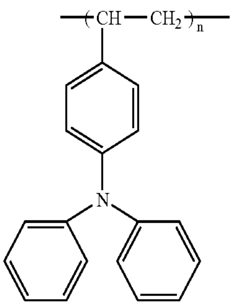

DPA-PS

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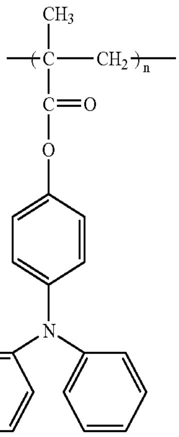
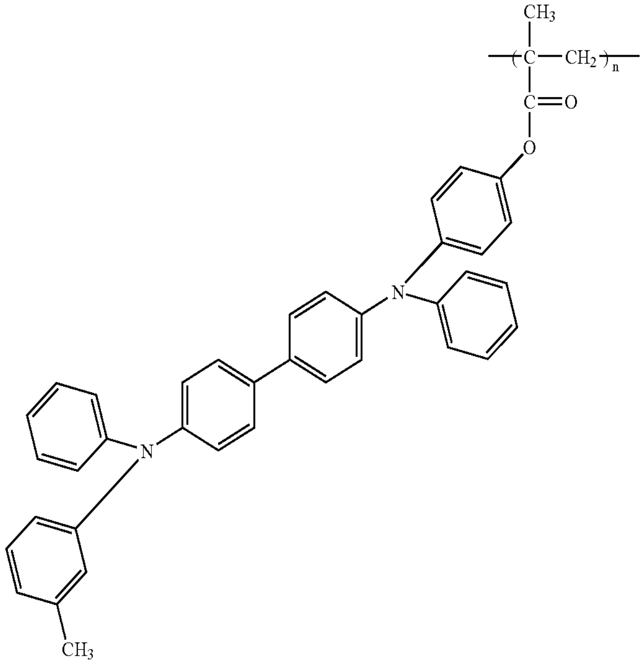


TPA-PMMA



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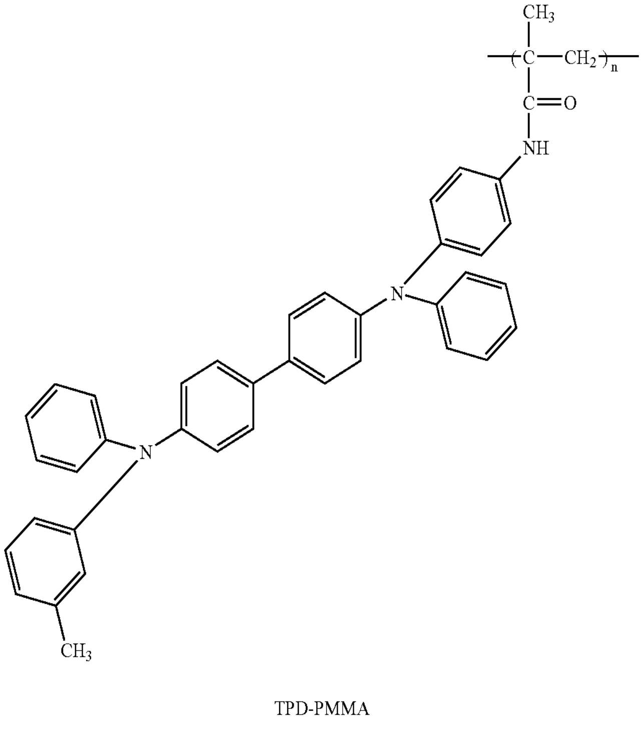

TPD-PMMA

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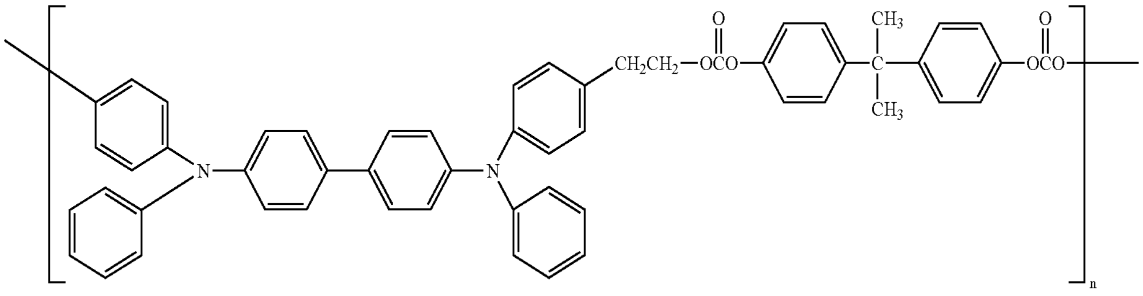
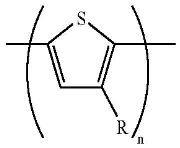
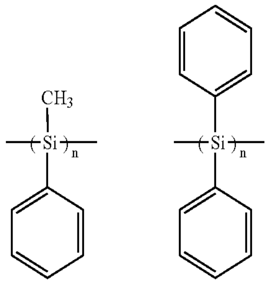


TPD-PCA

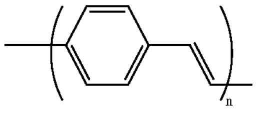


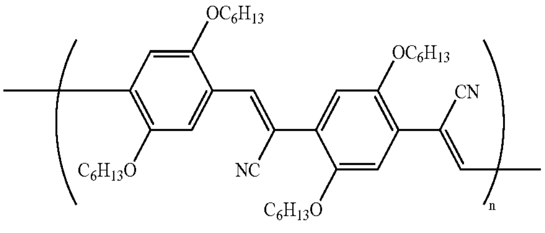
R: C_6H_{13}, C_8H_{17}, $C_{12}H_{25}$
Poly thiophene

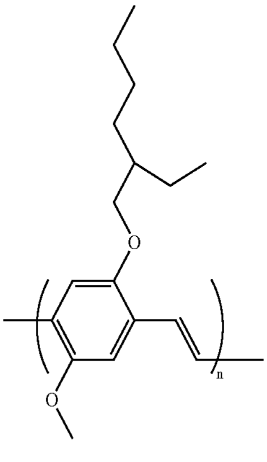


Polysilane

Polymer-Based Light-Emitting Materials and Charge-Transporting Materials







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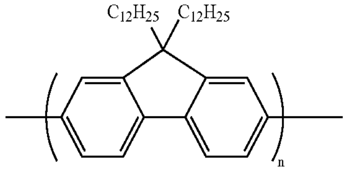
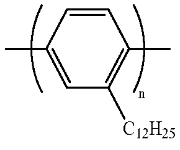
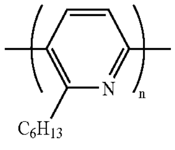






In the organic light-emitting device of the present invention, the layers containing the condensed polycyclic compounds represented by the general formula [I] or the general formula [II] and the layers containing other organic compounds are generally formed into thin films by a vacuum deposition process or a coating process in which they are dissolved in a suitable solvent. In particular, when the film is formed by a coating process, it is also possible to form the film in combination with suitable binding resins.

The above-described binding resins can be selected from a wide range of binding resins, and include, but not limited to, polyvinylcarbazole resins, polycarbonate resins, polyester resins, polyallylate resins, polystyrene resins, acrylic resins, methacrylic resins, butyral resins, polyvinylacetal resins, diallylphthalate resins, phenol resins, epoxy resins, silicone resins, polysulfone resins, urea resins and the like. In addition, one of them or a mixture of two or more of them may be used in the form of a homopolymer or a copolymer.

The materials for the anode preferably have a large work function, and elemental metals such as gold, platinum, nickel, palladium, cobalt, serene, vanadium and alloys thereof and metal oxides such as tin oxides, zinc oxides, indium tin oxides (ITO) and indium zinc oxides can be used. In addition, conductive polymers such as polyaniline, polypyrrole, polythiophene and poyphenylene sulfide can be used. These electrode materials can be used singly or in combination.

On the other hand, the materials for the cathode preferably have a small work function, and elemental metals such as lithium, sodium, potassium, calcium, magnesium, aluminum, indium, silver, lead, tin and chrome and alloys thereof can be used. Metal oxides such as indium tin oxides (ITO) can also be used. The cathode may have one-layered structure or may have a multilayered structure.

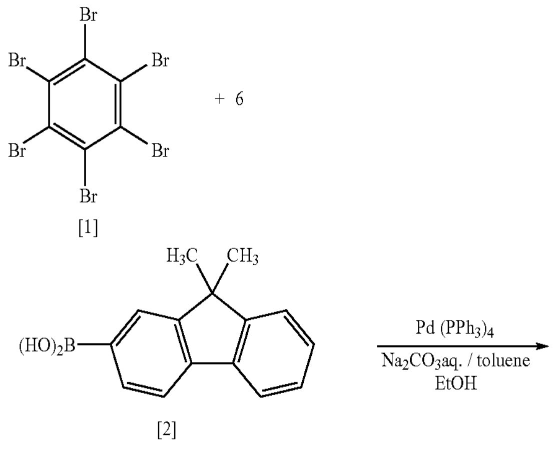
The substrates for use in the present invention include, but not limited to, metal substrates, opaque substrates such as ceramic substrates, transparent substrates such as glass, quartz and plastic sheet. Moreover, it is possible to control the color of emitted light using a color filter film, a fluorescent color conversion filter film, a dielectric reflecting film and the like for the substrate.

Furthermore, a protective layer or a sealing layer can also be provided to the prepared device for the purpose of preventing contact with oxygen, moisture and the like. The protective layer includes an inorganic material film such as a diamond thin film, a metal oxide or a metal nitride; a polymeric film such as a fluororesin, polyparaxylene, polyethylene, a silicone resin and a polystyrene resin; a photocurable resin or the like. Moreover, the device itself can be covered with glass, a gas-impermeable film, metal or the like and packaged with a suitable sealing resin.

EXAMPLES

The present invention will now be described in detail with reference to examples, but the present invention is not limited to them.

Example of Synthesis 1 (Synthesis of the Illustrated Compounds No. 1 and No. 11)



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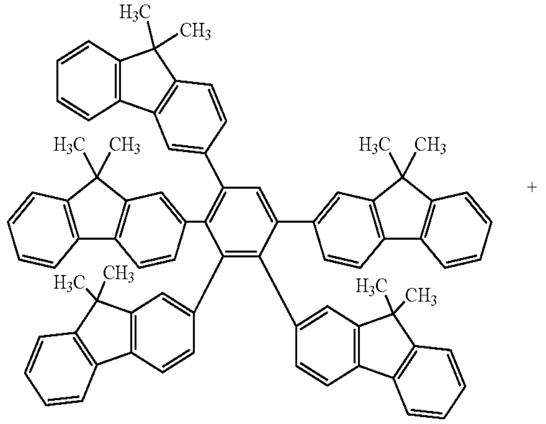
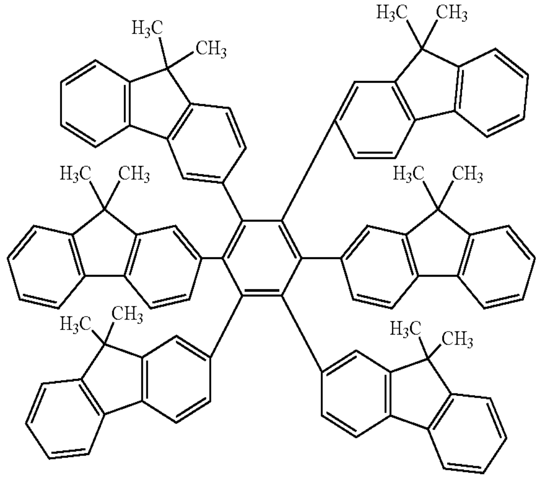


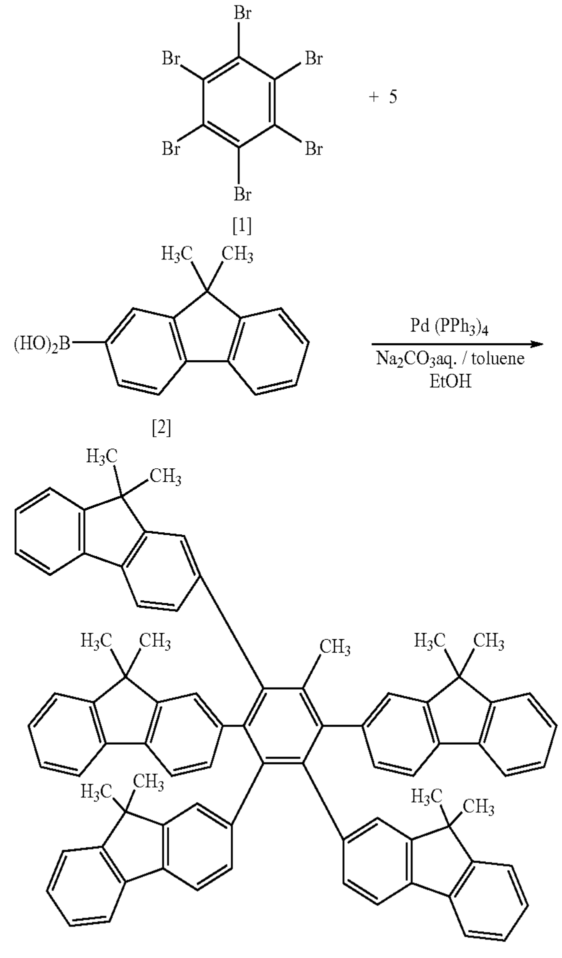
No. 1



No. 11

To a three-necked flask of 500 ml, 1.4 g (2.54 mmol) of hexabromobenzene [1], 6.0 g (25.4 mmol) of 9,9-dimethylfluorene-2-boronic acid [2], 160 ml of toluene and 80 ml of ethanol were charged and an aqueous solution of 30 g of sodium carbonate/150 ml of water was dropped under stirring at room temperature in a nitrogen atmosphere, and then 0.9 g (0.78 mmol) of tetrakis(triphenylphosphine)palladium (0) was added. After stirring at room temperature for 30 minutes, the mixture was raised to a temperature of 77° C. and stirred for 20 hours. After the reaction was completed, the organic layer was extracted with chloroform, dried with anhydrous sodium sulfate and purified with a silica gel column (hexane+toluene mixed developing solvent), obtaining 0.44 g (yield of 17%) of the illustrated compound No. 1 (white crystal) and 1.3 g (yield of 42%) of No. 11 (white crystal).

Example of Synthesis 2 (Synthesis of the Illustrated Compound No. 2)



No. 2

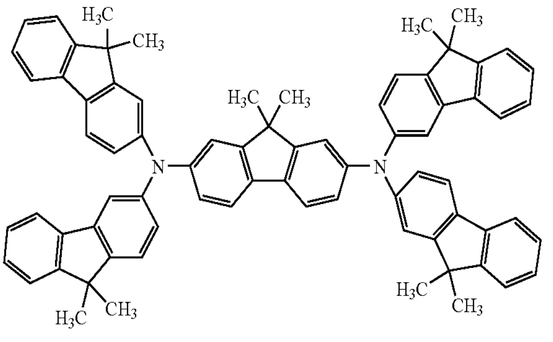
To a three-necked flask of 300 ml, 0.5 g (1.03 mmol) of 2,3,4,5,6-pentabromotoluene [1], 2.5 g (10.3 mmol) of 9,9-dimethylfluorene-2-boronic acid [2], 100 ml of toluene and 50 ml of ethanol were charged and an aqueous solution of 10 g of sodium carbonate/50 ml of water was dropped under stirring at room temperature in a nitrogen atmosphere, and then 0.3 g (0.26 mmol) of tetrakis(triphenylphosphine)palladium (0) was added. After stirring at room temperature for 30 minutes, the mixture was raised to a temperature of 7° C. and stirred for 20 hours. After the reaction, the organic layer was extracted with chloroform before dried with anhydrous sodium sulfate and purified with a silica gel column (hexane+toluene mixed developing solvent), obtaining 0.54 g (yield of 55%) of the illustrated compound No. 2 (white crystal).

Example 1

A device having the structure shown in FIG. **2** was prepared.

On a glass substrate as the substrate **1**, indium tin oxide (ITO) as the anode **2** was deposited by a sputtering process in a thickness of 120 nm and ultrasonically cleaned with acetone and isopropyl alcohol (IPA) in this order, and dried after the cleaning by boiling with IPA. Further, it was cleaned with UV/ozone. The resultant structure is referred to a transparent conductive supporting substrate.

On the transparent conductive supporting substrate, a 0.5% by weight chloroform solution of the compound represented by the following structural formula was applied by a spin-coating process to form a film having a thickness of 30 nm, forming the hole-transporting layer **5**.



The condensed polycyclic compound represented by the illustrated compound No. 11 was deposited on the hole-transporting layer **5** by a vacuum deposition process in a thickness of 50 nm to form the electron-transporting layer **6**. As for the conditions, the degree of the vacuum at the vapor deposition was 1.0x10^{-4} Pa and the speed of deposition was 0.2 to 0.3 nm/sec.

A vapor deposition material consisting of aluminum and lithium (lithium concentration of 1 atomic %) was used to form a metal layer film having a thickness of 50 nm on the electron-transporting layer **6** by a vacuum deposition process, and further by the vacuum deposition process an aluminum layer having a thickness of 150 nm was provided to form the cathode **4**. As for the conditions, the degree of the vacuum at the vapor deposition was 1.0x10^{-4} Pa and the speed of deposition was 1.0 to 1.2 nm/sec.

The resultant structure was covered with a protective glass plate in a nitrogen atmosphere and sealed with an acrylic resin-based adhesive material.

When the thus obtained organic EL device was applied with a direct-current voltage of 10 V using an ITO electrode (anode **2**) as a positive electrode and an Al—Li electrode (cathode **4**) as a negative electrode, the current passed through the device at a current density of 12.0 mA/cm^2 and the light emission of blue color was observed at a luminance of 2,800 cd/m^2.

In addition, when the voltage was applied for 100 hours while maintaining the current density at 10.0 mA/cm^2, the initial luminance of 2,200 cd/m^2 dropped to 2,000 cd/m^2 after 100 hours, exhibiting only a small reduction of luminance.

Examples 2 to 10

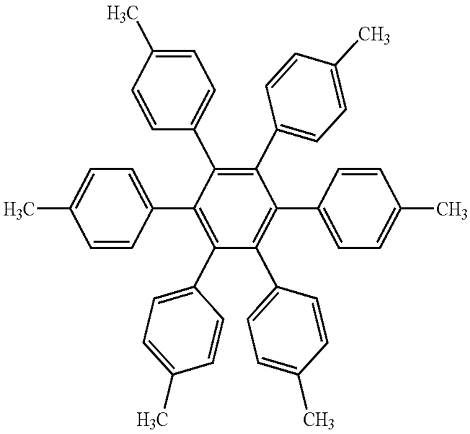
Devices were prepared and evaluated in the same manner as in Example 1 except that illustrated compounds shown in Table 1 replaced the illustrated compound No. 11. The results are shown in Table 1.

Comparative Examples 1 to 5

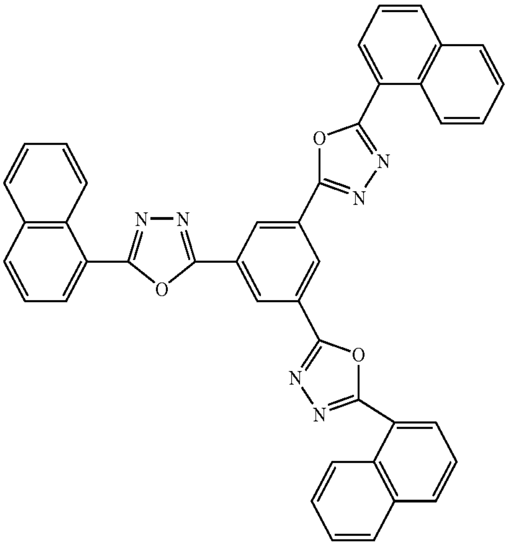
Devices were prepared and evaluated in the same manner as in Example 1 except that the compounds represented by the structural formulas below replaced the illustrated compound No. 11. The results are shown in Table 1.

TABLE 1

Comparative compound No. 1



Comparative compound No. 2



Comparative compound No. 3

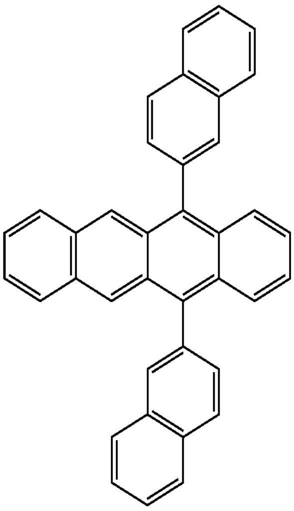
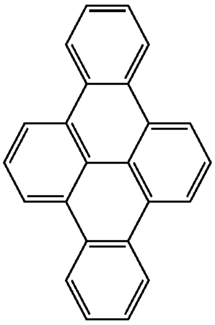
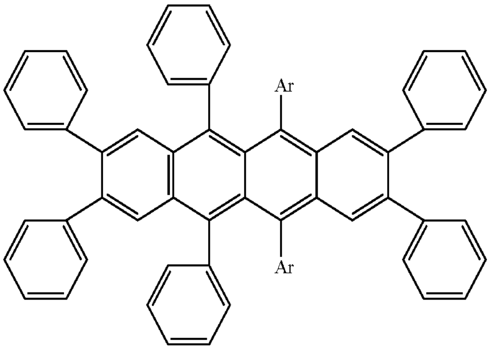


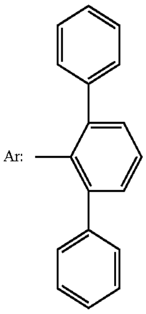
TABLE 1-continued

Comparative compound No. 4



Comparative compound No. 5





			Initial		Durability		
Example No.		Illustrated Compound No.	Applied Voltage (V)	Luminance (cd/m^2)	Current Density (mA/cm^2)	Initial Luminance (cd/m^2)	Luminance After 100 Hours (cd/m^2)
Example	1	11	10	2,800	10.0	2,200	2,000
	2	1	10	2,600	10.0	1,900	1,600
	3	3	10	3,000	10.0	2,400	2,000
	4	6	10	1,900	10.0	1,400	1,100
	5	8	10	1,800	10.0	1,500	1,300
	6	9	10	2,000	10.0	1,500	1,200
	7	12	10	2,400	10.0	1,900	1,500
	8	14	10	950	10.0	800	700
	9	17	10	1,700	10.0	1,400	1,300
	10	21	10	2,200	10.0	1,900	1,500
Comparative Example	1	Comparative Compound 1	10	150	10.0	140	No Light Emission
	2	2	10	170	10.0	150	No Light Emission
	3	3	10	300	10.0	250	30
	4	4	10	250	10.0	240	90
	5	5	10	450	10.0	420	150

Example 11

The device shown in FIG. **3** was prepared.

The hole-transporting layer **5** was formed on the transparent conductive supporting substrate in the same manner as in Example 1.

The condensed polycyclic compound represented by the illustrated compound No. 1 was deposited on the hole-transporting layer **5** by a vacuum deposition process in a thickness of 20 nm to form the light-emitting layer **3**. As for the conditions, the degree of the vacuum at the vapor deposition was 1.0×10^{-4} Pa and the speed of deposition was 0.2 to 0.3 nm/sec.

Aluminum-trisquinolinol was deposited on the light-emitting layer **3** by a vacuum deposition process in a thickness of 40 nm to form the electron-transporting layer **6**. As for the conditions, the degree of the vacuum at the vapor deposition was 1.0×10^{-4} Pa and the speed of deposition was 0.2 to 0.3 nm/sec.

The device was sealed after the cathode **4** was formed in the same manner as in Example 1.

When the thus obtained device was applied with a direct-current voltage of 8 V using an ITO electrode (anode **2**) as a positive electrode and an Al—Li electrode (cathode **4**) as a negative electrode, the current having a current density of 14.0 mA/cm^2 passed through the device and the light emission of blue color was observed at a luminance of 5,800 cd/m^2.

In addition, when the voltage was applied for 100 hours while maintaining the current density at 10.0 mA/cm^2, the initial luminance of 4,500 cd/m^2 dropped to 4,200 cd/m^2 after 100 hours, exhibiting only a small reduction of luminance.

Examples 12 to 20

Devices were prepared and evaluated in the same manner as in Example 11 except that illustrated compounds shown in Table 2 replaced the illustrated compound No. 1. The results are shown in Table 2.

Comparative Examples 6 to 10

Devices were prepared and evaluated in the same manner as in Example 11 except that the comparative compounds No. 1 to 5 replaced the illustrated compound No. 1. The results are shown in Table 2.

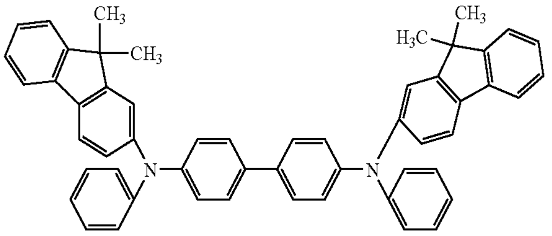
TABLE 2

		Initial		Durability		
Example No.	Illustrated Compound No.	Applied Voltage (V)	Luminance (cd/m^2)	Current Density (mA/cm^2)	Initial Luminance (cd/m^2)	Luminance After 100 Hours (cd/m^2)
Example 11	1	8	5,800	10.0	4,500	4,200
12	2	8	5,300	10.0	4,200	4,000
13	4	8	2,900	10.0	2,200	2,000
14	7	8	4,200	10.0	3,400	3,200
15	10	8	3,000	10.0	2,400	2,000
16	13	8	3,100	10.0	2,200	2,000
17	15	8	3,600	10.0	2,800	2,300
18	18	8	3,700	10.0	2,700	2,500
19	20	8	2,800	10.0	2,400	2,100
20	22	8	3,200	10.0	2,500	2,200
Comparative Example 6	Comparative Compound 1	8	350	10.0	300	No Light Emission
7	2	8	400	10.0	350	No Light Emission
8	3	8	1,000	10.0	850	100
9	4	8	750	10.0	650	50
10	5	8	1,500	10.0	1,100	350

Example 21

The device shown in FIG. **3** was prepared.

On the transparent conductive supporting substrate similar to that in Example 1, a 0.5% by weight chloroform solution of the compound represented by the following structural formula was applied by a spin-coating process to form a film having a thickness of 20 nm, forming the hole-transporting layer **5**.



In addition, the condensed polycyclic compound represented by the illustrated compound No. 11 and the fluorene compound represented by the illustrated compound No. FL-6 (weight ratio of 100:1) were deposited by a vacuum deposition process in a thickness of 20 nm to form the light-emitting layer **3**. As for the conditions, the degree of the vacuum at the vapor deposition was 1.0×10^{-4} Pa and the speed of deposition was 0.2 to 0.3 nm/sec.

Moreover, aluminum-trisquinolinol was deposited by a vacuum deposition process in a thickness of 40 nm to form the electron-transporting layer **6**. As for the conditions for deposition, the degree of the vacuum at the vapor deposition was 1.0×10^{-4} Pa and the speed of deposition was 0.2 to 0.3 nm/sec.

The device was then sealed after the cathode **4** was formed in the same manner as in Example 1.

When the thus obtained device was applied with a direct-current voltage of 8 V using an ITO electrode (anode **2**) as a positive electrode and an Al—Li electrode (cathode **4**) as a negative electrode, the current passed through the device at a current density of 13.0 mA/cm^2 and the light emission of blue color was observed at a luminance of 13,000 cd/m^2.

In addition, when the voltage was applied for 100 hours while maintaining the current density at 10.0 mA/cm^2, the initial luminance of 10,000 cd/m^2 dropped to 8,900 cd/m^2 after 100 hours, exhibiting only a small reduction of luminance.

Examples 22 to 40

Devices were prepared and evaluated in the same manner as in Example 21 except that illustrated fluorene compounds shown in Table 3 replaced the illustrated fluorene compound No. FL-6. The results are shown in Table 3.

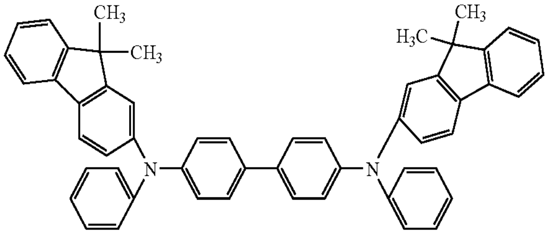
Comparative Examples 11 to 15

Devices were prepared and evaluated in the same manner as in Example 21 except that the comparative compounds No. 1 to 5 replaced the illustrated compound No. 11. The results are shown in Table 3.

Example 41

The device shown in FIG. **3** was prepared.

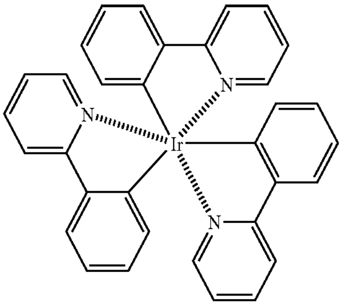
On the transparent conductive supporting substrate similar to that in Example 1, a 0.5% by weight chloroform solution of the compound represented by the following structural formula was applied by a spin-coating process to form a film having a thickness of 20 nm, forming the hole-transporting layer **5**.



In addition, the condensed polycyclic compound represented by the illustrated compound No. 2 and the compound represented by the following structural formula (weight ratio of 100:5) were deposited by a vacuum deposition process in a thickness of 20 nm to form the light-emitting layer **3**. As for the conditions for deposition, the degree of the vacuum at the vapor deposition was 1.0×10^{-4} Pa and the speed of deposition was 0.2 to 0.3 nm/sec.

TABLE 3

				Initial			Durability	
Example No.		Illustrated Compound No.	Illustrated Compound No.	Applied Voltage (V)	Luminance (cd/m^2)	Current Density (mA/cm^2)	Initial Luminance (cd/m^2)	Luminance After 100 Hours (cd/m^2)
Example	21	11	FL-6	8	13,000	10.0	10,000	9,000
	22	11	FL-1	8	11,000	10.0	8,500	8,000
	23	11	FL-2	8	11,000	10.0	8,000	7,000
	24	11	FL-3	8	8,500	10.0	7,500	6,500
	25	11	FL-4	8	13,000	10.0	9,500	7,500
	26	11	FL-5	8	12,000	10.0	9,000	7,000
	27	11	FL-7	8	7,000	10.0	6,000	5,500
	28	11	FL-8	8	7,500	10.0	6,500	6,000
	29	11	FL-9	8	12,000	10.0	10,000	9,000
	30	11	FL-10	8	6,500	10.0	6,000	5,500
	31	11	FL-11	8	15,000	10.0	12,000	11,000
	32	11	FL-12	8	9,000	10.0	8,000	6,500
	33	11	FL-13	8	7,000	10.0	6,500	6,000
	34	11	FL-14	8	8,000	10.0	6,500	5,500
	35	11	FL-15	8	11,000	10.0	9,000	8,000
	36	11	FL-16	8	16,000	10.0	13,000	11,000
	37	11	FL-17	8	13,000	10.0	11,000	9,500
	38	11	FL-18	8	9,500	10.0	8,000	6,500
	39	11	FL-19	8	7,500	10.0	6,000	5,000
	40	11	FL-20	8	6,500	10.0	6,000	5,000
Comparative	11	Comparative 1	1	8	2,500	10.0	2,000	300
Example	12	Compound 2	2	8	2,000	10.0	15,000	No Light Emission
	13	3	3	8	3,000	10.0	25,000	600
	14	4	4	8	2,500	10.0	2,000	400
	15	5	5	8	3,500	10.0	3,000	1,000



Moreover, bathophenanthroline (BPhen) was deposited by a vacuum deposition process in a thickness of 40 nm to form the electron-transporting layer **6**. As for the conditions for deposition, the degree of the vacuum at the vapor deposition was 1.0×10^{-4} Pa and the speed of deposition was 0.2 to 0.3 nm/sec.

The device was then sealed after the cathode **4** was formed in the same manner as in Example 1.

When the thus obtained device was applied with a direct-current voltage of 8 V using an ITO electrode (anode **2**) as a positive electrode and an Al—Li electrode (cathode **4**) as a negative electrode, the current passed through the device at a current density of 9.5 mA/cm^2 and the light emission of green color was observed at a luminance of 7,000 cd/m^2.

In addition, when the voltage was applied for 100 hours while maintaining the current density at 7.0 mA/cm^2, the initial luminance of 5,000 cd/m^2 dropped to 4,500 cd/m^2 after 100 hours, exhibiting only a small reduction of luminance.

Examples 42 to 50

Devices were prepared and evaluated in the same manner as in Example 41 except that illustrated compounds shown in Table 4 replaced the illustrated compound No. 2. The results are shown in Table 4.

Comparative Examples 16 to 20

Devices were prepared and evaluated in the same manner as in Example 41 except that the comparative compounds No. 1 to 5 replaced the illustrated compound No. 2. The results are shown in Table 4.

TABLE 4

				Initial		Durability		
Example No.		Illustrated Compound No.		Applied Voltage (V)	Luminance (cd/m^2)	Current Density (mA/cm^2)	Initial Luminance (cd/m^2)	Luminance After 100 Hours (cd/m^2)
Example	41	2		8	7,000	7.0	5,000	4,500
	42	3		8	6,500	7.0	5,000	4,000
	43	5		8	8,000	7.0	6,500	6,000
	44	6		8	7,000	7.0	6,000	5,000
	45	13		8	6,000	7.0	5,000	4,500
	46	15		8	8,500	7.0	7,500	6,500
	47	16		8	7,000	7.0	6,500	6,000
	48	19		8	4,500	7.0	4,000	3,500
	49	20		8	5,000	7.0	4,000	3,000
	50	22		8	6,500	7.0	5,500	4,500
Comparative	16	Comparative	1	8	900	7.0	800	100
Example	17	Compound	2	8	650	7.0	600	No Light Emission
	18		3	8	1,500	7.0	1,000	300
	19		4	8	1,000	7.0	850	100
	20		5	8	2,000	7.0	1,500	550

Example 51

The device shown in FIG. **1** was prepared.

On the transparent conductive supporting substrate similar to that in Example 1, a solution in which 0.050 g of the condensed polycyclic compound represented by the illustrated compound No. 1 and 1.00 g of poly-N-vinylcarbazole (weight average molecular weight=63,000) were dissolved in 80 ml of chloroform was applied by a spin-coating process (the number of revolutions=2,000 rpm) to form a film having a thickness of 120 nm, forming the organic layer (light-emitting layer **3**).

The device was then sealed after the cathode **4** was formed in the same manner as in Example 1.

When the thus obtained device was applied with a direct-current voltage of 10 V using an ITO electrode (anode **2**) as a positive electrode and an Al—Li electrode (cathode **4**) as a negative electrode, the current passed through the device at a current density of 7.7 mA/cm^2 and the light emission of blue color was observed at a luminance of 1,400 cd/m^2.

In addition, when the voltage was applied for 100 hours while maintaining the current density at 5.0 mA/cm^2 in a nitrogen atmosphere, the initial luminance of 950 cd/m^2 dropped to 900 cd/m^2 after 100 hours, exhibiting only a small reduction of luminance.

Examples 52 to 55

Devices were prepared and evaluated in the same manner as in Example 51 except that illustrated compounds shown in Table 5 replaced the illustrated compound No. 1. The results are shown in Table 5.

Comparative Examples 21 to 25

Devices were prepared and evaluated in the same manner as in Example 51 except that the comparative compounds No. 1 to 5 replaced the illustrated compound No. 1. The results are shown in Table 5.

TABLE 5

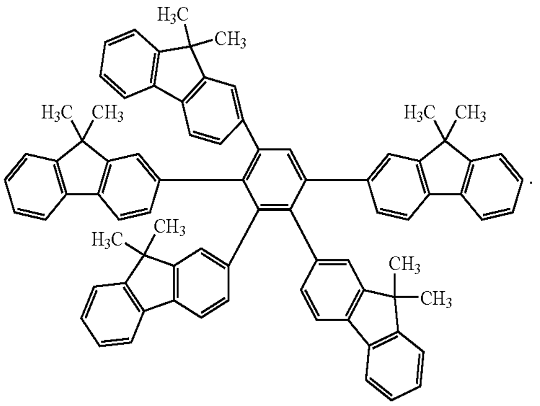
				Initial		Durability		
Example No.		Illustrated Compound No.		Applied Voltage (V)	Luminance (cd/m^2)	Current Density (mA/cm^2)	Initial Luminance (cd/m^2)	Luminance After 100 Hours (cd/m^2)
Example	51	1		10	1,400	5.0	950	900
	52	2		10	1,200	5.0	900	800
	53	11		10	1,500	5.0	1,200	1,100
	54	17		10	1,400	5.0	1,000	950
	55	19		10	1,300	5.0	1,000	850
Comparative Example	16	Comparative Compound	1	10	250	5.0	200	No Light Emission
	17		2	10	150	5.0	100	No Light Emission
	18		3	10	350	5.0	300	No Light Emission
	19		4	10	300	5.0	250	No Light Emission
	20		5	10	550	5.0	450	100

As described above by illustrating embodiments and examples, the organic light-emitting devices using the condensed polycyclic compounds represented by the general formula [1] or the general formula [11] provide the light-emission having high luminance at a low applied voltage and are also excellent in durability. Particularly, the organic layers containing the condensed polycyclic compounds of the present invention are excellent as an electron-transporting layer as well as a light-emitting layer.

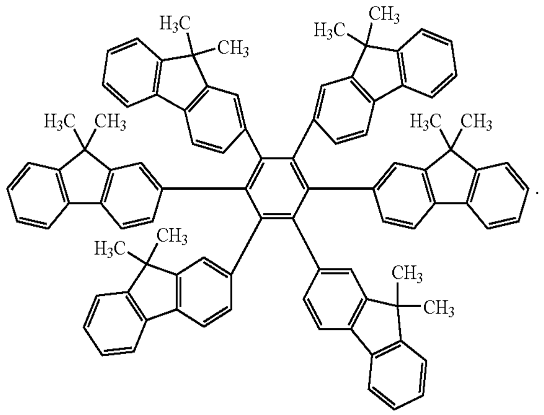
Moreover, it is possible to prepare the devices by using a vacuum deposition process, casting process or the like, and the devices having a large area can be prepared easily at a relatively low cost.

The invention claimed is:

1. A condensed polycyclic compound represented by the following structural formula:



2. A condensed polycyclic compound represented by the following structural formula:



3. An organic light-emitting device comprising a pair of electrodes consisting of an anode and a cathode and one or a plurality of organic compound-containing layers sandwiched between the pair of electrodes, wherein at least one layer of the organic compound-containing layers contains at least the condensed polycyclic compound according to claim **1**.

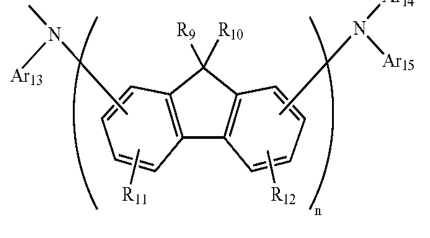
4. An organic light-emitting device comprising a pair of electrodes consisting of an anode and a cathode and one or a plurality of organic compound-containing layers sandwiched between the pair of electrodes, wherein at least one layer of the organic compound-containing layers contains at least the condensed polycyclic compound according to claim **2**.

5. The organic light-emitting device according to claim **3**, wherein at least one layer of the organic compound-containing layers containing the condensed polycyclic compound is an electron-transporting layer or a light-emitting layer.

6. The organic light-emitting device according to claim **4**, wherein at least one layer of the organic compound-containing layers containing the condensed polycyclic compound is an electron-transporting layer or a light-emitting layer.

7. The organic light-emitting device according to claim **3**, wherein at least one of the layers containing the condensed polycyclic compound is a light-emitting layer containing a fluorene compound represented by general formula [VIII]:

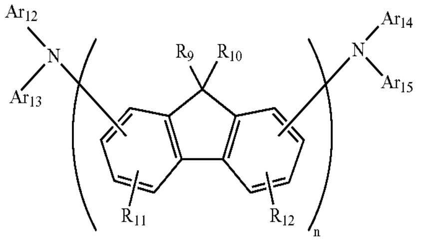
[VIII]



wherein R_9 and R_{10} are the same or different and are each independently hydrogen or a group selected from the group consisting of alkyl, aralkyl, aryl and heterocyclic, each having no substituent or a substituent; any pair of R_9 combined to their respective fluorene structures are the same or different to each other; any pair of R_{10} combined to their respective fluorene structures are the same or different to each other; R_{11} and R_{12} are the same or different and are each independently hydrogen, halogen, cyano or a group selected from the group consisting of alkyl, aralkyl, aryl and heterocyclic, each having no substituent or a substituent; any pair of R_{11} combined to their respective fluorene structures are the same or different to each other; any pair of R_{12} combined to their respective fluorene structures are the same or different to each other; Ar_{12}, Ar_{13}, Ar_{14} and Ar_{15} are the same or different and are each independently a group selected from the group consisting of aromatic, heterocyclic, condensed polycyclic aromatic and condensed polycyclic heterocyclic, each having no substituent or a substituent, and Ar_{12} and Ar_{14} can be bonded to Ar_{13} and Ar_{15} respectively to form a ring; and n is an integer from 1 to 10.

8. The organic light-emitting device according to claim **4**, wherein at least one of the layers containing the condensed polycyclic compound is a light-emitting layer containing a fluorene compound represented by general formula [VIII]:

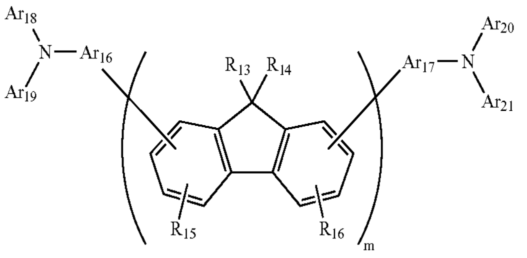
[VIII]



wherein R_9 and R_{10} are the same or different and are each independently hydrogen, halogen, cyano or a group selected from the group consisting of alkyl, aralkyl, aryl and heterocyclic, each having no substituent or a substituent; any pair of R_9 combined to their respective fluorene structures are the same or different to each other; any pair of R_{10} combined to their respective fluorene structures are the same or different to each other; R_{11} and R_{12} are the same or diffenrent and are each independently hydrogen, halogen, cyano or a group selected from the group consisting of alkyl, aralkyl, aryl and heterocyclic, each having no substituent or a substituent; any pair of R_{11} combined to their respective fluorene structures are the same or different to each other; any pair of R_{12} combined to their respective fluorene structures are the same or different to each other; Ar_{12}, Ar_{13}, Ar_{14} and Ar_{15} are the same or different and are each independently a group selected from the group consisting of aromatic, heterocyclic, condensed polycyclic aromatic and condensed polycyclic heterocyclic, each having no substituent or a substituent, and Ar_{12} and Ar_{14} can be bonded to Ar_{13} and Ar_{15} respectively to form a ring; and n is an integer from 1 to 10.

9. The organic light-emitting device according to claim **3**, wherein at least one of the layers containing the condensed polycyclic compound is a light-emitting layer containing a fluorene compound represented by general formula [IX]:

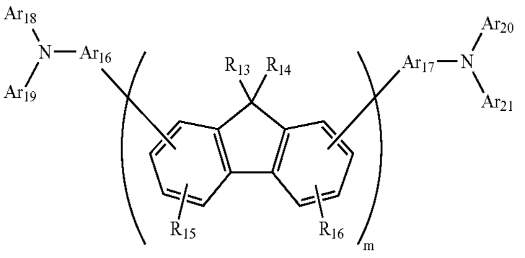
[IX]



wherein R_{13} and R_{14} are the same or different and are each independently hydrogen or a group selected from the group consisting of alkyl, aralkyl, aryl and heterocyclic, each having no substituent or a substituent; any pair of R_{13} combined to their respective fluorene structures are the same or different to each other; any pair of R_{14} combined to their respective fluorene structures are the same or different to each other; R_{15} and R_{16} are the same or different and are each independently hydrogen, halogen, cyano or a group selected from the group consisting of alkyl, aralkyl, aryl and heterocyclic, each having no substituent or a substituent; any pair of R_{15} combined to their respective fluorene structures are the same or different to each other; any pair of R_{16} combined to their respective fluorene structures are the same or different to each other; Ar_{16} and Ar_{17} are the same or different and are each independently a divalent group selected from the group consisting of divalent aromatic and divalent heterocyclic, each having no substituent or a substituent; Ar_{18}, Ar_{19}, Ar_{20} and Ar_{21} are the same or different and are each independently a group selected from the group consisting of aromatic, heterocyclic, condensed polycyclic aromatic and condensed polycyclic heterocyclic, each having no substituent or a substituent, and Ar_{18} and Ar_{20} can be bonded to Ar_{19} and Ar_{21} respectively to form a ring; and m is an integer from 1 to 10.

10. The organic light-emitting device according to claim **4**, wherein at least one of the layers containing the condensed polycyclic compound is a light-emitting layer containing a fluorene compound represented by general formula [IX]:

[IX]



wherein R_{13} and R_{14} are the same or different and are each independently hydrogen or a group selected from the group consisting of alkyl, aralkyl, aryl and heterocyclic, each having no substituent or a substituent; any pair of R_{13} combined to their respective fluorene structures are the same or different to each other; any pair of R_{14} combined to their respective fluorene structures are the same or different to each other; R_{15} and R_{16} are the same or different and are each independently hydrogen, halogen, cyano or a group selected from the group consisting of alkyl, aralkyl, aryl and heterocyclic, each having no substituent or a substituent; any pair of R_{15} combined to their respective fluorene structures are the same or different to each other; any pair of R_{16} combined to their respective fluorene structures are the same or different to each other; Ar_{16} and Ar_{17} are the same or different and are each independently a divalent group selected from the group consisting of divalent aromatic and divalent heterocyclic, each having no substituent or a substituent; Ar_{18}, Ar_{19}, Ar_{20} and Ar_{21} are the same or different and are each independently a group selected from the group consisting of aromatic, heterocyclic, condensed polycyclic aromatic and condensed polycyclic heterocyclic, each having no substituent or a substituent, and Ar_{18} and Ar_{20} can be bonded to Ar_{19} and Ar_{21} respectively to form a ring; and m is an integer from 1 to 10.

* * * * *

专利名称(译)	缩合多环化合物和使用其的有机发光器件		
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[标]申请(专利权)人(译)	佳能株式会社		
申请(专利权)人(译)	佳能株式会社		
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发明人	SUZUKI, KOICHI KAWAI, TATSUNDO SENOO, AKIHIRO YAMADA, NAOKI SAITOH, AKIHITO OKAJIMA, MAKI		
IPC分类号	H01L51/54 C07C13/567 C09K11/06 H01L51/50 C07C13/66 C07C15/24 C07C15/28 C07C15/30 C07C15/38 C07C15/56 C07C15/58 C07C15/60 C07C15/62 C07C25/22 C07C211/58 C07C211/61 C07C255/52 C07C255/58 C07D219/02 C07D401/14 C07D471/04 H01L51/00 H01L51/30		
CPC分类号	C07C13/567 C07C13/66 C07C15/24 C07C15/28 C07C15/30 C07C15/38 C07C25/22 C07C211/61 C07C255/58 C09K11/06 H01L51/0058 H01L51/006 H01L51/0071 C07C2103/18 C07C2103/24 C07C2103/50 C09K2211/1003 C09K2211/1007 C09K2211/1011 C09K2211/1014 C09K2211/1029 H01L51/0036 H01L51/0038 H01L51/0039 H01L51/004 H01L51/0042 H01L51/005 H01L51/0053 H01L51/0054 H01L51/0055 H01L51/0065 H01L51/0067 H01L51/0069 H01L51/007 H01L51/0078 H01L51/0079 H01L51/0081 H01L51/0094 H01L51/5012 H01L51/5048 Y10S428/917 C07C2603/18 C07C2603/24 C07C2603/50		
审查员(译)	MORRIS，特雷尔		
优先权	2002246600 2002-08-27 JP 2003291191 2003-08-11 JP		
其他公开文献	US20050236974A1		
外部链接	Espacenet USPTO		

摘要(译)

由通式[I]表示的新的稠合多环化合物： 其中R1是氢，卤素，氰基，取代的氨基或选自烷基，芳烷基，芳基，杂环基的基团，各自没有取代基或取代基; Ar1与Ar5相同或不同，各自独立地为稠合多环芳香族基团或稠合多环杂环基，各自不具有取代基或取代基，用于在光输出方面效率极高的有机发光装置。高亮度，非常耐用。

[I]