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(54) **VINYL-BASED POLYMER WITH SILICON OR/AND TIN AND ORGANIC LIGHT EMISSION DIODE USING THE SAME**

VINYLBASIERTES POLYMER MIT SILIZIUM ODER/UND ZINN SOWIE DAVON GEBRAUCH MACHENDE ORGANISCHE LEUCHTDIODE

POLYMÈRE À BASE DE VINYLE AVEC DU SILICIUM ET/OU DE L'ÉTAIN ET DIODE ÉLECTROLUMINESCENTE ORGANIQUE QUI L'UTILISE

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EP 2 144 973 B1

Description

[Technical Field)

[0001] The present invention relates to a vinyl-based polymer comprising silicon and/or tin, and more particularly to a vinyl-based polymer comprising silicon and tin used to form a light emitting layer of an organic light emitting diode.

[Background Art]

[0002] An Organic Light Emitting Diode (OLED) has various advantages over a Thin Film Transistor-Liquid Crystal Display (TFT-LCD), such as lower voltage requirement for driving, slim shape, wide viewing angle, faster response time, etc. Furthermore, the OLED provides equivalent or superior image quality, especially in small and medium sizes, to the TFT-LCD and is produced via a simple manufacturing process which leads to a competitive price as compared to other types of display devices. With such advantages, it has been spotlighted as a next step in display technology.

[0003] The OLED includes a lower substrate where an Indium Tin Oxide (ITO) transparent electrode pattern is formed as an anode on a transparent glass substrate, an upper substrate where a metal electrode is formed as a cathode on a substrate, and an organic light emitting material disposed between the upper and lower substrates. With this configuration, when voltage is applied between the transparent electrode and the metal electrode, current flows through the organic light emitting material, so that the OLED emits light.

[0004] Organic light emitting materials used for OLEDs were first developed in 1987 by the Eastman Kodak Company using small molecules such as aromatic diamines and an aluminum complex as a light emitting layer material (Applied Physics Letters, Vol. 51, p 913, 1987). Also, OLEDs using such materials were first reported as a device with practical performance by C. W. Tang, et al. [Applied Physics Letters, Vol. 51, No. 12, pp 913-915, 1987].

[0005] Those documents disclose an organic light emitting layer which has a stacked structure of a diamine derivative thin film (hole transport layer) and an Alq3(tris(8-hydroxy-quinolate)aluminum) thin film (electron transportable light emitting layer).

[0006] The foregoing materials for the light emitting layer are all polymers which are soluble in common solvents, unlike low molecular weight light emitting materials, and can form a light emitting layer by coating methods.

[0007] Recently, a variety of polymeric light emitting materials have been proposed (e.g. Advanced Materials, Vol.12, pp 1737-1750, 2000).

[0008] In the case of manufacturing a device using the polymeric light emitting material by coating, the polymeric light emitting material provides merits in that manufacturing processes can be simplified and in that large scale devices can be easily made, unlike when low molecular vacuum deposition is employed.

[0009] When an electric field is applied to an OLED such that holes and electrons are injected from an anode and a cathode, the holes and electrons are recombined into excitons in a light emitting layer.

[0010] Then, the excitons emit light when returning to the ground state.

[0011] Light emission mechanisms can be divided into two categories: fluorescence using singlet excitons and phosphorescence using triplet excitons.

[0012] Recently, reports have been made that a phosphorescent material as well as a fluorescent material can be used as a light emitting material for an OLED (by D.F. O'Brien et al., Applied Physics Letters, 74 (3), pp 442-444, 1999; M.A. Baldo et al., Applied Physics Letters, 75 (1), pp 4-6, 1999). Phosphorescence is based on the following mechanism: after transition of electrons from the ground state to the excited state, non-emissive transition of singlet excitons to triplet excitons occurs through intersystem crossing, and then, transition of triplet excitons to the ground state occurs while emitting light.

[0013] Here, since the triplet excitons are spin-forbidden directly to the groundstate in transition, they undergo transition to the ground state after flipping of electron spins. Thus, phosphorescence has a longer lifetime (emission time) than fluorescence.

[0014] That is, fluorescence has an emission duration of just several nano seconds, whereas phosphorescence has a relatively long duration of several micro seconds.

[0015] In view of quantum mechanics, when holes from the anode and electrons from the cathode are recombined into the excitons in an OLED, the generation ratio of singlet to triplet is 1:3, which means three times as many triplet excitons are generated as singlet electrons.

[0016] Hence, in fluorescence, 25% of the excitons are in an excited singlet state (75% in a triplet state), thereby limiting the emission efficiency. In phosphorescence, however, 75% of the excitons in the triplet state can be used along with 25% of the excitons in the excited singlet state, which enables 100% internal quantum efficiency to be obtained in theory.

[0017] Thus, a phosphorescent material can provide about three times higher emission efficiency than a fluorescent material in practical use.

[0018] For the OLED having the structure described above, a luminescent pigment (dopant) can be added to the light emitting layer (host) to improve efficiency and stability of light emission.

[0019] In this case, the efficiency and performance of the light emitting device can vary depending on what type of host is used for the light emitting layer. As proposed from studies on the light emitting layer (host), examples of an monomolecular organic host material include naphthalene, anthracene, phenanthrene, tetracene, pyrene, benzopyrene, chrysene, picene, carbazole, fluorine, biphenyl, terphenyl, triphenylene oxide, dihalobiphenyl, trans-stilbene, and 1,4-diphenylbutadiene.

[0020] A polymer host can also make an idential function through synthesis of polymers comprising the molecules as proposed above as examples. Document US5807945 relates to copolymers for the production of electroluminescent arrangements, which polymers are based on a well known basic structure, such as polystyrene, with covalently bonded luminophoric units in the side chains. In particular, it discloses a styrene derivativewhich is initially produced starting from 3-(6-hydroxyhexoxycarbonyl)-7-diethylaminocoumarin (24) and 4-(dimethylchlorosilyl)-styrene. The styrene derivative is then polymerised in the presence of 9-vinylcarbazole as comonomer together with AIBN as free-radical initiator to form a copolymer. Although advances have been achieved in the field of OLED technology, there is a need of further improvements in emission efficiency, color purity, and electrical stability.

[0021] Moreover, the current advances in technology are insufficient to realize a large-scale light emitting device.

[0022] Thus, there is still a need of a polymeric light emitting material that can solve the problems of the conventional materials as described above.

[Disclosure]

[Technical Problem]

[0023] Therefore, the present invention is conceived in view of the above problems of the conventional technique, and it is an aspect of the present invention to provide a vinyl-based polymer comprising silicon and/or tin for an organic layer of an OLED, which is soluble in an organic solvent and can emit fluorescent and phosphorescent light from red to blue wavelengths so as to be used for a host material of an organic light emitting layer in the OLED.

[Technical Solution]

[0024] In accordance with an aspect of the present invention, the above and other objects can be accomplished by the provision of a vinyl-based polymer comprising silicon and/or tin for an organic layer of an OLED, which includes a repeat unit represented by Formula 8 and formed by polymerization of a monomer represented by Formula 5.

[0025] In accordance with another aspect of the present invention, a vinyl-based polymer comprising silicon and/or tin for an organic layer of an OLED includes a repeat unit represented by Formula 8 and formed by polymerization of a monomer represented by Formula 5, and a repeat unit represented by Formula 4 and formed by polymerization of a monomer represented by Formula 3.

[Advantageous Effects]

[0026] According to the exemplary embodiments of the present invention, since a vinyl-based polymer comprising silicon and/or tin is soluble in an organic solvent and can emit fluorescent and phosphorescent light from red to blue wavelengths, the polymer can be used for a host material of an organic light emitting layer in an OLED.

[Description of Drawings]

[0027] The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

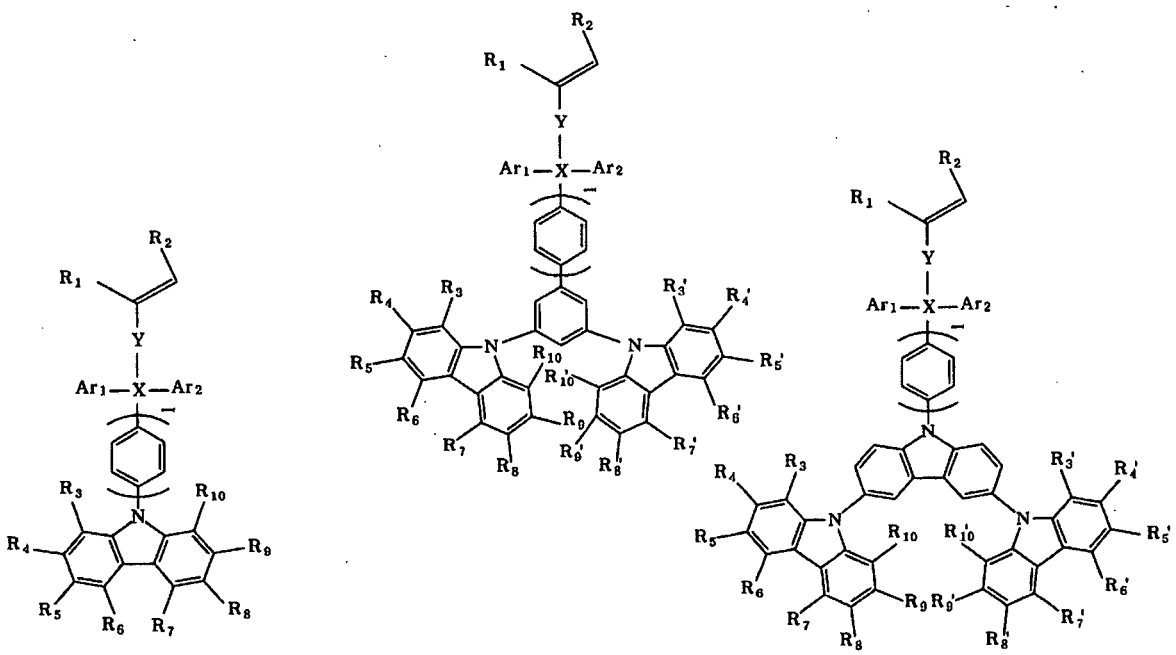
Fig. 1 is a cross-sectional view of a conventional OLED including a substrate, anode, hole transport layer, light emitting layer, electron transport layer, and cathode;
Fig. 2 is a 1H-NMR spectrum of Monomer M-5 in Example 9;
Fig. 3 is a PL spectrum of Polymer P-4 in Example 14;
Fig. 4 is a graph depicting the relationship between luminance and voltage in a device having the structure A1 (1000Å)/ LiF (10Å)/ Alq3 (200 Å)/ Balq (50 Å)/ EML (P-4+Ir(ppy)3)/ PEDOT/ ITO (1500 Å); and
Fig. 5 is a graph depicting the relationship between luminance and voltage in a device having the structure Al (1000 Å)/ LiF (10 A)/ Alq3 (200 A)/ Balq (50 A)/ EML (P-4+CBP+Ir(ppy)3)/ PEDOT/ ITO (1500 A).

[Mode for Invention]

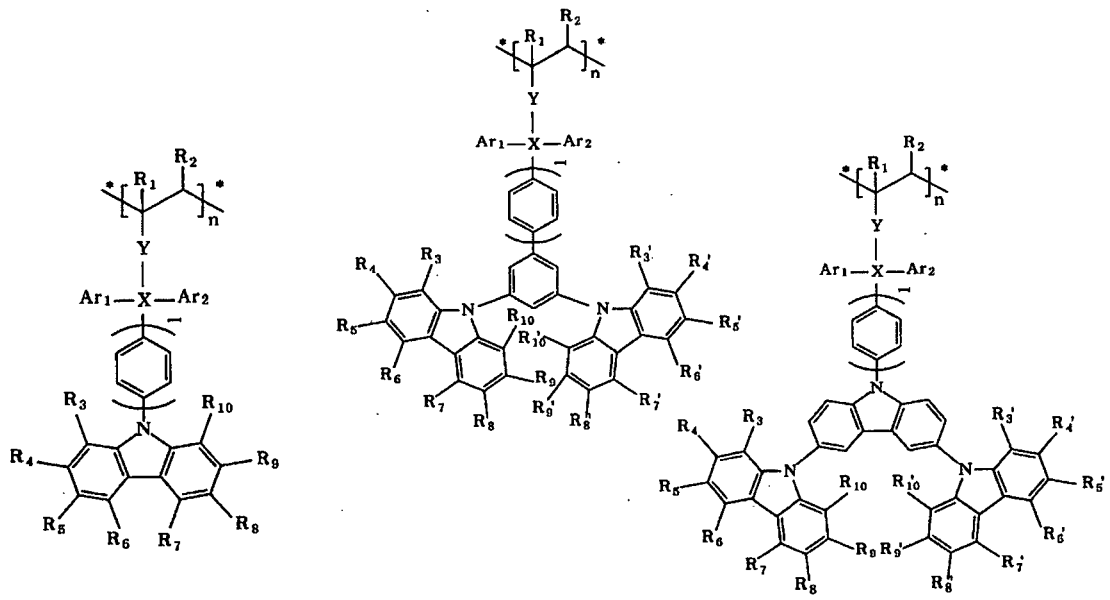
[0028] According to a first embodiment of the present invention, a vinyl-based polymer comprising silicon and/or tin for an organic layer of an OLED comprises a repeat unit represented by the following Formula 8 and formed by polymerization of a monomer represented by the following Formula 5.

[0029] According to a second embodiment of the present invention, a vinyl-based polymer comprising silicon and/or tin for an organic layer of an OLED comprises a repeat unit represented by the following Formula 8 and formed by polymerization of a monomer represented by the following Formula 5, and a repeat unit represented by the following Formula 4 and formed by polymerization of a monomer represented by the following Formula 3.

[Formula 5]



[Formula 8]



wherein in Formulas 5 and 8, X represents silicon (Si) or tin (Sn);

Ar_1, Ar_2, and Ar_3 may be the same or different and each represents a C1-C30 substituted or non-substituted alkyl group, a C1-C30 substituted or non-substituted acyl group, a C1-C30 substituted or non-substituted alkoxycarbonyl group, a C1-C30 substituted or non-substituted alkoxy group, a C2-C30 substituted or non-substituted alkenyl group, a C2-C30 substituted or non-substituted alkynyl group, a C2-C30 substituted or non-substituted alkylcarboxyl group, a C6-C30 substituted or non-substituted aryl group, a C6-C30 substituted or non-substituted aralkyl group, a C6-C30 substituted or non-substituted aralkyloxy group, a C2-C30 substituted or non-substituted heteroaryl group, a C2-C30 substituted or non-substituted heteroaryloxy group, a C6-C30 substituted or non-substituted aryloxy group, and a C4-C30 substituted or non-substituted cycloalkyl group;

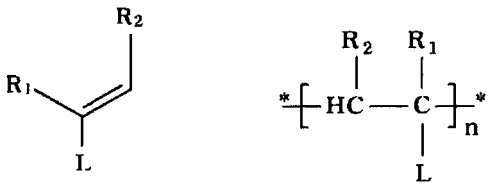
Y represents an alkylene group, preferably C1-C20, more preferably C1-C12, and even more preferably C1-C8, e.g., methylene, ethylene, propylene, an arylene group, preferably C6-C30, more preferably C6-C20, and even more preferably C6-C12, e.g., phenylene, biphenylene, naphthalene, an oxyalkylene group, preferably C1-C20, more preferably C1-C12, and even more preferably C1-C8, e.g., oxymethylene, oxyethylene, an oxyarylene group, preferably C6-C20, more preferably C6-C16, and even more preferably C6-C12, e.g., oxyphenylene, oxybiphenylene, oxynaphthalene, an oxycarbonyl group, an amide group, a urethane group, and such divalent organic groups may also be displaced by the foregoing substituted groups;

R_1 and R_2 may be the same or different and each represents a hydrogen atom or a univalent substitution group, namely an alkyl group, preferably C1-C20, an alkenyl group, preferably C2-C20, an aryl group, preferably C6-C30, an alkoxy group, preferably C1-C20, an aryloxy group, preferably C6-C20, a hetero-oxy group, preferably C2-C20, a silyloxy group, preferably C3-C40, an acyl group, preferably C1-C20, an alkoxycarbonyl group, preferably C2-C20, an acyloxy group, preferably C2-C20, an acylamino group, preferably C2-C20, an alkoxycarbonylamino group, preferably C2-C20, an anyloxycarbonylamino group, preferably C7-C20, a sulfamoylamino group, preferably C1-C20, a sulfonyl group, preferably C0-C20, an alkylthio group, preferably C1-C20, an arylthio group, preferably C6-C20, a heterocyclic thiol group, preferably C1-C20, a sulfonyl group, preferably C1-C20, an ureide group, preferably C1-C20, a phosphoamide group, preferably C1-C20, a hydroxyl group, a halogen, a cyano group, a sulfone group, a carboxyl group, a nitro group, a heteroatom, a silyl group, preferably C3-C40;

R_3-R_{10} and R_3'-R_{10}' may be the same or different and each represents a C1-C30 substituted or non-substituted alkyl group, a C1-C30 substituted or non-substituted acyl group, a C1-C30 substituted or non-substituted alkoxycarbonyl group, a C1-C30 substituted or non-substituted alkoxy group, a C2-C30 substituted or non-substituted alkenyl group, a C2-C30 substituted or non-substituted alkynyl group, a C2-C30 substituted or non-substituted alkylcarboxyl group, a C6-C30 substituted or non-substituted aryl group, a C6-C30 substituted or non-substituted aralkyl group, a C6-C30 substituted or non-substituted aralkyloxy group, a C2-C30 substituted or non-substituted heteroaryl group, a C2-C30 substituted or non-substituted heteroaryloxy group, a C6-C30 substituted or non-substituted aryloxy group, a C4-C30 substituted or non-substituted cycloalkyl group, -N(R)(R'), where R and R' independently represent hydrogen, a C1-C30 alkyl group, a C6-C30 aryl group, or a C2-C30 heteroaryl group, a cyano

group, a hydroxyl group, and a carboxyl group, and
where two or more neighboring groups of R_3-R_{10}' may be connected to form a ring;
1 is an integer from 0 to 10;and wherein n is an integer from 1 to 1,000,000.

[Formula 3] [Formula 4]



(in Formulas 3 and 4, L represents carbazole, triphenylamine, phenyl, naphthyl, anthracenyl, pyridyl, which can be substituted by a group selected from the group consisting of a cyano group (-CN), a hydroxyl group (-OH), a C1-C30 alkoxycarbonyl group displaceable by a C1-C6 alkoxycarbonyl group, a C1-C30 (di-)alkylaminocarbonyl group, a C1-C30 alkylcarbonyl group, a halogen, a hydroxyl group, a silyl group, a C1-C30 alkyl group, a C6-C18 aryl group, C1-C30 alkoxy group, a C1-C30 alkoxycarbonyl group, a C1-C30 acyloxy group, and a C1-C30 alkylcarbonyl group; and R_1 and R2 may be the same or different and each represents a hydrogen atom or a univalent substitution group, namely an alkyl group (preferably C1-C20), an alkenyl group (preferably C2-C20), an aryl group (preferably C6-C30), an alkoxy group (preferably C1-C20), an aryloxy group (preferably C6-C20), a hetero-oxy group (preferably C2-C20), a silyloxy group (preferably C3-C40), an acyl group (preferably C1-C20), an alkoxycarbonyl group (preferably C2-C20), an acyloxy group (preferably C2-C20), an acylamino group (preferably C2-C20), an alkoxycarbonylamino group (preferably C2-C20), an anyloxycarbonylamino group (preferably C7-C20), a sulfamoylamino group (preferably C1-C20), a sulfonyl group (preferably C0-C20), an alkylthio group (preferably C1-C20), an arylthio group (preferably C6-C20), a heterocyclic thiol group (preferably C1-C20), a sulfonyl group (preferably C1-C20), an ureide group (preferably C1-C20), a phosphoamide group (preferably C1-C20), a hydroxyl group, a halogen, a cyano group, a sulfone group, a carboxyl group, a nitro group, a heteroatom, a silyl group (preferably C3-C40).)

[0030] As described above, both Reaction Schemes 1 and 2 of the present invention are required to comprise the repeat unit represented by Formula 8 and formed by polymerizing the monomer represented by Formula 5.

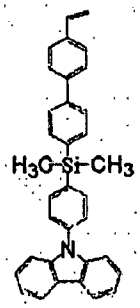
[0031] Here, when the repeat unit represented by Formula 8 and the repeat unit represented by Formula 4 are mixed into a copolymer, each of the repeat unit in Formula 8 and the repeat unit in Formula 4 is provided in an amount of at least 0.5% by weight or more relative to the entire polymer.

[0032] That is, whether in a polymer of the repeat unit represented by Formula 8 or in a copolymer of the repeat unit represented by Formula 8 and the repeat unit represented by Formula 4, a polymer according to the present invention is required to comprise the repeat unit represented by Formula 8. In particular, in the case of the copolymer of the repeat unit represented by Formula 8 and the repeat unit represented by Formula 4, each of the repeat units forms at least 0.5% by weight or more of the entire polymer.

[0033] Thus, all polymers comprising at least 0.5 wt% or more of the repeat unit represented by Formula 8 and the repeat unit represented by Formula 4 to form the copolymer should be construed to fall within the scope of the appended claims of the present invention.

[0034] The monomer represented by Formula 5 is specifically be represented by the following Formula 6.

[formula 6]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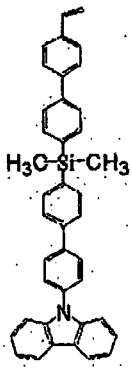
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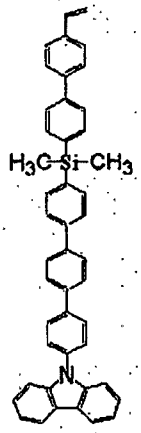
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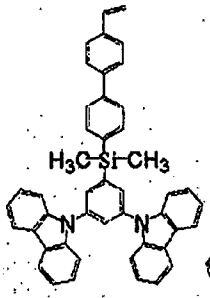
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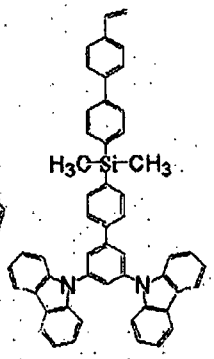
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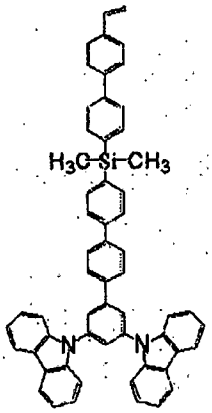
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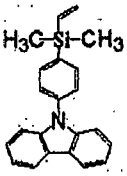
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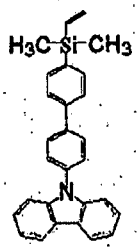
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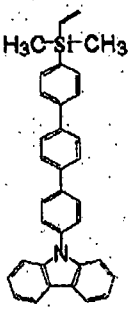
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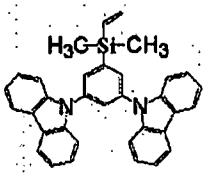
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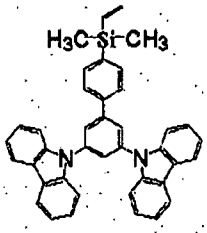
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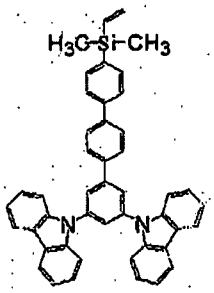
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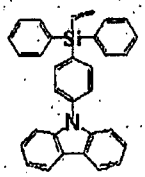
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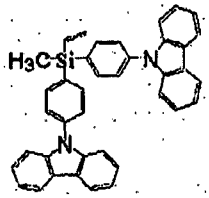
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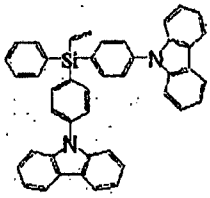
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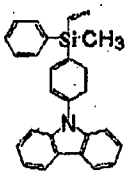
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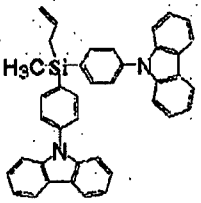
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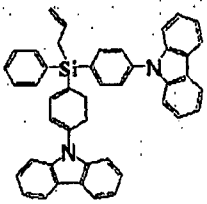
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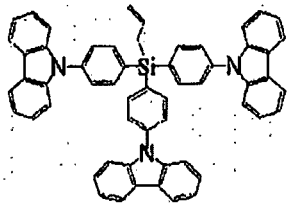
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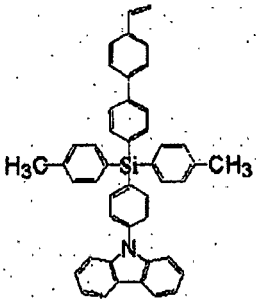
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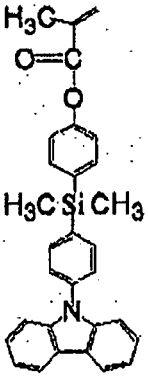
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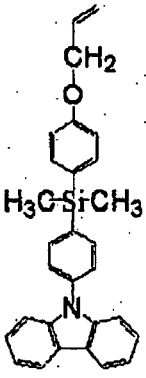
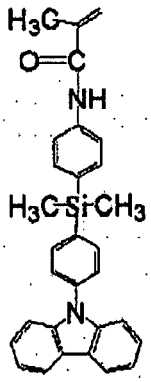
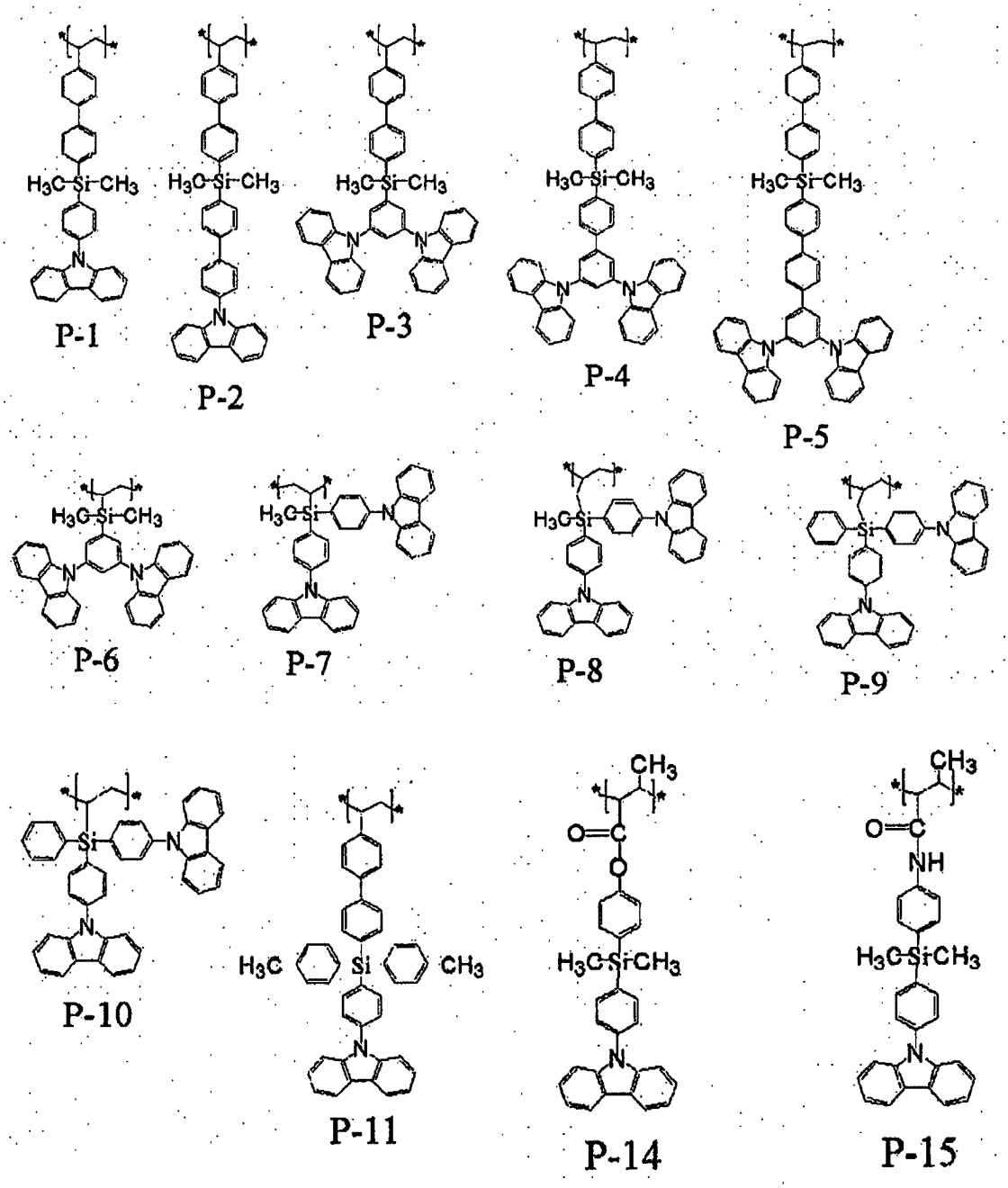
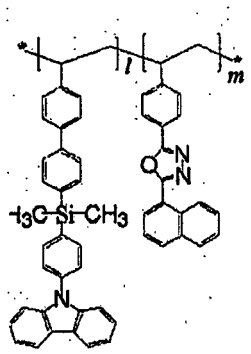

M-24


M-25

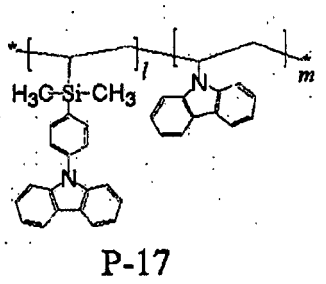
[0035] The repeat unit represented by Formula 8 obtained by polymerizing the monomer represented by Formula 5 may be specifically represented by the following Formula 7.

[Formula 7]

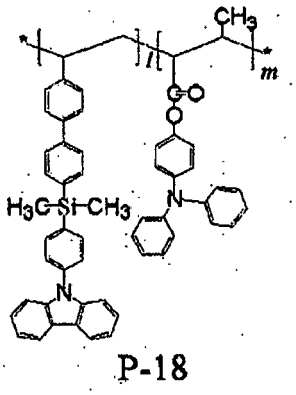




P-16



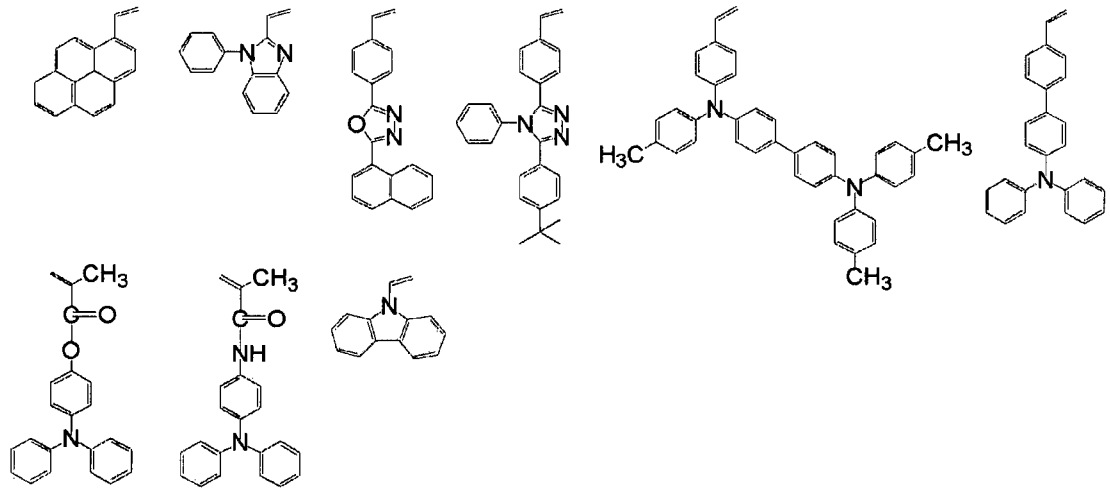
P-17



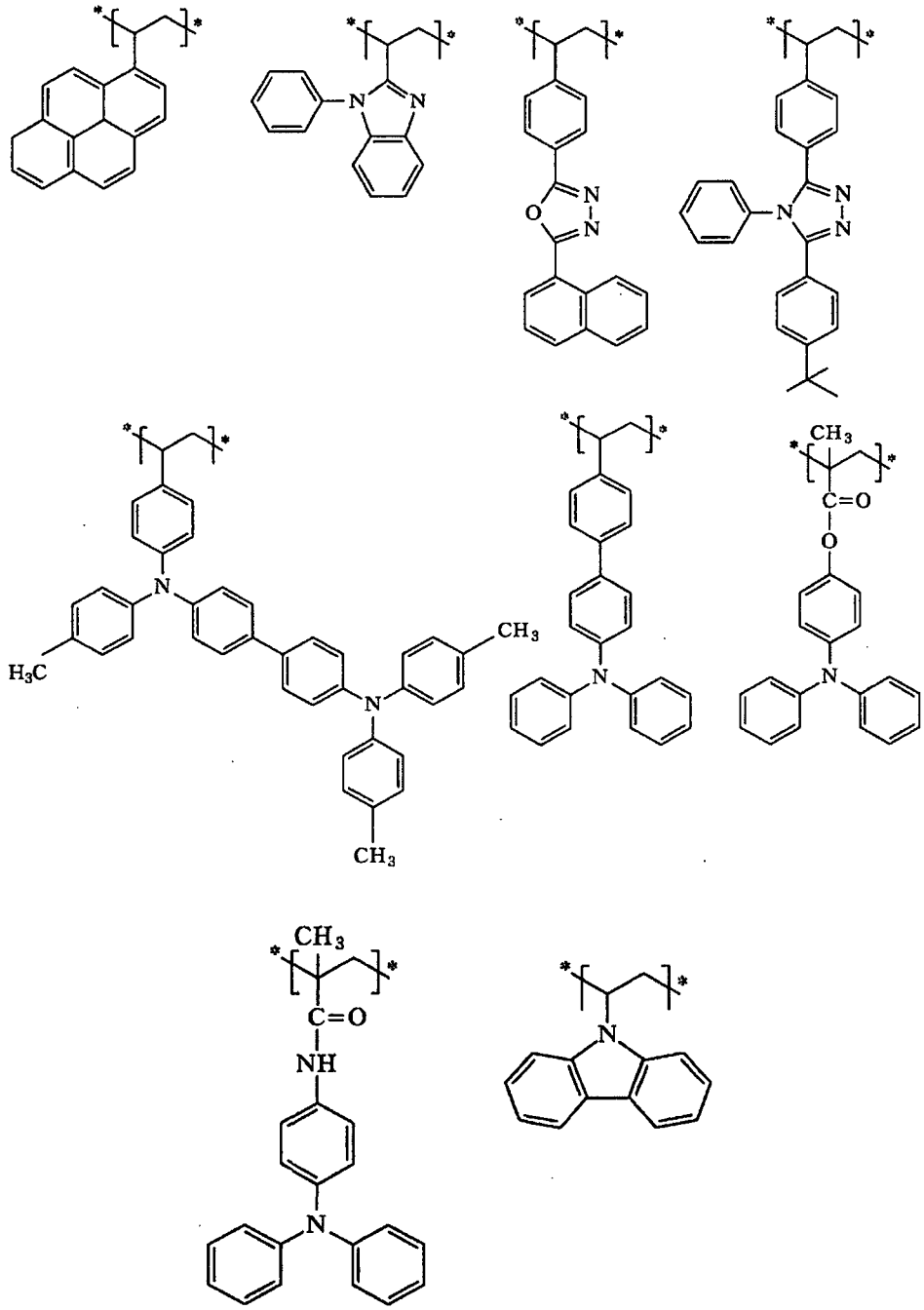
P-18

[0036] The monomer represented by Formula 3 may be specifically represented by the following Formula 9, and the repeat unit represented by Formula 4 may be specifically represented by the following Formula 10.

[Formula 9]



[Formula 10]



[0037] Here, Formula 6 is only illustrative examples of Formula 5, the repeat unit represented by Formula 7 is only an illustrative example of Formula 8, the monomer represented by Formula 9 is only an illustrative example of Formula 3, and a repeat unit represented by Formula 10 is only an illustrative example of an Formula 4.

[0038] In the present invention, a polymerization method is not limited to a specific one. A general method, such as radical polymerization, cation polymerization, anion polymerization, living cation polymerization, living anion polymerization, coordination polymerization, etc., can be used. Preferably, radical polymerization, cation polymerization, and living cation polymerization are used.

[0039] With such methods, a polymer can be obtained by adjusting reaction temperature, reaction solvent, reaction time, reaction initiator, etc.

[0040] Although the molecular weight of the polymer according to the present invention can be varied depending on polymerization methods and conditions, the polymer has a weight average molecular weight preferably ranging from 1,000 to 5,000,000, more preferably from 2,000 to 2,000,000, and even more preferably from 3,000 to 1,000,000.

[0041] The polymer has a number average molecular weight ranging preferably from 500 to 2,000,000, more preferably from 1,000 to 1,000,000, and even more preferably from 2,000 to 500,000.

[0042] The weight average molecular weight over the number average molecular weight is preferably from 1 to 20, more preferably from 1 to 15, and even more preferably from 1 to 10.

[0043] Although regularity of a substituent group of the polymer according to the present invention with respect to direction, i.e., tacticity, varies depending on polymerization methods and conditions, the regularity may be syndiotactic, isotactic, a combination of syndiotactic and isotactic, atactic, and the like.

[0044] Further, a terminal of the polymer is not limited to any specific one.

[0045] Hereinafter, a synthesis method of a compound and a polymer represented by Formulas 5 and 8 is illustrated in detail with the following Reaction Schemes 1 to 4.

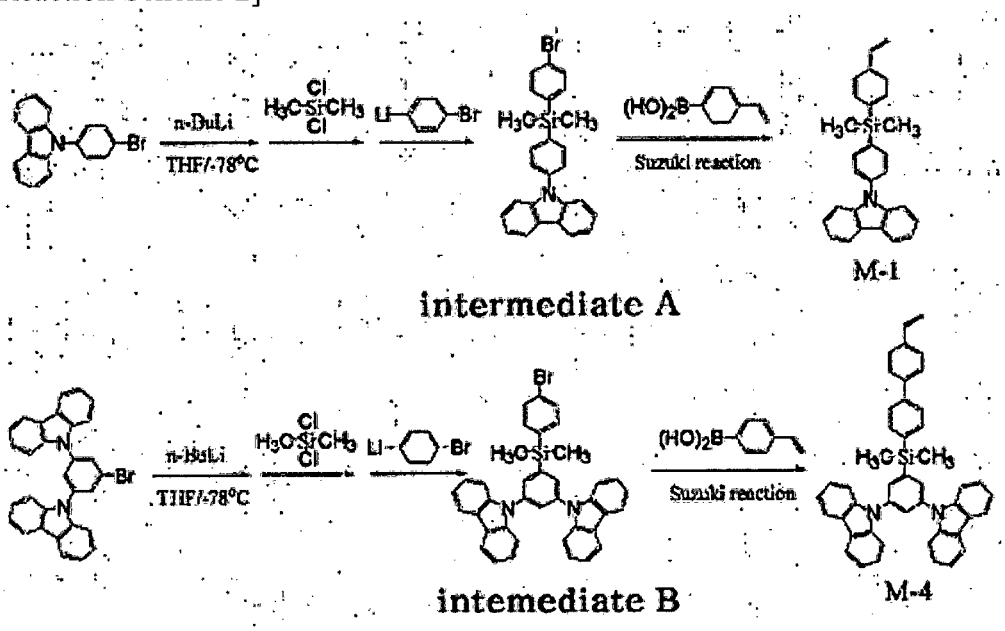
[0046] In addition to the method according to the following Reaction Schemes, a monomer comprising silicon and/or tin of the present invention and a polymer thereof may be prepared by other methods so long as the final product has the same structure as the monomer or the polymer.

[0047] Thus, in the reaction for preparing a monomer comprising silicon and/or tin of the present invention and a (co)polymer formed by polymerizing the monomer, a solvent, reaction temperature, concentration, catalyst, and the like do not need to be specifically limited, and a preparation yield need not be specifically limited, either.

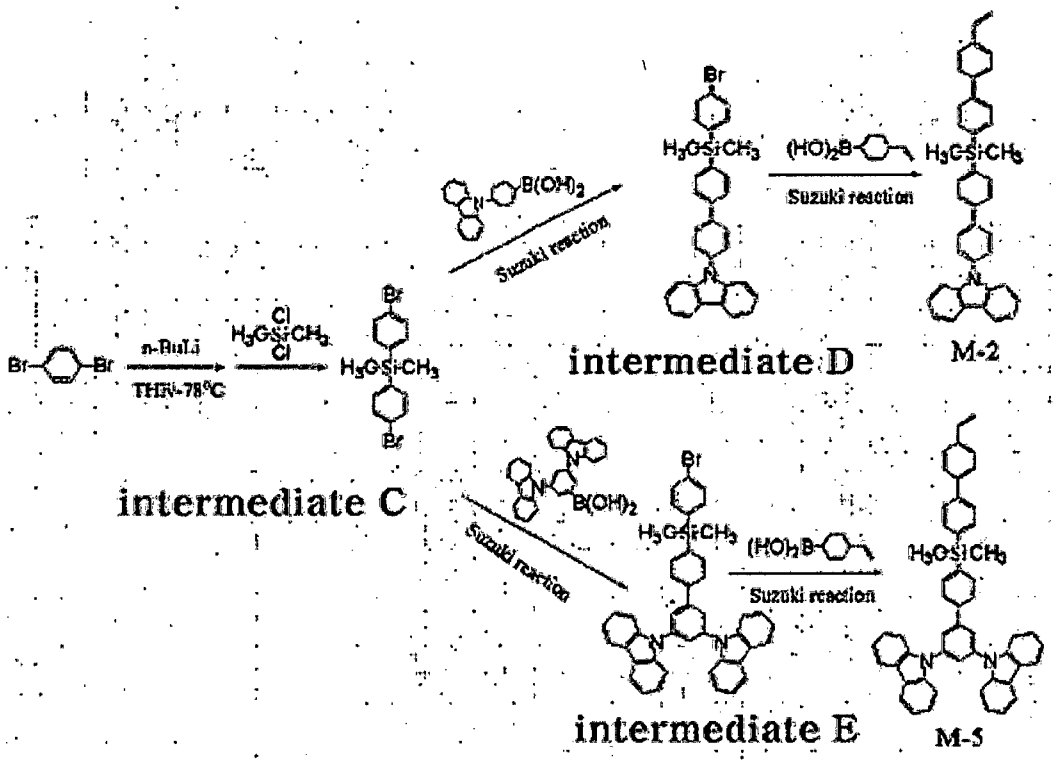
[Reaction Scheme 1]

[0048]

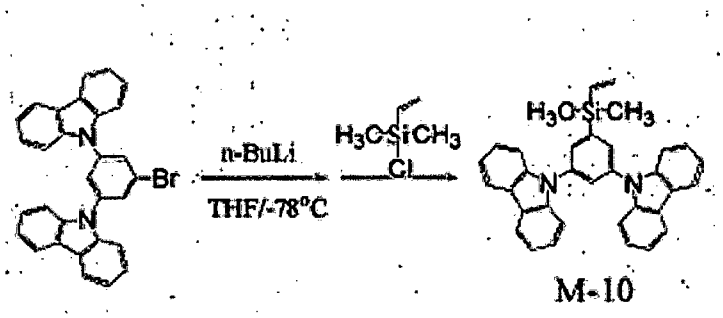
[Reaction Scheme 2]



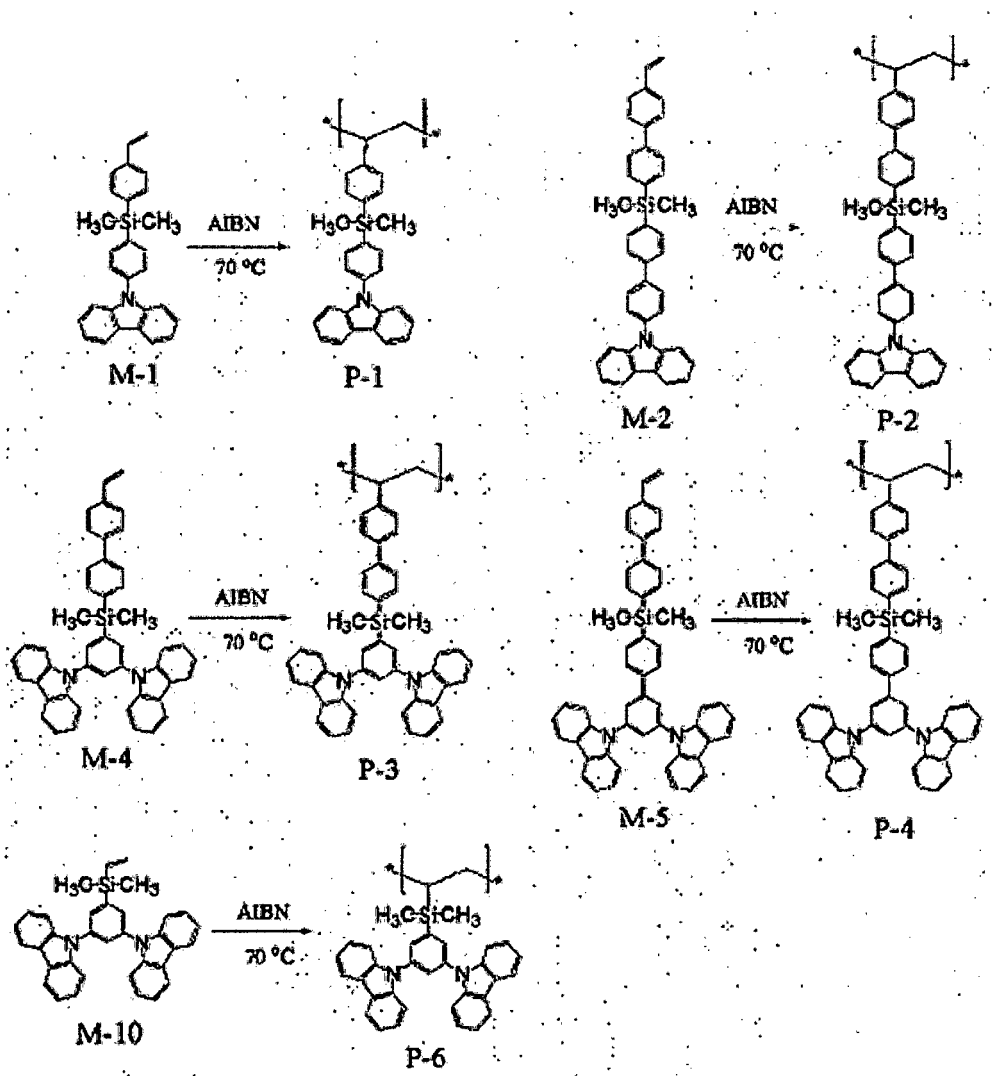
[Reaction Scheme 2]



[Reaction Scheme 3]



[Reaction Scheme 4]



[0049] In an OLED, the polymer according to the present invention can be used for a material of a light emitting layer, a hole injection material, a hole transport material, an electron transport material, an electron injection material, an interlayer, and a material for a hole blocking layer. Preferably, the polymer is used for a host material of the light emitting layer.

[0050] The OLED of the present invention optionally includes an interlayer, a hole transport layer, and an electron transport layer in addition to general components including an anode, a light emitting layer, and a cathode.

[0051] Fig. 1 is a cross-sectional view of an OLED including a substrate, anode, hole transport layer, light emitting layer, electron transport layer, and cathode.

[0052] A method of manufacturing an electroluminescent display employing an organic electroluminescent polymer according to the present invention will be described with reference to Fig. 1.

[0053] First, a substrate 11 is coated with an electrode material for an anode 12. Here, the substrate 11 employs a typical substrate for an OLED, and is preferably a glass substrate or a transparent plastic substrate which ensures excellent transparency, a smooth surface, easy handling, and waterproofing.

[0054] Examples of the electrode material for the anode 12 include indium tin oxide (ITO), tin oxide (SnO_2) zinc oxide (ZnO), etc., which are transparent and have excellent conductivity.

[0055] A hole transport layer 13 is formed on the anode 12 by vacuum deposition, sputtering or spin coating, and a light emitting layer 14 is formed thereon by vacuum deposition, spin coating or solution coating such as ink-jet printing.

[0056] An electron transport layer 15 is formed on the light emitting layer 14 before forming a cathode 16.

[0057] Here, the light emitting layer 14 has a thickness of 5nm to 1 μm, preferably 10 to 500nm, and each of the hole transport layer 13 and the electron transport layer 15 has a thickness of 10-10,000Å.

[0058] The electron transport layer 15 can be formed of a material generally used in the art by vacuum deposition, sputtering or spin coating.

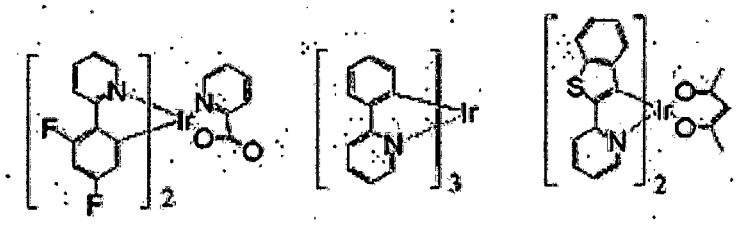
[0059] The hole transport layer 13 and electron transport layer 15 serve to enhance luminous recombination in a light emitting polymer by efficiently transferring carriers to the light emitting polymer.

[0060] According to the present Invention, materials for the hole transport layer 13 and electron transport layer 15 are not limited to particular ones. Examples of the material for the hole transport layer include PEDOT:PSS, which is poly(3,4-ethylenedioxy-thiophene) (PEDOT) doped with a (poly(styrene sulfonic acid) (PSS) layer, and N,N'-bis(3-methylphenyl)-N,N-diphenyl-[1,1'-biphenyl]-4,4'-diamine (TPD). Further, examples of the material for the electron transport layer include aluminum trihydroxyquinoline (Alq3), PBD(2-(4-biphenylyl)-5-phenyl-1,3,4-oxadiazole), which is a 1,3,4-oxadiazole derivative, TPQ(1,3,4-tris[(3-phenyl-6-trifluoromethyl)quinoxaline-2-yl]benzene), which is a quinoxaline derivative, and triazole derivatives.

[0061] The polymer of the present invention can be used in combination with a phosphorescent organic compound. Here, the phosphorescent organic compound is an organic metal complex that can be phosphorescent in a triplet state and contains a metal ion selected at least from Group VIII in the periodic table of Gregor Johann Mendel, i.e., Fe, Co, Ni, Ru, Ph, Os, Ir, and Pt. Preferably, the phosphorescent organic compound is a metal complex containing Ir or Pt ions.

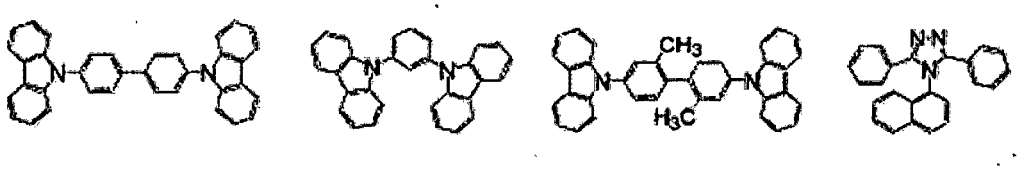
[0062] The following Formula 11 represents examples of the metal complex, but it should be noted that the present invention is not limited to these examples.

[formula 11]



[0063] When the polymer according to the present invention is subjected to solution coating to form a layer, it may be blended with a low molecular weight host. The following formula 12 represents illustrative examples of the low molecular weight host, but it should be noted that the present invention is not limited to these examples.

[formula 12]



[0064] Further, the polymer may be blended with a polymer having a conjugated double bond, such as a fluorine-based polymer, polyphenylenevinylene, and polyparaphenylene. If necessary, it may be mixed with a binder resin.

[0065] Examples of the binder resin include polyvinylcarbazole, polycarbonate, polyester, polyarylate, polystyrene, acryl polymer, methacryl polymer, polybutyral, polyvinylacetal, diallylphthalate polymer, phenol resin, epoxy resin, silicone resin, polysulfone resin, urea resin, and the like. These resins may be used alone or in combinations thereof.

[0066] Optionally, a hole blocking layer of lithium fluoride (LiF) may further be formed by vacuum deposition and the like to control a hole-transport speed in the light emitting layer 14 and to increase recombination efficiency between electrons and holes.

[0067] Finally, the electron transport layer 15 is coated with an electrode material for the cathode 16.

[0068] Examples of the metal for the cathode includes lithium (Li), magnesium (Mg), calcium (Ca), aluminum (Al), and Al:Li, Ba:Li, Ca:Li, and the like, which have a low work function.

[0069] Hereinafter, illustrative examples for preparation of a vinyl-based monomer comprising silicon and/or tin and a copolymer formed by polymerizing the same according to the embodiments of the present invention will be described. However, it should be noted that the following examples are given by way of illustration only and do not limit the present invention.

[0070] Also, a description for the matter apparent to those skilled in the art will be omitted herein.

Example 1: Preparation of Intermediate A

[0071] N-(4-Bromophenyl) carbazole (5g, 15.51mmol) was dissolved in anhydrous diethyl ether (50ml) under a nitrogen atmosphere, followed by dropwise addition of n-butyl lithium (10.7ml, 17.06mmol) at -78°C and stirring the mixture for one hour.

[0072] Dichloromethylsilane (2g, 15.51mmol) was added to anhydrous diethyl ether (30ml), followed by cooling to -78°C and slowly dropping the produced carbazole product into the solution.

[0073] The mixture was stirred at -78°C for 20 minutes and then stirred at room temperature for one hour.

[0074] After cooling the mixture to -78°C, 4-4'-dibromobenzene (3.65g, 15.51mmol) was dissolved in anhydrous diethyl ether (30ml) and n-butyl lithium (10.7ml, 17.06mmol) was added dropwise, followed by stirring for one hour.

[0075] The product was slowly dropped into a silicon compound. The resultant mixture was stirred at -78 °C for 20 minutes and then stirred at room temperature for 8 hours or more.

[0076] When the reaction was completed, extraction of the mixture was carried out with ethyl ether, followed by washing with water and 10% sodium bicarbonate several times and drying over anhydrous magnesium sulphate.

[0077] The resultant product was filtered to remove the solvent and refined on a silica gel column using a blended solvent of methylene chloride/hexane (1/3), thereby obtaining 3.1g (43.8%) of Intermediate A.

Example 2: Preparation of Monomer M-1

[0078] 3.1g (6.79mmol) of Intermediate A, 1.0g (6.79mmol) of vinylphenylboronic acid, and 0.15g of tetrakistriphenylphosphine palladium were dissolved in tetrahydrofuran (THF) under an argon atmosphere in a 250ml round-bottom flask equipped with a thermometer, a reflux condenser, and a stirrer. Then, 20ml of 2M potassium carbonate was added to the dissolved mixture and refluxed at 75°C for 48 hours.

[0079] When the reaction was completed, the resultant solution was cooled to room temperature, followed by extraction with methylene chloride several times and washing the extracted substance with water several times.

[0080] After removal of water using anhydrous magnesium sulphate, the extracted substance was filtered to remove the solvent. The resultant product was refined on a silica gel column using a blended solvent of methylene chloride/hexane (1/3), thereby obtaining 2.32g (71.3%) of Monomer M-1.

[0081] The monomer had a maximum luminous wavelength of 348nm in its solution state.

Example 3: Preparation of Intermediate B

[0082] 9-(3-Bromo-5-(9H-carbazole-9-yl)phenyl-9H-carbazole (10g, 20.5mmol) was dissolved in anhydrous diethyl ether (60ml) under a nitrogen atmosphere, followed by dropwise addition of n-butyl lithium (15.4ml, 24.6mmol) at -78°C and stirring the mixture for one hour.

[0083] Dichloromethylsilane (2.91g, 22.5mmol) was added to anhydrous diethyl ether (50ml), followed by cooling to -78°C and slowly dropping the produced carbazole product into the solution.

[0084] The mixture was stirred at -78°C for 20 minutes and then stirred at room temperature for one hour.

[0085] After cooling the mixture down to -78°C, 4-4'-dibromobenzene (5.3g, 22.5mmol) was dissolved in anhydrous diethyl ether (50ml) and n-butyl lithium (16.87ml, 27mmol) was added dropwise, followed by stirring for one hour.

[0086] The product was slowly dropped into a silicon compound. The resultant mixture was stirred at -78°C for 20 minutes and then stirred at room temperature for 8 hours or more.

[0087] When the reaction was completed, extraction of the mixture was carried out with ethyl ether, followed by washing with water and 10% sodium bicarbonate several times and drying with anhydrous magnesium sulphate.

[0088] The resultant product was filtered to remove the solvent, refined on a silica gel column using a blended solvent of methylene chloride/hexane (1/2), and recrystallized in hexane, thereby obtaining 2.28g (41.4%) of Intermediate B.

Example 4: Preparation of Monomer M-4 in Chemical Formula 1

[0089] 3.0g (4.82mmol) of the intermediate B, 0.75g (5.06mmol) of vinylphenylboronic acid, and 0.13g of tetrakistriphenylphosphine palladium were dissolved in THF under an argon atmosphere in a 250ml round-bottom flask equipped with a thermometer, a reflux condenser, and a stirrer. Then, 20ml of 2M potassium carbonate was added to the dissolved mixture and refluxed at 75°C for 48 hours.

[0090] When the reaction was completed, the resultant solution was cooled to room temperature, followed by extraction with methylene chloride several times and washing the extracted substance with water several times.

[0091] After removal of water using anhydrous magnesium sulphate, the extracted substance was filtered to remove

the solvent. The resultant product was refined on a silica gel column using a blended solvent of methylene chloride/hexane (1/2), thereby obtaining 1.37g (43.4%) of Monomer M-2.

[0092] The monomer had a maximum luminous wavelength of 346nm in its solution state.

Example 5: Preparation of Intermediate C

[0093] 4-4'-dibromobenzene (20.0g, 84.77mmol) was dissolved in anhydrous diethyl ether (80ml) under a nitrogen atmosphere, followed by dropwise addition of n-butyl lithium (63.5ml, 101.7mmol) at -78°C and stirring the mixture for one hour. Dichloromethylsilane (4.75g, 36.8mmol) was added to anhydrous diethyl ether (40ml), followed by cooling to -78 °C and slowly dropping the produced carbazole product into the solution.

[0094] The mixture was stirred at -78°C for 20 minutes and then stirred at room temperature for one hour.

[0095] When the reaction was completed, extraction of the mixture was carried out with ethyl ether, followed by washing with water and 10% sodium bicarbonate several times and drying with anhydrous magnesium sulphate.

[0096] The resultant product was filtered to remove the solvent, refined on a silica gel column using a solvent of hexane, and recrystallized in hexane, thereby obtaining 6.4g (47%) of Intermediate C as white crystals.

Example 6: Preparation of Intermediate D

[0097] 4.0g (10.08mmol) of the intermediate C, 9-(4-(4,4,5,5-tetramethyl-1,3,2-5 dioxaborolan-2-yl)phenyl)-9H-carbazole (10.5mmol), and 0.22g of tetrakistriphenylphosphine palladium were dissolved in THF under an argon atmosphere in a 250ml round-bottom flask equipped with a thermometer, a reflux condenser, and a stirrer. Then, 20ml of 2M potassium carbonate was added to the dissolved mixture and refluxed at 75 °C for 48 hours.

[0098] When the reaction was completed, the resultant solution was cooled to room temperature, followed by extraction with methylene chloride several times and washing the extracted substance with water several times.

[0099] After removal of water using anhydrous magnesium sulphate, the extracted substance was filtered to remove the solvent. The resultant product was refined on a silica gel column using a blended solvent of methylene chloride/hexane (1/2), thereby obtaining 2.8g (50.0%) of Intermediate D.

Example 7: Preparation of Monomer M-2 in Chemical Formula 1

[0100] 2.53g (4.75mmol) of the intermediate D, 0.77g (5.22mmol) of vinylphenylboronic acid, and 0.12g of tetrakistriphenylphosphine palladium were dissolved in THF under an argon atmosphere in a 250ml round-bottom flask equipped with a thermometer, a reflux condenser, and a stirrer. Then, 20ml of 2M potassium carbonate was added to the dissolved mixture and refluxed at 75 °C for 48 hours.

[0101] When the reaction was completed, the resultant solution was cooled to room temperature, followed by extraction with methylene chloride several times and washing the extracted substance with water several times.

[0102] After removal of water using anhydrous magnesium sulphate, the extracted substance was filtered to remove the solvent. The resultant product was refined on a silica gel column using a blended solvent of methylene chloride/hexane (1/3), thereby obtaining 1.7g (64.4%) of Monomer M-2.

[0103] The monomer had a maximum luminous wavelength of 370nm in its solution state.

Example 8: Preparation of Intermediate E

[0104] 4.0g (10.8mmol) of the intermediate C, 3-(9H-carbazole-9-yl)-5-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)phenyl)-9H-carbazole (10.5mmol), and 0.22g of tetrakistriphenylphosphine palladium were dissolved in THF under an argon atmosphere in a 250ml round-bottom flask equipped with a thermometer, a reflux condenser, and a stirrer. Then, 20ml of 2M potassium carbonate was added to the dissolved mixture and refluxed at 75 °C for 48 hours.

[0105] When the reaction was completed, the resultant solution was cooled to room temperature, followed by extraction with methylene chloride several times and washing the extracted substance with water several times.

[0106] After removal of water using anhydrous magnesium sulphate, the extracted substance was filtered to remove the solvent. The resultant product was refined on a silica gel column using a blended solvent of methylene chloride/hexane (1/2), thereby obtaining 3.5g (47.8%) of Intermediate E.

Example 9: Preparation of Monomer M-5 in Chemical Formula 1

[0107] 3.0g (4.29mmol) of the intermediate E, 0.7g (4.72mmol) of vinylphenylboronic acid, and 0.1g of tetrakistriphenylphosphine palladium were dissolved in THF under an argon atmosphere in a 250ml round-bottom flask equipped with a thermometer, a reflux condenser, and a stirrer. Then, 20ml of 2M potassium carbonate was added to the dissolved

mixture and refluxed at 75°C for 48 hours.

[0108] When the reaction was completed, the resultant solution was cooled to room temperature, followed by extraction with methylene chloride several times and washing the extracted substance with water several times.

[0109] After removal of water using anhydrous magnesium sulphate, the extracted substance was filtered to remove the solvent.

[0110] The resultant product was refined on a silica gel column using a blended solvent of methylene chloride/hexane (1/3),thereby obtaining 1.87g (60.5%) of Monomer M-5.

[0111] The monomer had a maximum luminous wavelength of 380nm in its solution state.

Example 10: Preparation of Monomer M-10 in Chemical Formula 1

[0112] 9-(3-Bromo-5-(9H-carbazole-9-yl)phenyl-9H-carbazole (10.2mmol) was dissolved in anhydrous diethyl ether (50ml) under a nitrogen atmosphere, followed by adding n-butyl lithium (7.1ml, 11.2mmol) by drops at -78 °C and stirring for one hour.

[0113] Chlorodimethylvynylsilane (1.23g, 10.2mmol) was added to anhydrous diethyl ether (20ml), followed by cooling to -78°C and slowly dropping the afore-prepared product into the solution.

[0114] The mixture was stirred at -78°C for 20 minutes and then stirred at room temperature for one hour. When the reaction was completed, extraction of the mixture was carried out with ethyl ether, followed by washing with water and 10% sodium bicarbonate several times and drying with anhydrous magnesium sulphate. The resultant product was filtered to remove the solvent and refined on a silica gel column using a blended solvent of methylene chloride/hexane (1/3), thereby obtaining 2.9g (58%) of Monomer M-10.

Example 11: Preparation of Polymer P-1 in Chemical Formula 2

[0115] 0.7g (1.45mmol) of Monomer M-1 and 2.4mg (0.014mmol) of AIBN were dissolved in 2.5ml of NMP under a nitrogen atmosphere. The mixture was degassed by a freeze-pump-thaw process and stirred at 70 °C for 48 hours. Then, the reactant was precipitated in methanol to obtain a white polymer.

[0116] The resultant product was filtered and re-dissolved in chloroform to be re-precipitated.

[0117] The re-precipitated polymer was filtered and refined using acetone in a Soxhlet device for 24 hours, thereby obtaining 0.45g of a polymer.

[0118] The polymer had a maximum luminous wavelength of 348nm in its solution state.

Example 12: Preparation of Polymer P-2 in Chemical Formula 2

[0119] 0.7g (1.26mmol) of Monomer M-2 and 2.0mg (0.012mmol) of AIBN were dissolved in 2.5ml of NMP under a nitrogen atmosphere. The mixture was degassed by a freeze-pump-thaw process and stirred at 70 °C for 48 hours. Then, the reactant was precipitated in methanol to obtain a white polymer.

[0120] The polymer was filtered and re-dissolved in chloroform to be re-precipitated.

[0121] Then, the re-precipitated polymer was filtered and refined using acetone in a Soxhlet device for 24 hours, thereby obtaining 0.23g of a polymer.

[0122] The polymer had a maximum luminous wavelength of 370nm in its solution state.

Example 13: Preparation of Polymer P-3 in Chemical Formula 2

[0123] 0.7g (1.08mmol) of Monomer M-4 and 1.7mg (0.010mmol) of AIBN were dissolved in 2.3ml of NMP under a nitrogen atmosphere. The mixture was degassed by a freeze-pump-thaw process and stirred at 70°C for 48 hours. Then, the reactant was precipitated in methanol to obtain a white polymer.

[0124] The polymer was filtered and re-dissolved in chloroform to be re- precipitated.

[0125] Then, the re-precipitated polymer was filtered and refined using acetone in a Soxhlet device for 24 hours, thereby obtaining 0.42g of a polymer.

[0126] The polymer had a maximum luminous wavelength of 346nm in its solution state.

Example 14: Preparation of Polymer P-4 in Chemical Formula 2

[0127] 0.7g (0.97mmol) of Monomer M-5 and 1.6mg (0.0097mmol) of AIBN were dissolved in 2.3ml of NMP under a nitrogen atmosphere. The mixture was degassed by a freeze-pump-thaw process and stirred at 70°C for 48 hours. Then, the reactant was precipitated in methanol to obtain a white polymer.

[0128] The polymer was filtered and re-dissolved in chloroform to be re-precipitated.

[0129] Then, the re-precipitated polymer was filtered and refined using acetone in a Soxhlet device for 24 hours, thereby obtaining 0.49g of a polymer.

[0130] The polymer had a maximum luminous wavelength of 380nm in its solution state.

Example 15: Preparation of Polymer P-6 in Chemical Formula 2

[0131] 0.8g (0.97mmol) of Monomer M-10 and 2.66mg (0.0162mmol) of AIBN were dissolved in 2.3ml of NMP under a nitrogen atmosphere. The mixture was degassed by a freeze-pump-thaw process and stirred at 70 °C for 48 hours. Then, the reactant was precipitated in methanol to obtain a white polymer.

[0132] The polymer was filtered and re-dissolved in chloroform to be re-precipitated.

[0133] The re-precipitated polymer was filtered and refined using acetone in a Soxhlet device for 24 hours, thereby obtaining 0.3g of a polymer.

Example 16: Evaluation of Characteristics of Device

[0134] An ITO substrate as an anode was treated by spin coating to form PEDOT. With a polymer host doped into the PEDOT with a dopant by 7%, a light emitting layer was formed on the PEDOT by spin coating. BAlq was vacuum-deposited on the light emitting layer to form a hole blocking layer having a thickness of 50 Å. Then, Alq3 was vacuum-deposited on the light emitting layer to form an electron transport layer having a thickness of 200 Å. On the electron transport layer were sequentially vacuum-deposited LiF to 10 Å and A1 to 1000 Å to form a cathode, thereby producing an OLED.

[0135] The OLED manufactured according to this example had a threshold voltage, and driving voltage, current efficiency and power efficiency at 1000nit, as shown in Table 1.

[0136] Structure of Evaluated Device: Al(1000 Å)/ LiF (10 Å)/ Alq3 (200 Å)/ Balq (50 Å)/ EML (polymer host+Ir(ppy)3)/ PEDOT/ ITO (1500 Å)

[Table 1]

Kind of Device	Compound	Von	At 1000nit		
			V	cd/A	lm/W
Green	P-1	4.6	12.3	4.7	1.2
	P-2	4.0	11.9	4.0	1.0
	P-3	4.2	10.3	7.8	2.4

Example 17: Evaluation of Characteristics of Device

[0137] An ITO substrate as an anode was treated with spin coating to form PEDOT. With the mixture of P-4 and CBP in the weight ratio of 1:2 doped into the PEDOT with a dopant by 7%, a light emitting layer was formed on the PEDOT by spin coating. BAlq was vacuum-deposited on the light emitting layer to form a hole blocking layer having a thickness of 50 Å. Then, Alq3 was vacuum-deposited on the light emitting layer to form an electron transport layer having a thickness of 200 Å. On the electron transport layer were sequentially vacuum-deposited LiF to 10 Å and A1 to 1000 Å to form a cathode, thereby producing an OLED. A comparative device included PVK as a polymer host.

Structure of Evaluated Device: A1(1000Å)/ LiF (10 Å)/ Alq3 (200 Å)/ Balq (50 Å)/ EML (P-4+CBP+Ir(ppy)3)/ PEDOT/ ITO (1500 Å)

Structure of Comparative Device: Al(1000 Å)/ LiF (10 Å)/ Alq3 (200 Å)/ Balq (50 Å)/ EML (PVK+CBP+Ir(ppy)3)/ PEDOT/ ITO (1500 Å)

[0138] The OLED manufactured according to the foregoing examples had a threshold voltage, and driving voltage, current efficiency and power efficiency of 1000 nit, as shown in Table 2.

[Table 2]

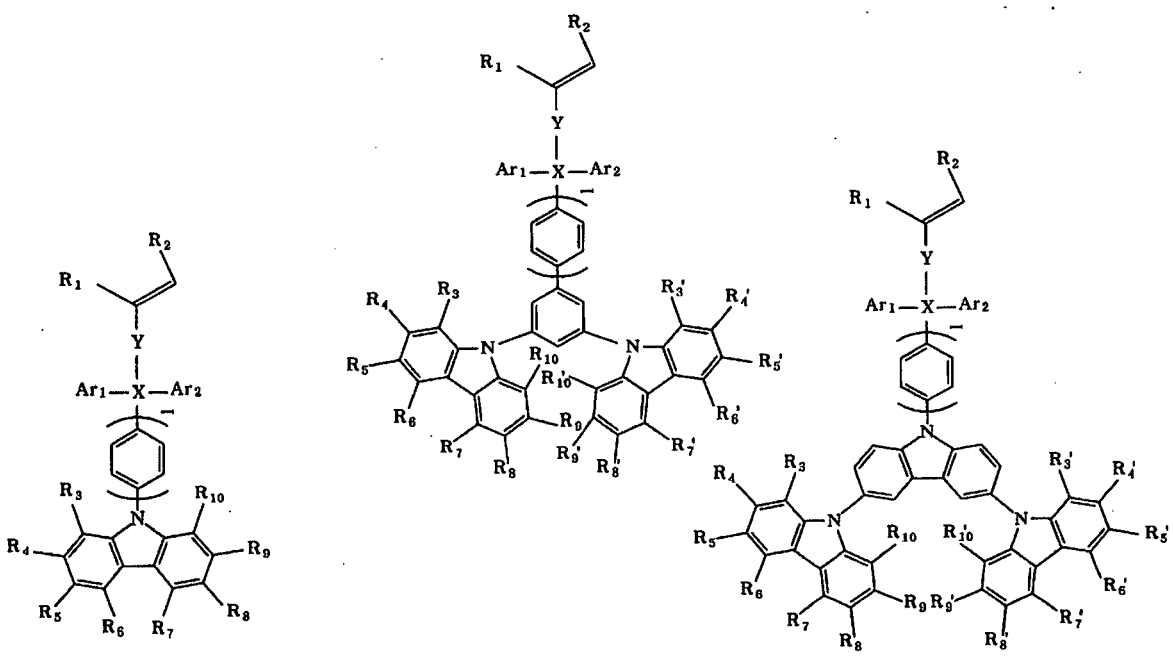
Kind of Device	Compound	Von	At 1000nit		
			V	cd/A	lm/W
Green	PVK	4	7.4	15.3	6.63
	P-4	3.6	7.4	16.8	7.14

[0139] Although the exemplary embodiments of the invention have been illustrated with reference to the accompanying drawings, the present invention is not limited to the embodiments and drawings. Therefore, it should be understood that the exemplary embodiments described above are given by way of illustration only and do not limit the scope of the present invention.

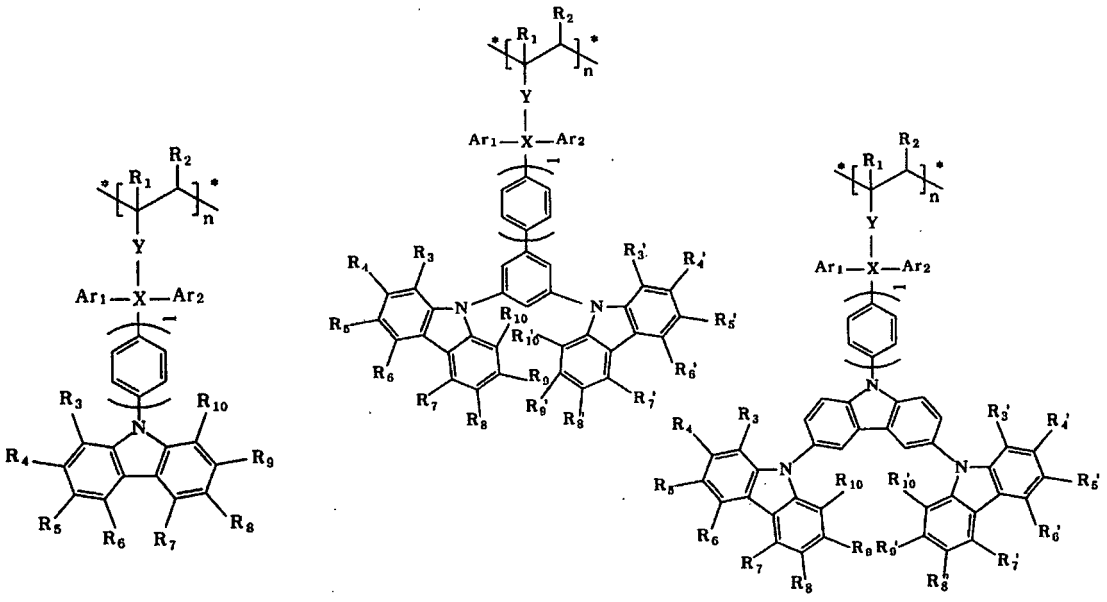
Claims

1. A polymer for an organic layer of an organic light emitting diode comprising a repeat unit represented by the following Formula 8 and formed by polymerization of a monomer represented by the following Formula 5:

[Formula 5]



[Formula 8]



wherein in Formulas 5 and 8, X represents silicon (Si) or tin (Sn);

Ar_1, Ar_2, and Ar_3 may be the same or different and each represents a C1-C30 substituted or non-substituted alkyl group, a C1-C30 substituted or non-substituted acyl group, a C1-C30 substituted or non-substituted alkoxycarbonyl group, a C1-C30 substituted or non-substituted alkoxy group, a C2-C30 substituted or non-substituted alkenyl group, a C2-C30 substituted or non-substituted alkynyl group, a C2-C30 substituted or non-substituted alkylcarbonyl group, a C6-C30 substituted or non-substituted aryl group, a C6-C30 substituted or non-substituted aralkyl group, a C6-C30 substituted or non-substituted aralkyloxy group, a C2-C30 substituted or non-substituted heteroaryl group, a C2-C30 substituted or non-substituted heteroaryloxy group, a C6-C30 substituted or non-substituted acyloxy group, and a C4-C30 substituted or non-substituted cycloalkyl group;

Y represents an alkylene group, preferably C1-C20, more preferably C1-C12, and even more preferably C1-C8, e.g., methylene, ethylene, propylene, an arylene group, preferably C6-C30, more preferably C6-C20, and even more preferably C6-C12, e.g., phenylene, biphenylene, naphthalene, an oxyalkylene group, preferably C1-C20, more preferably C1-C12, and even more preferably C1-C8, e.g., oxymethylene, oxyethylene, an oxyarylene group, preferably C6-C20, more preferably C6-C16, and even more preferably C6-C12, e.g., oxyphenylene, oxybiphenylene, oxynaphthalene, an oxycarbonyl group, an amide group, a urethane group, and such divalent organic groups may also be displaced by the foregoing substituted groups;

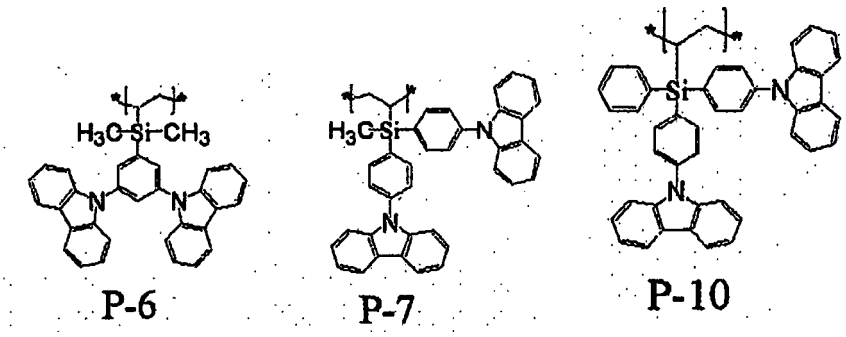
R_1 and R_2 may be the same or different and each represents a hydrogen atom or a univalent substitution group, namely an alkyl group, preferably C1-C20, an alkenyl group, preferably C2-C20, an aryl group, preferably C6-C30, an alkoxy group, preferably C1-C20, an aryloxy group, preferably C6-C20, a hetero-oxy group, preferably C2-C20, a silyloxy group, preferably C3-C40, an acyl group, preferably C1-C20, an alkoxycarbonyl group, preferably C2-C20, an acyloxy group, preferably C2-C20, an acylamino group, preferably C2-C20, an alkoxycarbonylamino group, preferably C2-C20, an anyloxycarbonylamino group, preferably C7-C20, a sulfamoylamino group, preferably C1-C20, a sulfonyl group, preferably C0-C20, an alkylthio group, preferably C1-C20, an arylthio group, preferably C6-C20, a heterocyclic thiol group, preferably C1-C20, a sulfonyl group, preferably C1-C20, an ureide group, preferably C1-C20, a phosphoamide group, preferably C1-C20, a hydroxyl group, a halogen, a cyano group, a sulfone group, a carboxyl group, a nitro group, a heteroatom, a silyl group, preferably C3-C40;

R_3-R_{10} and R_3'-R_{10}' may be the same or different and each represents a C1-C30 substituted or non-substituted alkyl group, a C1-C30 substituted or non-substituted acyl group, a C1-C30 substituted or non-substituted alkoxycarbonyl group, a C1-C30 substituted or non-substituted alkoxy group, a C2-C30 substituted or non-substituted alkenyl group, a C2-C30 substituted or non-substituted alkynyl group, a C2-C30 substituted or non-substituted alkylcarboxyl group, a C6-C30 substituted or non-substituted aryl group, a C6-C30 substituted or non-substituted aralkyl group, a C6-C30 substituted or non-substituted aralkyloxy group, a C2-C30 substituted or non-substituted heteroaryl group, a C2-C30 substituted or non-substituted heteroaryloxy group, a C6-C30 substituted or non-substituted aryloxy group, a C4-C30 substituted or non-substituted cycloalkyl group, -N(R)(R'), where R and R' independently represent hydrogen, a C1-C30 alkyl group, a C6-C30 aryl group, or a C2-C30 heteroaryl group, a cyano group, a hydroxyl group, and a carboxyl group, and

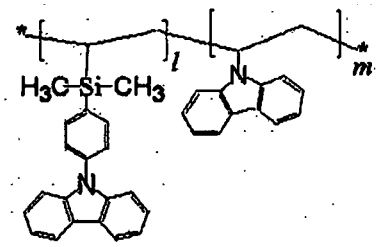
where two or more neighboring groups of R_3-R_{10}' may be connected to form a ring;

1 is an integer from 0 to 10;and wherein n is an integer from 1 to 1,000,000.

2. A polymer for an organic layer of an organic light emitting diode comprising a repeat unit selected from the group of repeat units consisting of:

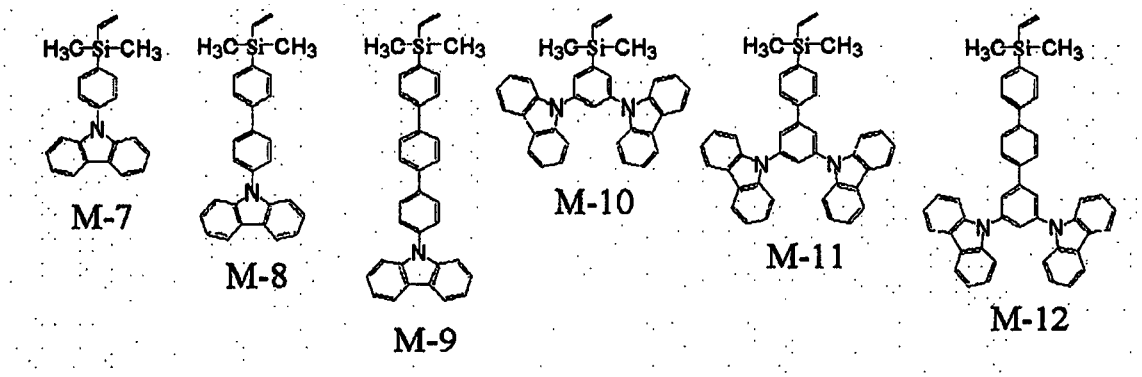


P-6 P-7 P-10

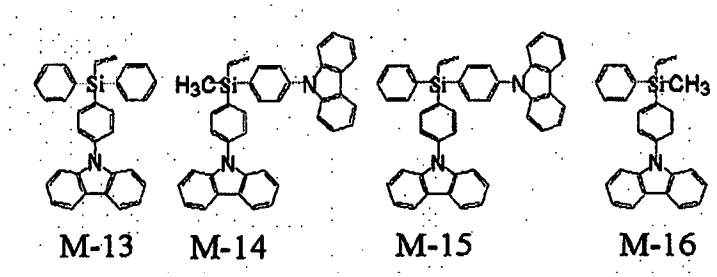


P-17

3. A polymer for an organic layer of an organic light emitting diode formed by polymerization of a monomer selected from the group consisting of:



M-7 M-8 M-9 M-10 M-11 M-12



M-13 M-14 M-15 M-16

4. A polymer for an organic layer of an organic light emitting diode according to one of claims 1, 2 or 3, further comprising a repeat unit represented by the following Formula 4 and formed by polymerization of a monomer represented by the following Formula 3:

[Formula 3] [Formula 4]

wherein in Formulas 3 and 4,

L represents carbazole, triphenylamine, phenyl, naphthyl, anthracenyl, pyridyl which can be substituted by a group selected from the group consisting of a cyano group (-CN), a hydroxyl group (-OH), a C1-C30 alkoxycarbonyl group displaceable by a C1-C6 alkoxycarbonyl group, a C1-C30 (di-)alkylaminocarbonyl group, a C1-C30 alkylcarbonyl group, a halogen, a hydroxyl group, a silyl group, a C1-C30 alkyl group, a C6-C18 aryl group, a C1-C30 alkoxy group, a C1-C30 alkoxycarbonyl group, a C1-C30 acyloxy group, and a C1-C30 alkylcarbonyl

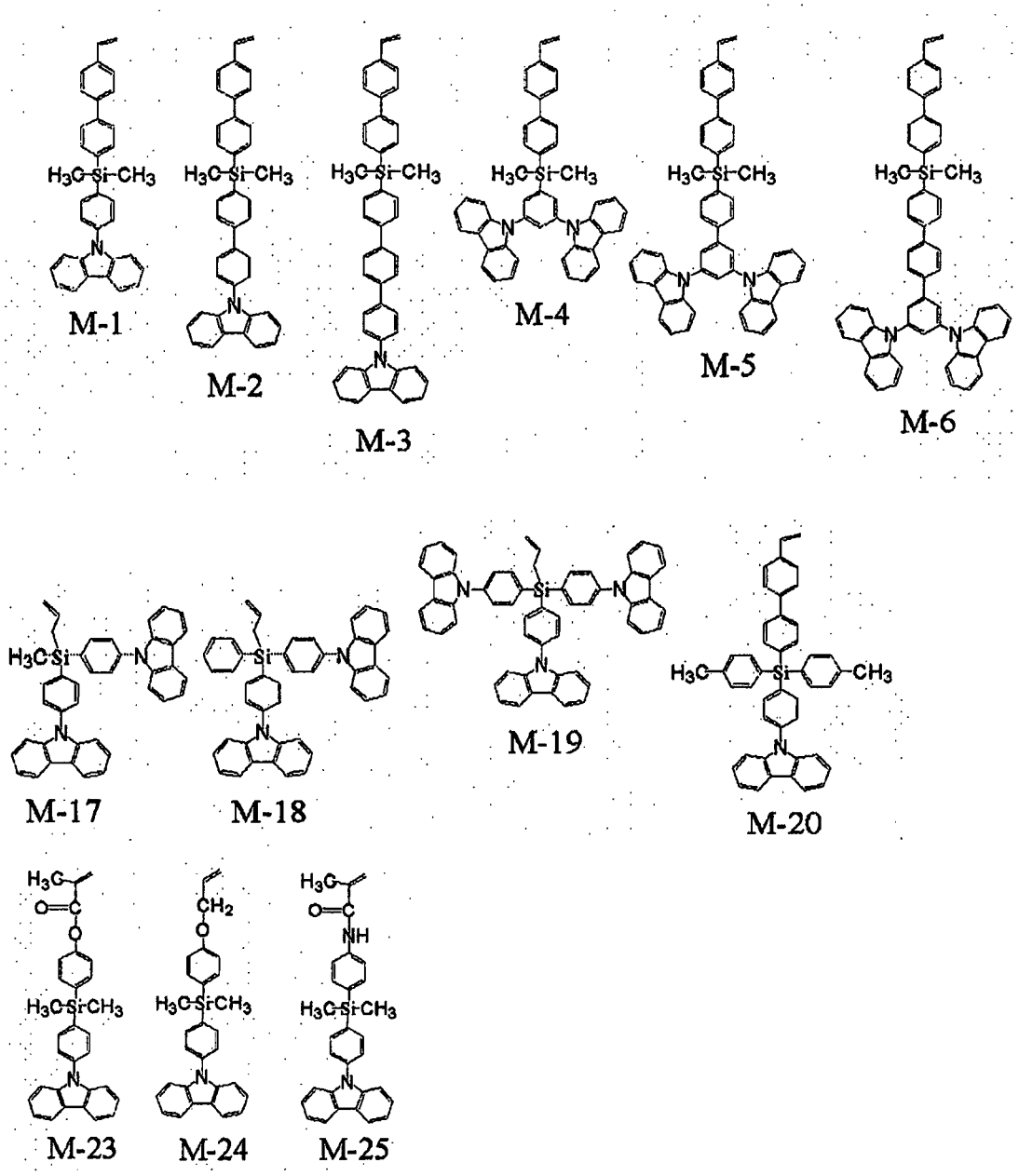
group;
R_1 and R_2 may be the same or different and each represents a hydrogen atom or a univalent substitution group, namely an alkyl group, preferably C1-C20, an alkenyl group, preferably C2-C20, an aryl group, preferably C6-C30, an alkoxy group, preferably C1-C20, an aryloxy group, preferably C6-C20, a hetero-oxy group, preferably C2-C20, a silyloxy group, preferably C3-C40, an acyl group, preferably C1-C20, an alkoxycarbonyl group, preferably C2-C20, an acyloxy group, preferably C2-C20, an acylamino group, preferably C2-C20, an alkoxycarbonylamino group, preferably C2-C20, an anyloxycarbonylamino group, preferably C7-C20, a sulfamoylamino group, preferably C1-C20, a sulfonyl group, preferably C0-C20, an alkylthio group, preferably C1-C20, an arylthio group, preferably C6-C20, a heterocyclic thiol group, preferably C1-C20, a sulfonyl group, preferably C1-C20, an ureide group, preferably C1-C20, a phosphoamide group, preferably C1-C20, a hydroxyl group, a halogen, a cyano group, a sulfone group, a carboxyl group, a nitro group, a heteroatom, a silyl group, preferably C3-C40.

5. The polymer according to claim 4, wherein the repeat unit represented by Formula 8 or the repeat unit of claim 2 forms at least 0.5% by weight or more of the entire polymer.

6. The polymer according to claim 4, wherein the repeat unit represented by Formula 4 forms at least 0.5% by weight or more of the entire polymer.

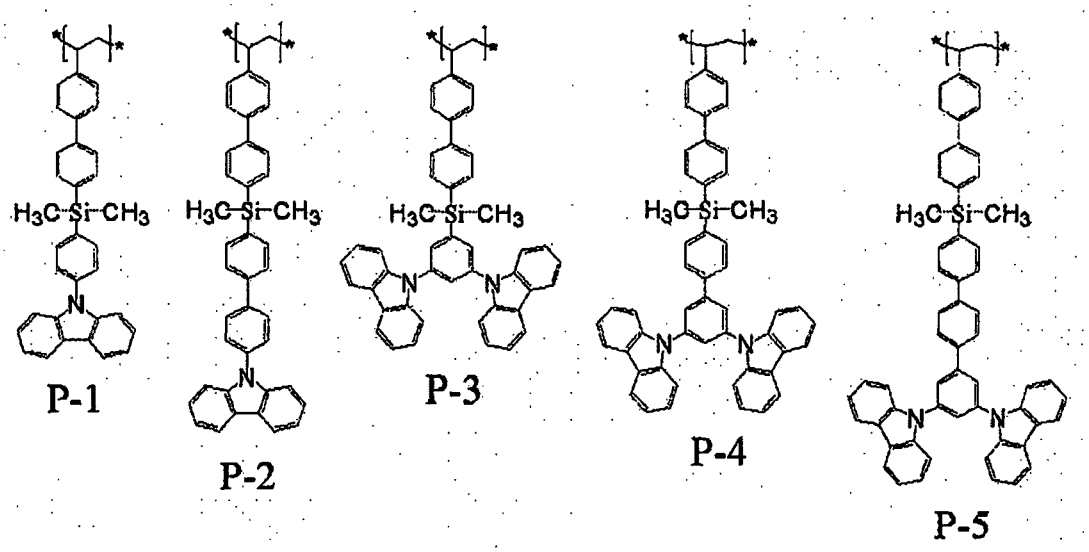
7. The polymer according to claim 1 or 4, wherein the monomer represented by Formula 5 is selected from the group of monomers represented by the following Formula 6.

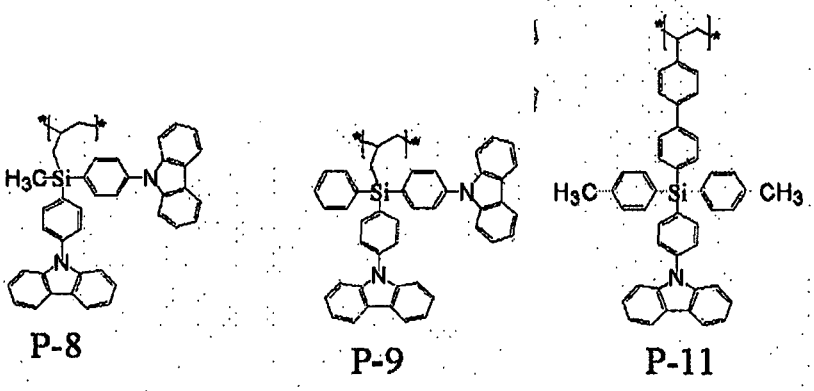
[Formula 6]

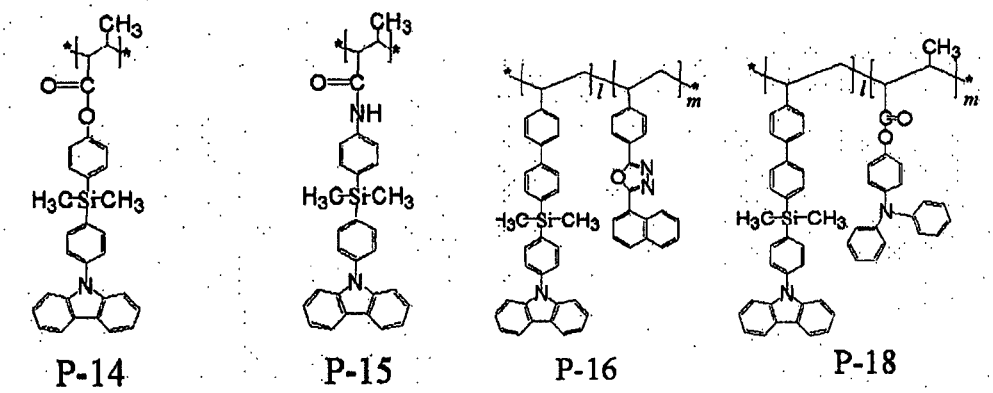


8. The polymer according to claim 1 or 4, wherein the repeat unit represented by Formula 8 is selected from the group of repeat units represented by the following Formula 7.

[Formula 7]

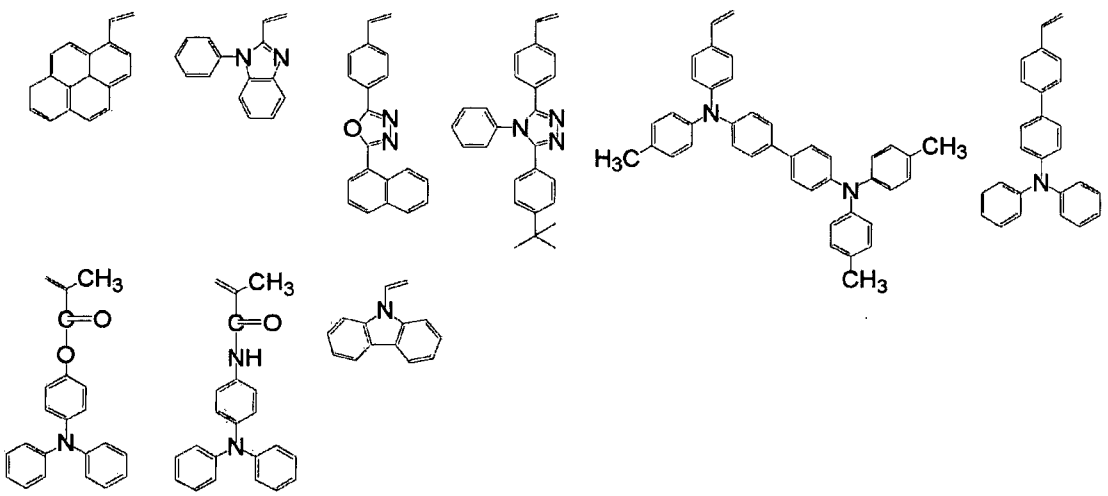






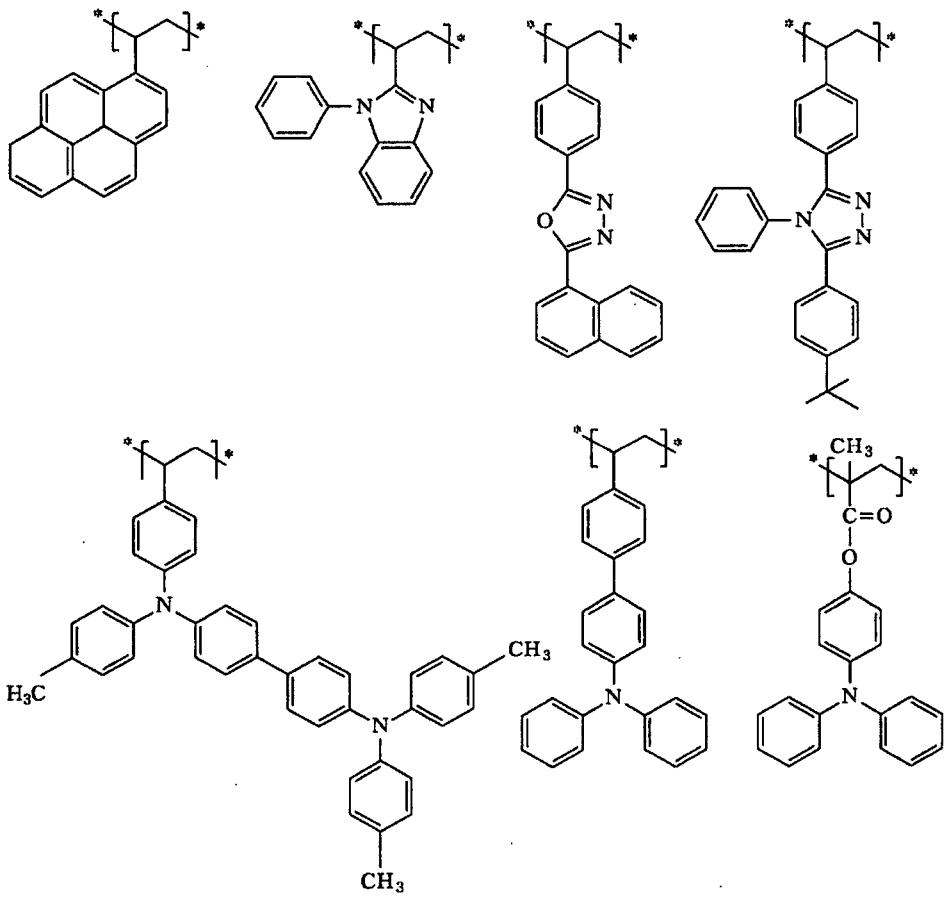
9. The polymer according to claim 4, wherein the monomer represented by Formula 3 is represented by the following Formula 9.

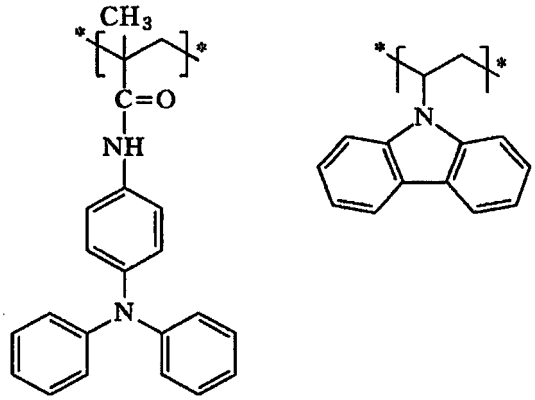
[Formula 9]



10. The polymer according to claim 4, wherein the repeat unit represented by Formula 4 is a repeat unit represented by the following Formula 10.

[Formula 10]





11. The polymer according to one of claims 1, 2, 3 or 4, wherein the polymer has a weight average molecular weight of 1,000 to 5,000,000.

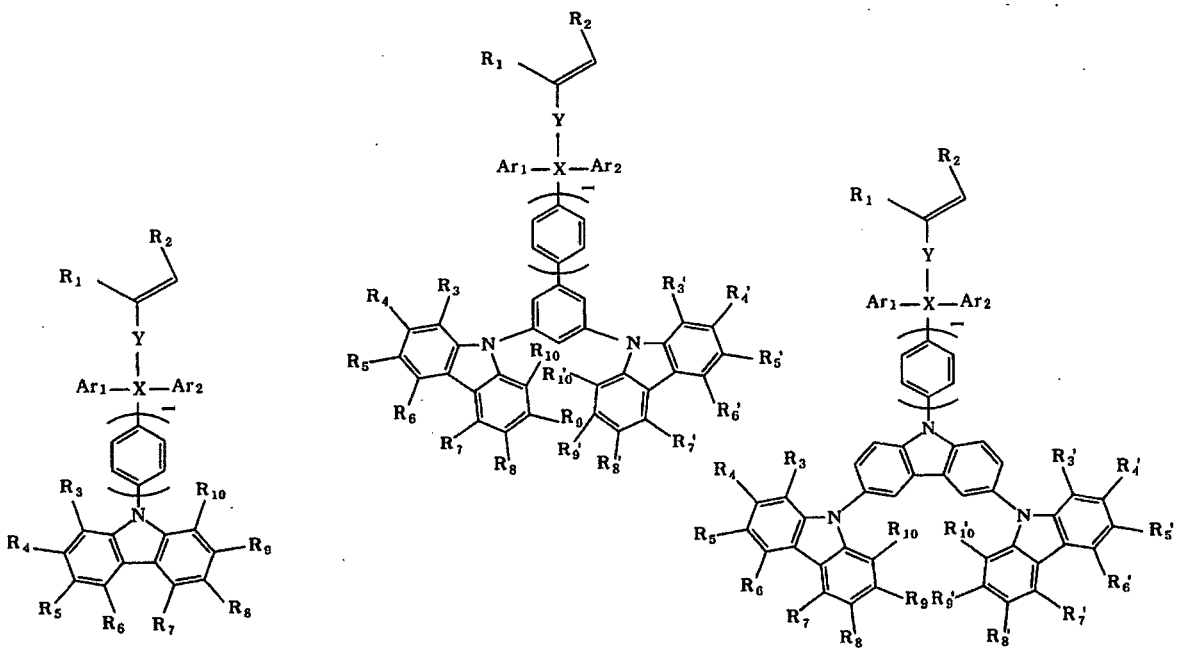
12. The polymer according to one of claims 1, 2, 3 or 4, wherein the polymer has a number average molecular weight of 500 to 2,000,000.

13. An organic light emitting diode comprising a pair of electrodes, and an organic layer containing the polymer according to any one of claims 1 to 12 as one component.

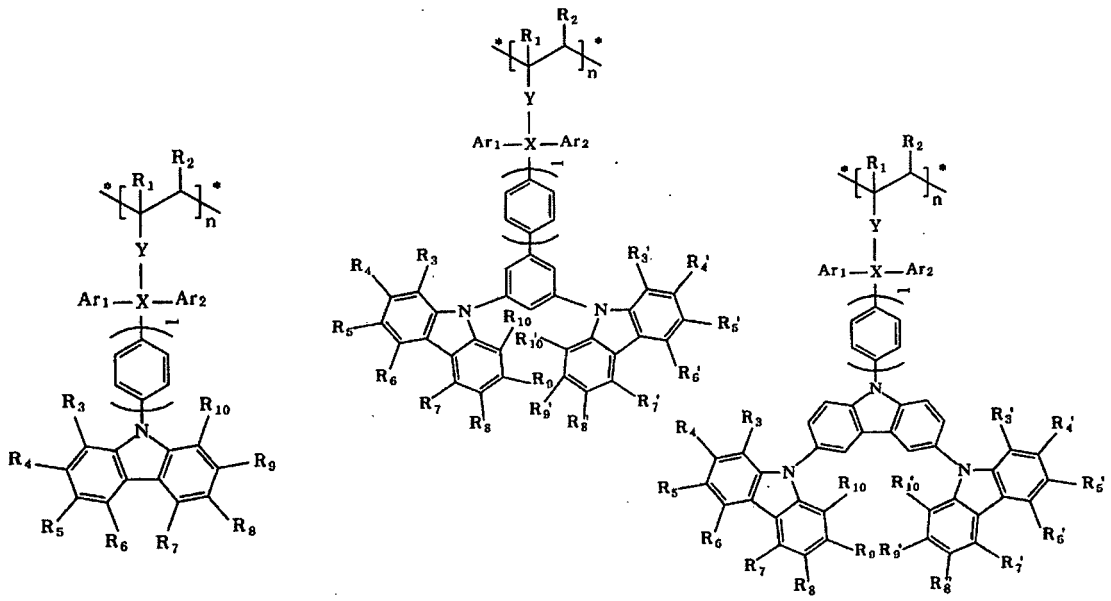
Patentansprüche

1. Polymer für eine organische Schicht einer organischen Leuchtdiode, umfassend eine Wiederholungseinheit, welche durch die folgende Formel 8 dargestellt ist und durch Polymerisation eines Monomers gebildet wird, wobei das Monomer durch die folgende Formel 5 dargestellt ist:

[Formel 5]



[Formel 8]



wobei in den Formeln 5 und 8 X Silicium (Si) oder Zinn (Sn) darstellt;

Ar_1, Ar_2, und Ar_3 können gleich oder verschieden sein und stellen jeweils eine C1-C30 substituierte oder nichtsubstituierte Alkylgruppe, eine C1-C30 substituierte oder nichtsubstituierte Acylgruppe, eine C1-C30 substituierte oder nichtsubstituierte Alkoxycarbonylgruppe, eine C1-C30 substituierte oder nichtsubstituierte Alkoxygruppe, eine C2-C30 substituierte oder nichtsubstituierte Alkenylgruppe, eine C2-C30 substituierte oder nichtsubstituierte Alkinylgruppe, eine C2-C30 substituierte oder nichtsubstituierte Alkylcarboxylgruppe, eine C6-C30 substituierte oder nichtsubstituierte Arylgruppe, eine C6-C30 substituierte oder nichtsubstituierte Aralkylgruppe, eine C6-C30 substituierte oder nichtsubstituierte Aralkyloxygruppe, eine C2-C30 substituierte oder nichtsubstituierte Heteroarylgruppe, eine C2-C30 substituierte oder nichtsubstituierte Heteroaryloxygruppe, eine C6-C30 substituierte oder nichtsubstituierte Aryloxygruppe, und eine C4-C30 substituierte oder nichtsubstituierte Cycloalkylgruppe dar;

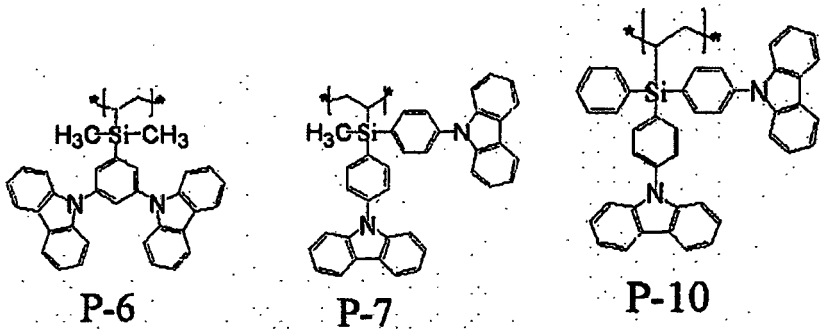
Y stellt eine Alkylengruppe dar, bevorzugt C1-C20, stärker bevorzugt C1-C12, und insbesondere bevorzugt C1-C8, z.B. Methylen, Ethylen, Propylen, eine Arylengruppe, bevorzugt C6-C30, stärker bevorzugt C6-C20, und insbesondere bevorzugt C6-C12, z.B. Phenylen, Biphenylen, Naphthalin, eine Oxyalkylengruppe, bevorzugt C1-C20, stärker bevorzugt C1-C12, und insbesondere bevorzugt C1-C8, z.B. Oxymethylen, Oxyethylen, eine Oxyarylengruppe, bevorzugt C6-C20, stärker bevorzugt C6-C16, und insbesondere bevorzugt C6-C12, z.B. Oxyphenylen, Oxybiphenylen, Oxynaphthalin, eine Oxycarbonylgruppe, eine Amidgruppe, eine Urethangruppe, und solche zweiwertige organische Gruppen können auch durch die vorherigen substituierten Gruppen ersetzt werden;

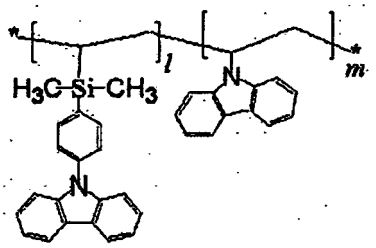
R_1 und R_2 können gleich oder verschieden sein und stellen jeweils ein Wasserstoffatom oder eine einwertige Substitutionsgruppe dar, nämlich eine Alkylgruppe, bevorzugt C1-C20, eine Alkenylgruppe, bevorzugt C2-C20, eine Arylgruppe, bevorzugt C6-C30, eine Alkoxygruppe, bevorzugt C1-C20, eine Aryloxygruppe, bevorzugt C6-C20, eine Heterooxygruppe, bevorzugt C2-C20, eine Silyloxygruppe, bevorzugt C3-C40, eine Acylgruppe, bevorzugt C1-C20, eine Alkoxycarbonylgruppe, bevorzugt C2-C20, eine Acyloxygruppe, bevorzugt C2-C20, eine Acylaminogruppe, bevorzugt C2-C20, eine Alkoxycarbonylaminogruppe, bevorzugt C2-C20, eine Anyl- bzw. Aryloxycarbonylaminogruppe, bevorzugt C7-C20, eine Sulfamoylaminogruppe, bevorzugt C1-C20, eine Sulfonylgruppe, bevorzugt Co-C20, eine Alkylthiogruppe, bevorzugt C1-C20, eine Arylthiogruppe, bevorzugt C6-C20, eine heterozyklische Thiolgruppe, bevorzugt C1-C20, eine Sulfonylgruppe, bevorzugt C1-C20, eine Ureidgruppe, bevorzugt C1-C20, eine Phosphoamidgruppe, bevorzugt C1-C20, eine Hydroxygruppe, ein Halogen, eine Cyanogruppe, eine Sulfongruppe, eine Carboxylgruppe, eine Nitrogruppe, ein Heteroatom, eine Silylgruppe, bevorzugt C3-C40;

R_3-R_{10} und R_3'-R_{10}' können gleich oder verschieden sein und stellen jeweils eine C1-C30 substituierte oder nichtsubstituierte Alkylgruppe, eine C1-C30 substituierte oder nichtsubstituierte Acylgruppe, eine C1-C30 substituierte oder nichtsubstituierte Alkoxycarbonylgruppe, eine C1-C30 substituierte oder nichtsubstituierte Alko-

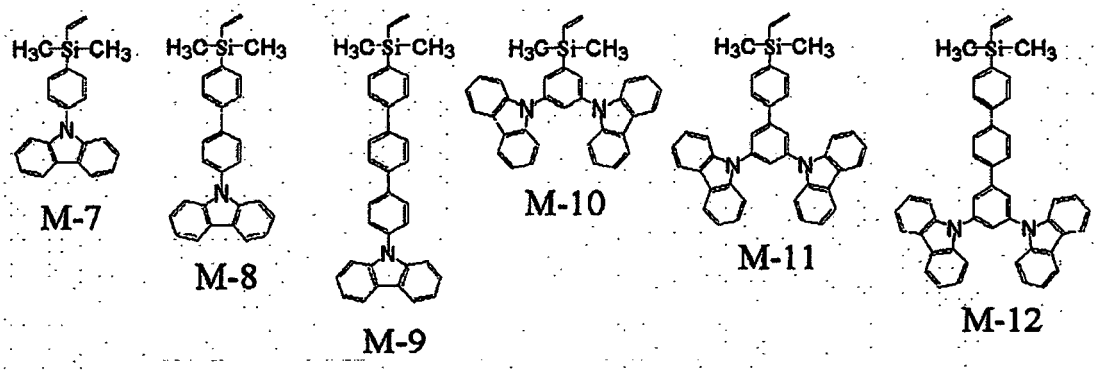
xygruppe, eine C2-C30 substituierte oder nichtsubstituierte Alkenylgruppe, eine C2-C30 substituierte oder nichtsubstituierte Alkinylgruppe, eine C2-C30 substituierte oder nichtsubstituierte Alkylcarboxylgruppe, eine C6-C30 substituierte oder nichtsubstituierte Arylgruppe, eine C6-C30 substituierte oder nichtsubstituierte Aralkylgruppe, eine C6-C30 substituierte oder nichtsubstituierte Aralkyloxygruppe, eine C2-C30 substituierte oder nichtsubstituierte Heteroarylgruppe, eine C2-C30 substituierte oder nichtsubstituierte Heteroaryloxygruppe, eine C6-C30 substituierte oder nichtsubstituierte Acryloxygruppe, eine C4-C30 substituierte oder nichtsubstituierte Cycloalkylgruppe, -N(R)(R'), wobei R und R' jeweils unabhängig voneinander Wasserstoff, eine C1-C30-Alkylgruppe, eine C6-C30-Arylgruppe oder eine C2-C30-Heteroarylgruppe sind, eine Cyanogruppe, eine Hydroxylgruppe, und eine Carboxylgruppe darstellen, und
wobei zwei oder mehr benachbarte Gruppen von R3-R10' verbunden sein können, um einen Ring zu bilden; 1 ist eine ganze Zahl von 0 bis 10; und wobei n eine ganze Zahl von 1 bis 1,000,000 ist.

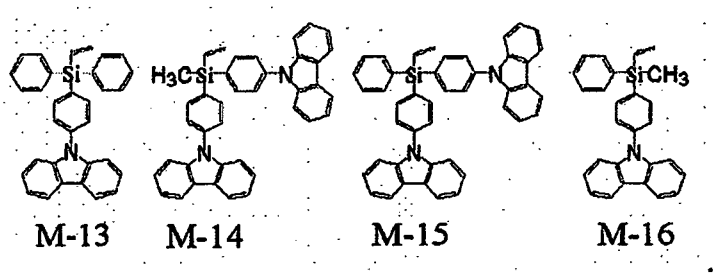
2. Polymer für eine organische Schicht einer organischen Leuchtdiode, umfassend eine Wiederholungseinheit, die aus der Gruppe bestehend aus den folgenden Wiederholungseinheiten ausgewählt ist:





3. Polymer für eine organische Schicht einer organischen Leuchtdiode, welches durch Polymerisation eines Monomers gebildet wird, welches ausgewählt ist aus der Gruppe bestehend aus:





4. Polymer für eine organische Schicht einer organischen Leuchtdiode nach einem der Ansprüche 1, 2 oder 3, weiterhin umfassend eine Wiederholungseinheit, die durch die folgende Formel 4 dargestellt ist und durch Polymerisation eines Monomers, dargestellt durch die folgende Formel 3, gebildet wird:

[Formel 3] [Formel 4]

wobei in den Formeln 3 und 4,

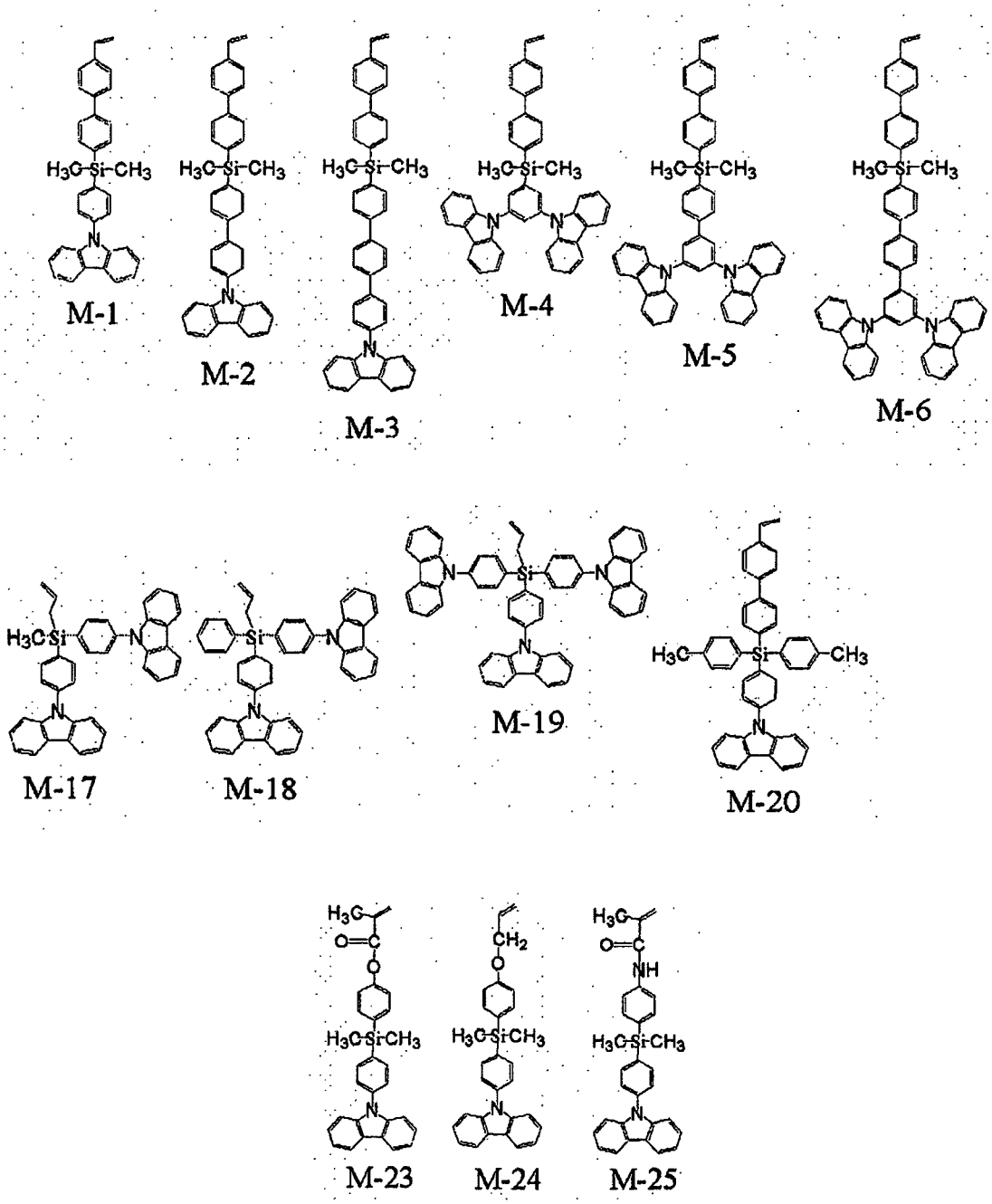
L stellt Carbazol, Triphenylamin, Phenyl, Naphthyl, Anthracenyl, Pyridyl dar, welche durch eine Gruppe, die aus der Gruppe bestehend aus einer Cyanogruppe (-CN), einer Hydroxylgruppe (-OH), einer C1-C30-Alkoxycarbonylgruppe, ersetzbar durch eine C1-C6-Alkoxycarbonylgruppe, eine C1-C30-(Di-)Alkylaminocarbonylgruppe, eine C1-C30-Alkylcarbonylgruppe, ein Halogen, eine Hydroxylgruppe, eine Silylgruppe, eine C1-C30-Alkylgruppe, eine C6-C18-Arylgruppe, eine C1-C30-Alkoxygruppe, eine C1-C30-Alkoxycarbonylgruppe, eine C1-C30-Acyloxygruppe, und eine C1-C30-Alkylcarbonylgruppe substituiert sein kann,
R_1 und R_2 können gleich oder verschieden sein und stellen jeweils ein Wasserstoffatom oder eine einwertige Substitutionsgruppe dar, nämlich eine Alkylgruppe, bevorzugt C1-C20, eine Alkenylgruppe, bevorzugt C2-C20, eine Arylgruppe, bevorzugt C6-C30, eine Alkoxygruppe, bevorzugt C1-C20, eine Aryloxygruppe, bevorzugt C6-C20, eine Heterooxygruppe, bevorzugt C2-C20, eine Silyloxygruppe, bevorzugt C3-C40, eine Acylgruppe, bevorzugt C1-C20, eine Alkoxycarbonylgruppe, bevorzugt C2-C20, eine Acyloxygruppe, bevorzugt C2-C20, eine Acylaminogruppe, bevorzugt C2-C20, eine Alkoxycarbonylaminogruppe, bevorzugt C2-C20, eine Anyl- bzw. Aryloxycarbonylgruppe, bevorzugt C7-C20, eine Sulfamoylaminogruppe, bevorzugt C1-C20, eine Sulfonylgruppe, bevorzugt C0-C20, eine Alkylthiogruppe, bevorzugt C1-C20, eine Arylthiogruppe, bevorzugt C6-C20, eine heterozyklische Thiolgruppe, bevorzugt C1-C20, eine Sulfonylgruppe, bevorzugt C1-C20, eine Ureidgruppe, bevorzugt C1-C20, eine Phosphoamidgruppe, bevorzugt C1-C20, eine Hydroxylgruppe, ein Halogen, eine Cyanogruppe, eine Sulfongruppe, eine Carboxylgruppe, eine Nitrogruppe, ein Heteroatom, eine Silylgruppe, bevorzugt C3-C40.

5. Polymer nach Anspruch 4, wobei die Wiederholungseinheit, dargestellt durch die Formel 8, oder die Wiederholungseinheit nach Anspruch 2 mindestens 0.5 Gewichtsprozent oder mehr des gesamten Polymers bildet.

6. Polymer nach Anspruch 4, wobei die Wiederholungseinheit, dargestellt durch die Formel 4, mindestens 0.5 Gewichtsprozent oder mehr des gesamten Polymers bildet.

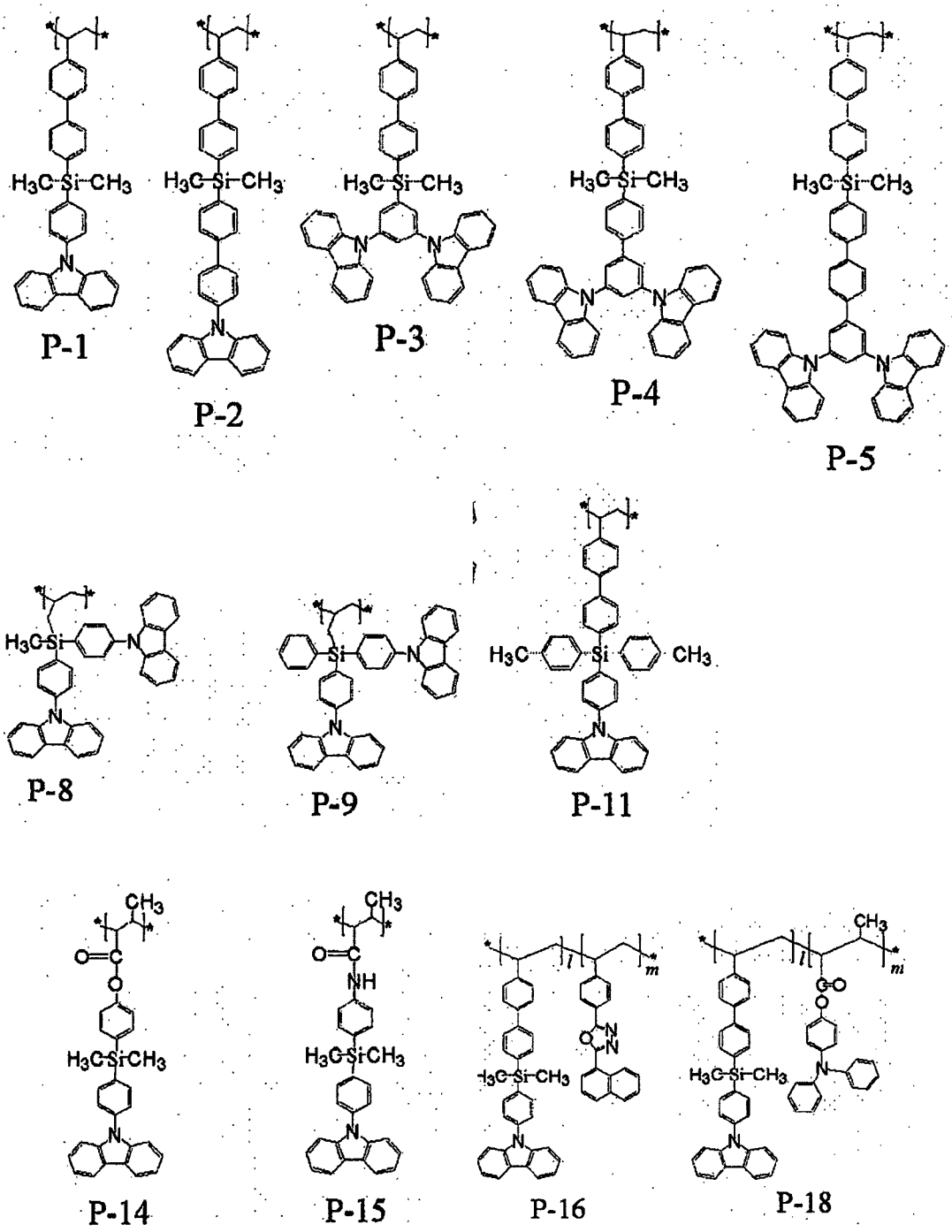
7. Polymer nach Anspruch 1 oder 4, wobei das Monomer, dargestellt durch Formel 5, ausgewählt ist aus der Gruppe von Monomeren, welche durch die folgende Formel 6 dargestellt sind.

[Formel 6]



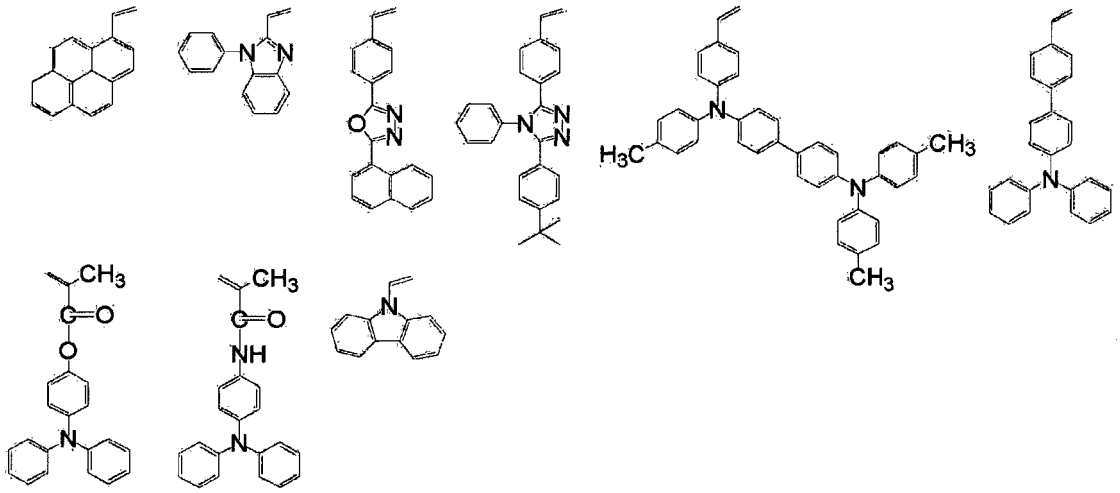
8. Polymer nach Anspruch 1 oder 4, wobei die Wiederholungseinheit, dargestellt durch die Formel 8, aus der Gruppe von Wiederholungseinheiten ausgewählt ist, welche durch die folgende Formel 7 dargestellt sind.

[Formel 7]



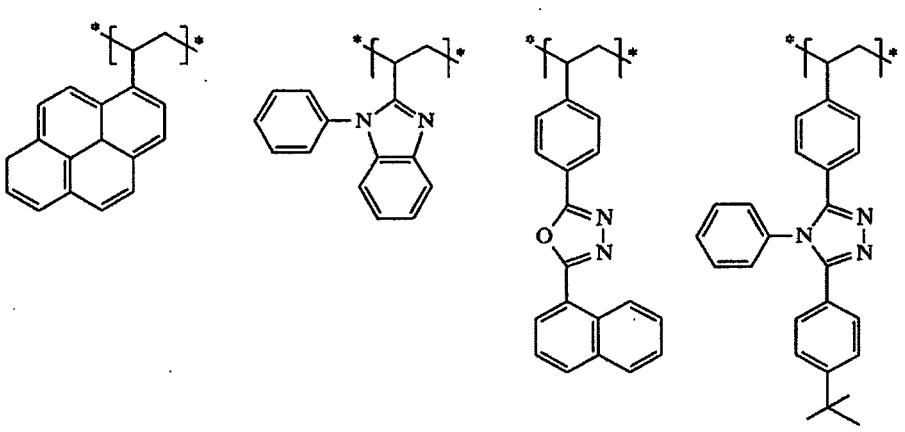
9. Polymer nach Anspruch 4, wobei das Monomer, das durch Formel 3 dargestellt ist, durch die folgende Formel 9 dargestellt ist.

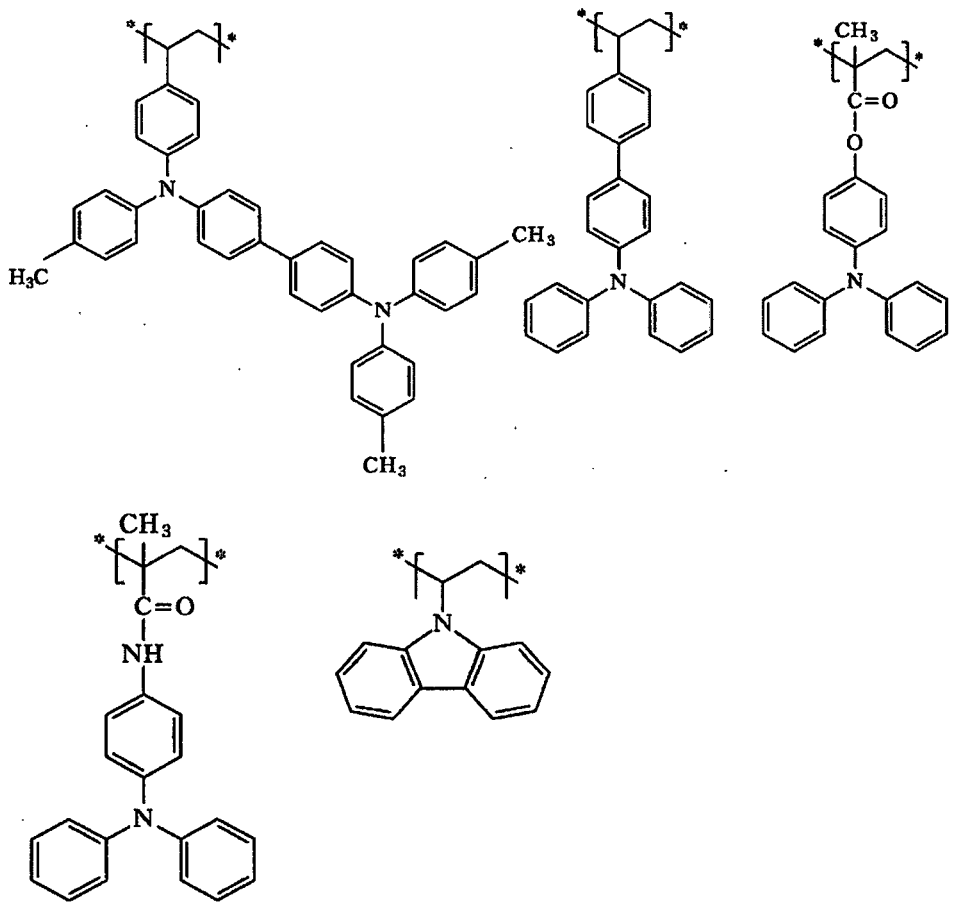
[Formel 9]



10. Polymer nach Anspruch 4, wobei die Wiederholungseinheit, dargestellt durch die Formel 4, eine Wiederholungseinheit ist, welche durch die folgende Formel 10 dargestellt ist.

[Formel 10]





11. Polymer nach einem der Ansprüche 1, 2, 3 oder 4, wobei das Polymer ein gewichtsmittleres Molekulargewicht von 1,000 bis 5,000,000 hat.

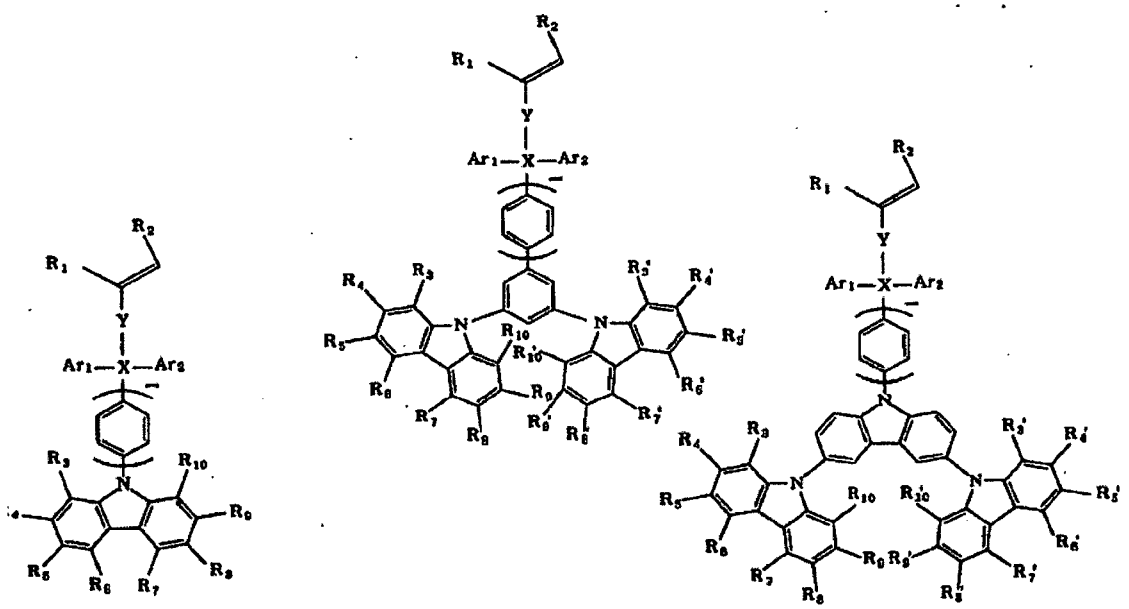
12. Polymer nach einem der Ansprüche 1, 2, 3 oder 4, wobei das Polymer ein zahlenmittleres Molekulargewicht von 500 bis 2,000,000 hat.

13. Organische Leuchtdiode, umfassend ein Elektrodenpaar und eine organische Schicht, die das Polymer nach irgendeinem der Ansprüche 1 bis 12 als eine Komponente beinhaltet.

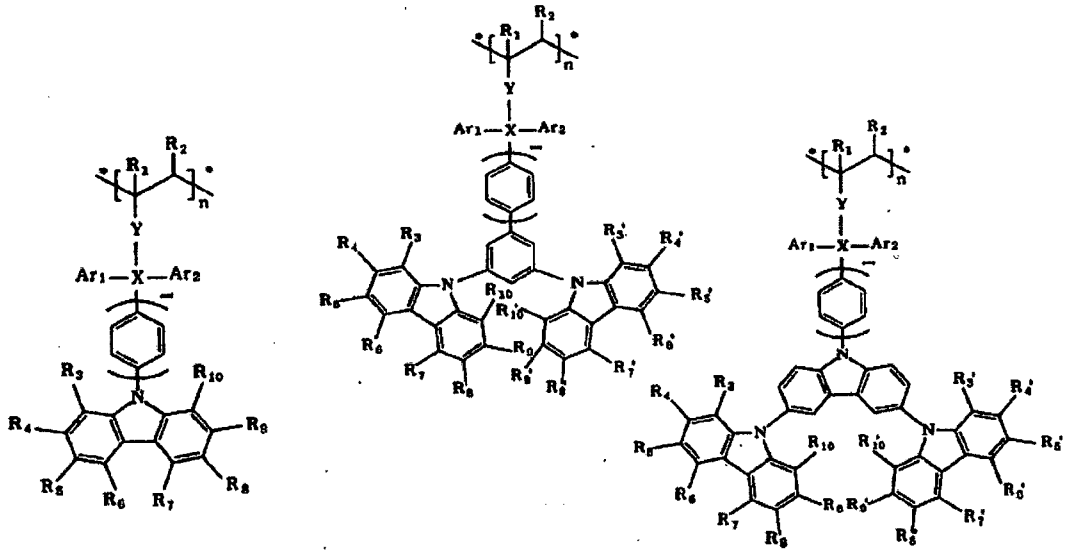
Revendications

1. Polymère pour une couche organique d'une diode électroluminescente organique comprenant un motif répétitif représenté par la Formule 8 ci-après et formé par polymérisation d'un monomère représenté par la Formule 5 ci-après :

[Formule 5]



[Formule 8]



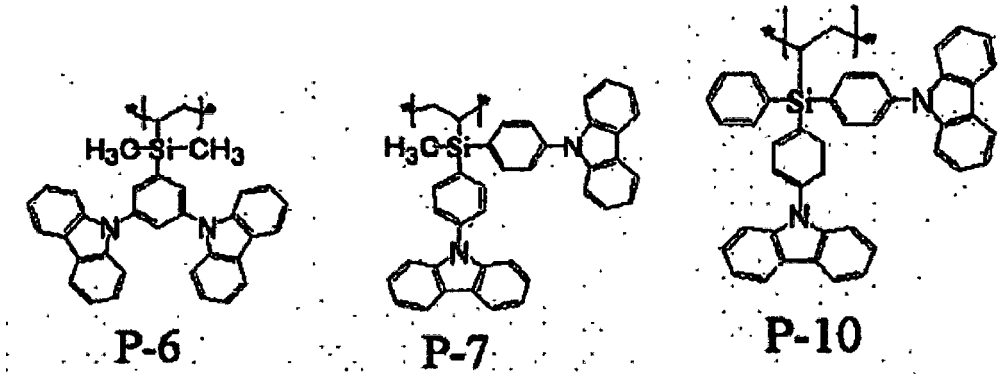
dans lequel, dans les Formules 5 et 8, X représente le silicium (Si) ou l'étain (Sn) ;

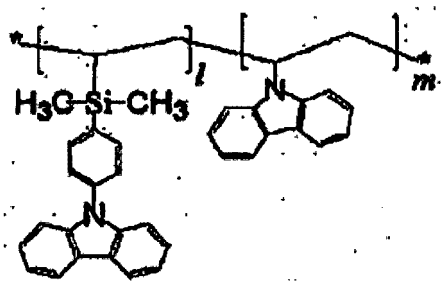
Ar_1, Ar_2 et Ar_3 peuvent être identiques ou différents et représentent chacun un groupe alkyle en C_1-C_{30} substitué ou non substitué, un groupe acyle en C_1-C_{30} substitué ou non substitué, un groupe alcoxycarbonyle en C_1-C_{30} substitué ou non substitué, un groupe alcoxy en C_1-C_{30} substitué ou non substitué, un groupe alcényle en C_2-C_{30} substitué ou non substitué, un groupe alcynyle en C_2-C_{30} substitué ou non substitué, un groupe alkylcarbonyle en C_2-C_{30} substitué ou non substitué, un groupe aryle en C_6-C_{30} substitué ou non substitué, un groupe aralkyle en C_6-C_{30} substitué ou non substitué, un groupe aralkyloxy en C_6-C_{30} substitué ou non substitué, un groupe hétéroaryle en C_2-C_{30} substitué ou non substitué, un groupe hétéroaryloxy en C_2-C_{30} substitué ou non substitué, un groupe aryloxy en C_6-C_{30} substitué ou non substitué, et un groupe cycloalkyle en C_4-C_{30} substitué ou non substitué ;

Y représente un groupe alkylène, de préférence en C_1-C_{20}, plus particulièrement en C_1-C_{12} et d'une manière encore plus préférée en C_1-C_8, p.ex. le méthylène, l'éthylène, le propylène, un groupe arylène, de préférence en C_6-C_{30}, plus particulièrement en C_6-C_{20} et d'une manière encore plus préférée en C_6-C_{12}, p.ex. phénylène, biphénylène, naphtalène, un groupe oxyalkylène, de préférence en C_1-C_{20}, plus particulièrement en C_1-C_{12} et d'une manière encore plus préférée en C_1-C_8, p.ex. oxyméthylène, oxyéthylène, un groupe oxyarylène, de préférence en C_6-C_{20}, plus particulièrement en C_6-C_{16} et d'une manière encore plus préférée en C_6-C_{12} p.ex.

oxyphénylène, oxybiphénylène, oxynaphtalène, un groupe oxycarbonyle, un groupe amide, un groupe uréthanne, et ces groupes organiques divalents peuvent être aussi déplacés par les groupes substitués ci-dessus ;
R_1 et R_2 peuvent être identiques ou différents et représentent chacun un atome d'hydrogène ou un groupe de substitution monovalent, plus précisément un groupe alkyle, de préférence en C_1-C_{20}, un groupe alcényle, de préférence en C_2-C_{20}, un groupe aryle, de préférence en C_6-C_{30}, un groupe alcoxy, de préférence en C_1-C_{20}, un groupe aryloxy, de préférence en C_6-C_{20}, un groupe hétéro-oxy, de préférence en C_2-C_{20}, un groupe silyloxy, de préférence en C_3-C_{40}, un groupe acyle, de préférence en C_1-C_{20}, un groupe alcoxycarbonyle, de préférence en C_2-C_{20}, un groupe acyloxy, de préférence en C_2-C_{20}, un groupe acylamino, de préférence en C_2-C_{20}, un groupe alcoxycarbonylamino, de préférence en C_2-C_{20}, un groupe anyloxycarbonylamino, de préférence en C_7-C_{20}, un groupe sulfamoylamino, de préférence en C_1-C_{20}, un groupe sulfonyle, de préférence en C_0-C_{20}, un groupe alkylthio, de préférence en C_1-C_{20}, un groupe arylthio, de préférence en C_6-C_{20}, un groupe thiol hétérocyclique, de préférence en C_1-C_{20}, un groupe sulfonyle, de préférence en C_1-C_{20}, un groupe uréido, de préférence en C_1-C_{20}, un groupe phosphamide, de préférence en C_1-C_{20}, un groupe hydroxyle, un halogène, un groupe cyano, un groupe sulfone, un groupe carboxyle, un groupe nitro, un hétéroatome, un groupe silyle, de préférence en C_3-C_{40} ;
R_3-R_{10} et R_3'-R_{10}' peuvent être identiques ou différents et représentent chacun un groupe alkyle en C_1-C_{30} substitué ou non substitué, un groupe acyle en C_1-C_{30} substitué ou non substitué, un groupe alcoxycarbonyle en C_1-C_{30} substitué ou non substitué, un groupe alcoxy en C_1-C_{30} substitué ou non substitué, un groupe alcényle en C_2-C_{30} substitué ou non substitué, un groupe alcynyle en C_2-C_{30} substitué ou non substitué, un groupe alkylcarbonyle en C_2-C_{30} substitué ou non substitué, un groupe aryle en C_6-C_{30} substitué ou non substitué, un groupe aralkyle en C_6-C_{30} substitué ou non substitué, un groupe aralkyloxy en C_6-C_{30} substitué ou non substitué, un groupe hétéroaryle en C_2-C_{30} substitué ou non substitué, un groupe hétéroaryloxy en C_2-C_{30} substitué ou non substitué, un groupe aryloxy en C_6-C_{30} substitué ou non substitué, un groupe cycloalkyle en C_4-C_{30} substitué ou non substitué, - N(R)(R'), où R et R' représentent chacun d'une manière indépendante un hydrogène, un groupe alkyle en C1-C_{30}, un groupe aryle en C_6-C_{30} ou un groupe hétéroaryle en C_2-C_{30}, un groupe cyano, un groupe hydroxyle et un groupe carboxyle, et
où deux groupes voisins, ou plus, de R_3-R_{10}' peuvent être reliés pour former un cycle ;
1 est un entier de 0 à 10 ; et où n est un entier de 1 à 1 000 000.

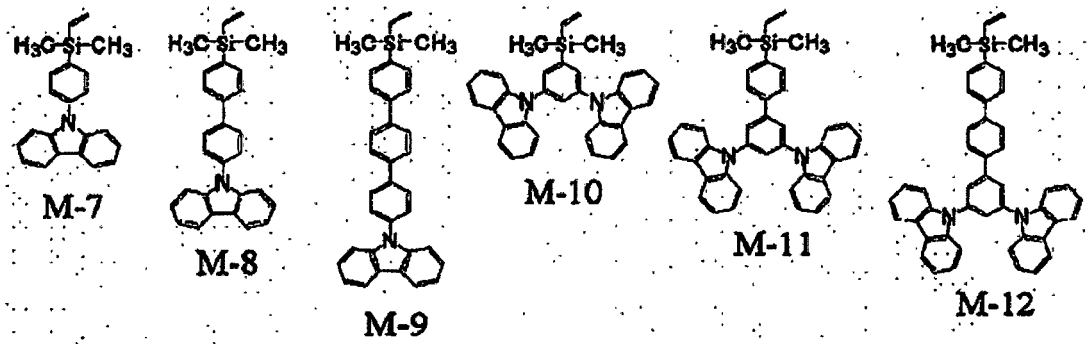
2. Polymère pour une couche organique d'une diode électroluminescente organique comprenant un motif répétitif choisi dans le groupe de motifs répétitifs consistant en :



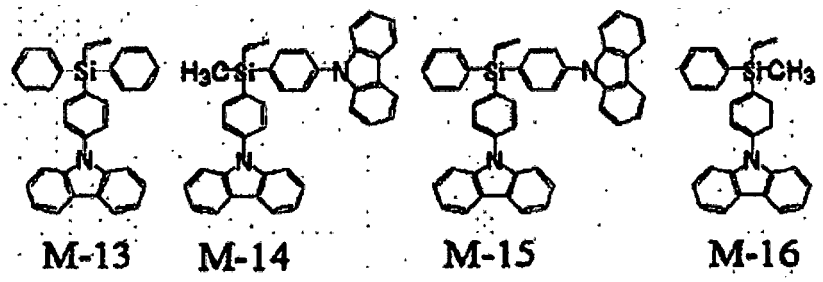


P-17

3. Polymère pour une couche organique d'une diode électroluminescente organique formé par polymérisation d'un monomère choisi dans le groupe consistant en :



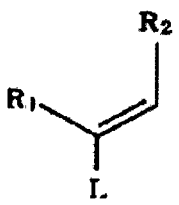
M-7 M-8 M-9 M-10 M-11 M-12



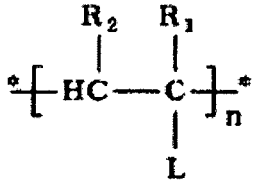
M-13 M-14 M-15 M-16

4. Polymère pour une couche organique d'une diode électroluminescente organique selon l'une des revendications 1, 2 ou 3, comprenant en outre un motif répétitif représenté par la Formule 4 ci-après, et formé par polymérisation d'un monomère représenté par la Formule 3 ci-après :

[Formule 3]



[Formule 4]



où, dans les Formules 3 et 4,

L représente un carbazole, une triphénylamine, un phényle, un naphtyle, un anthracényle, un pyridyle, qui peut être substitué par un groupe choisi dans le groupe consistant en un groupe cyano (-CN), un groupe hydroxyle

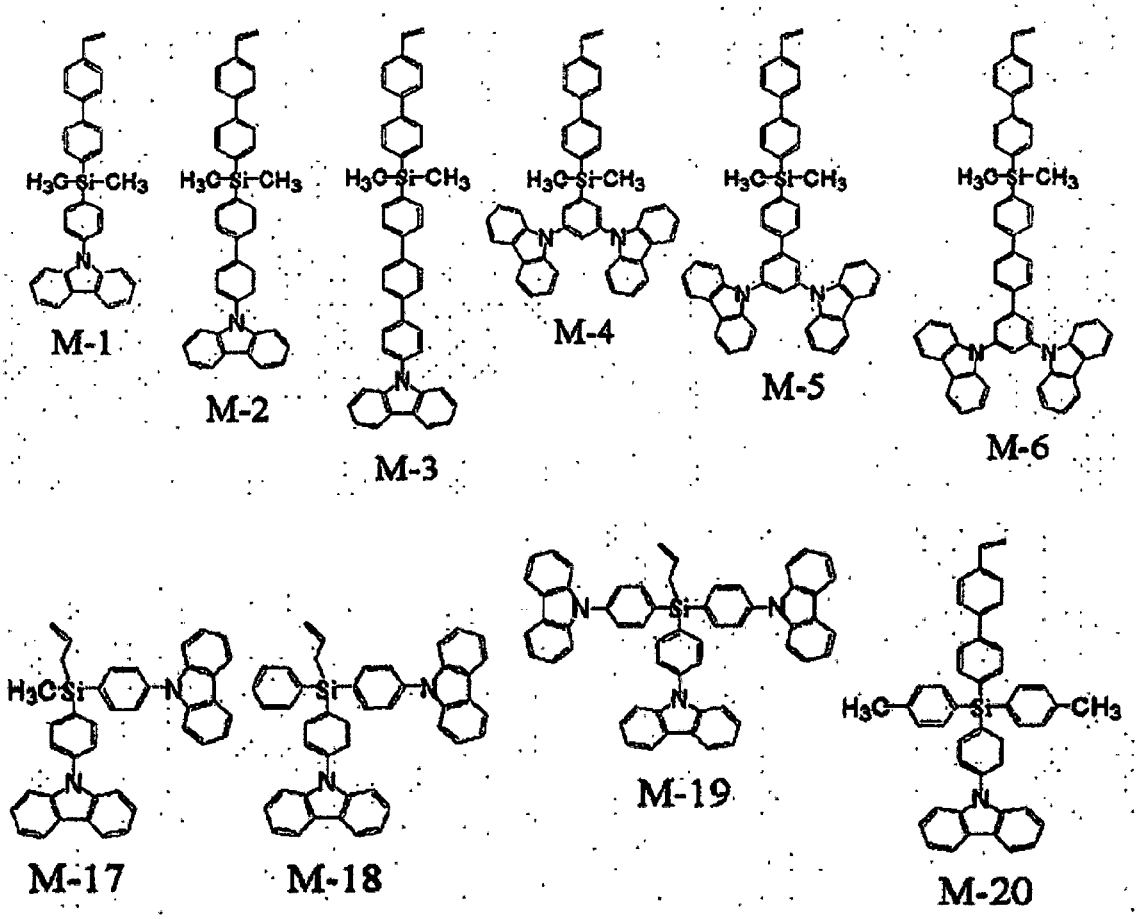
(-OH), un groupe alcoxycarbonyle en C_1-C_{30} pouvant être déplacé par un groupe alcoxycarbonyle en C_{1-6}, un groupe (di)alkylaminocarbonyle en C_1-C_{30}, un groupe alkylcarbonyle en C_1-C_{30}, un halogène, un groupe hydroxyle, un groupe silyle, un groupe alkyle en C_1-C_{30}, un groupe aryle en C_6-C_{18}, un groupe alcoxy en C_1-C_{30}, un groupe alcoxycarbonyle en C_1-C_{30}, un groupe acyloxy en C_1-C_{30} et un groupe alkylcarbonyle en C_1-C_{30} ;
R_1 et R_2 peuvent être identiques ou différents et représentent chacun un atome d'hydrogène ou un groupe de substitution monovalent, plus précisément un groupe alkyle, de préférence en C_1-C_{20}, un groupe alcényle, de préférence en C_2-C_{20}, un groupe aryle, de préférence en C_6-C_{30}, un groupe alcoxy, de préférence en C_1-C_{20}, un groupe aryloxy, de préférence en C_6-C_{20}, un groupe hétéro-oxy, de préférence en C_2-C_{20}, un groupe silyloxy, de préférence en C_3-C_{40}, un groupe acyle, de préférence en C_1-C_{20}, un groupe alcoxycarbonyle, de préférence en C_2-C_{20}, un groupe acyloxy, de préférence en C_2-C_{20}, un groupe acylamino, de préférence en C_2-C_{20}, un groupe alcoxycarbonylamino, de préférence en C_2-C_{20}, un groupe anyloxycarbonylamino, de préférence en C_7-C_{20}, un groupe sulfamoylamino, de préférence en C_1-C_{20}, un groupe sulfonyle, de préférence en C_0-C_{20}, un groupe alkylthio, de préférence en C_1-C_{20}, un groupe arylthio, de préférence en C_6-C_{20}, un groupe thiol hétérocyclique, de préférence en C_1-C_{20}, un groupe sulfonyle, de préférence en C_1-C_{20}, un groupe uréido, de préférence en C_1-C_{20}, un groupe phosphamide, de préférence en C_1-C_{20}, un groupe hydroxyle, un halogène, un groupe cyano, un groupe sulfone, un groupe carboxyle, un groupe nitro, un hétéroatome, un groupe silyle, de préférence en C_3-C_{40}.

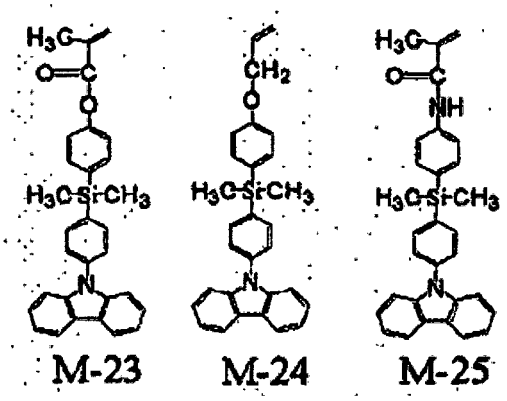
5. Polymère selon la revendication 4, dans lequel le motif répétitif représenté par la Formule 8 ou le motif répétitif de la revendication 2 forme au moins 0,5 % en poids ou plus du polymère dans sa totalité.

6. Polymère selon la revendication 4, dans lequel le motif répétitif représenté par la Formule 4 forme au moins 0,5 % en poids ou plus du polymère dans sa totalité.

7. Polymère selon la revendication 1 ou 4, dans lequel le monomère représenté par la Formule 5 est choisi dans le groupe de monomères représenté par la Formule 6.

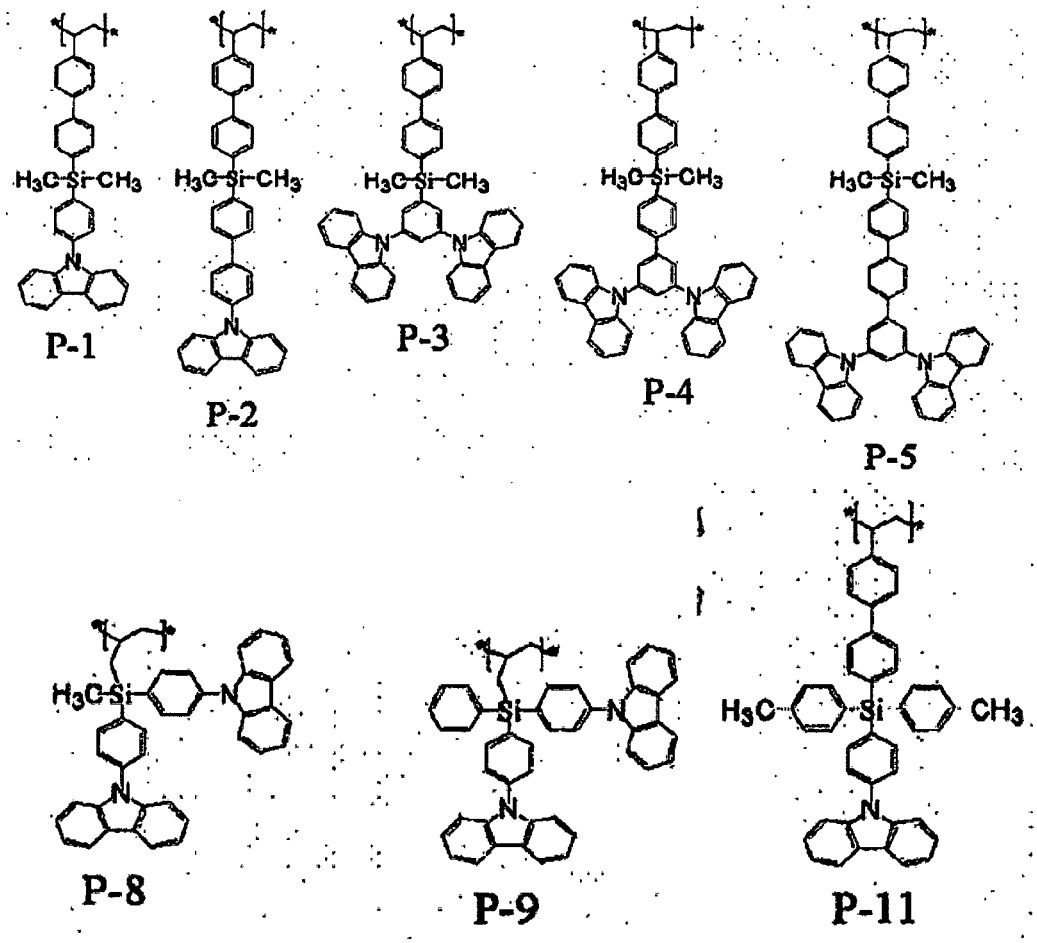
[Formule 6]

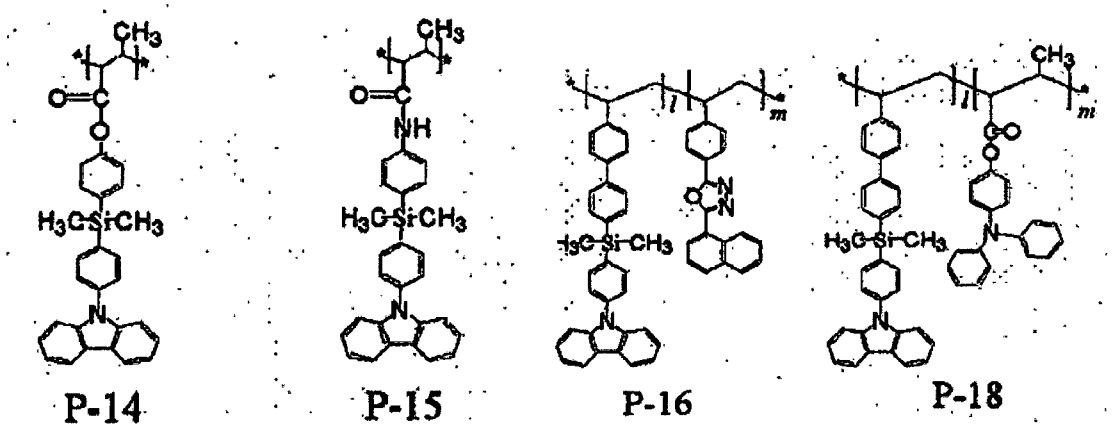




8. Polymère selon la revendication 1 ou 4, dans lequel le motif répétitif représenté par la Formule 8 est choisi dans le groupe de motifs répétitifs représenté par la Formule 7 ci-après.

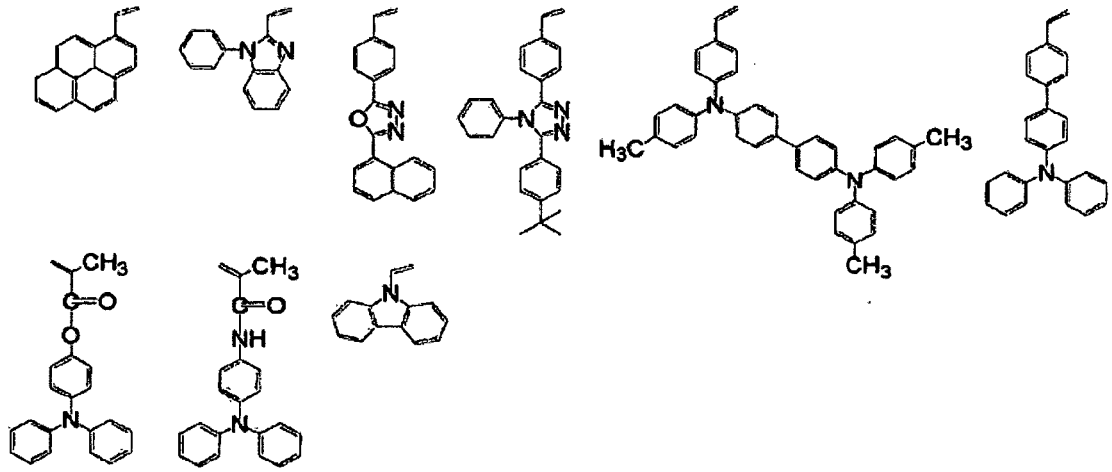
[Formule 7]





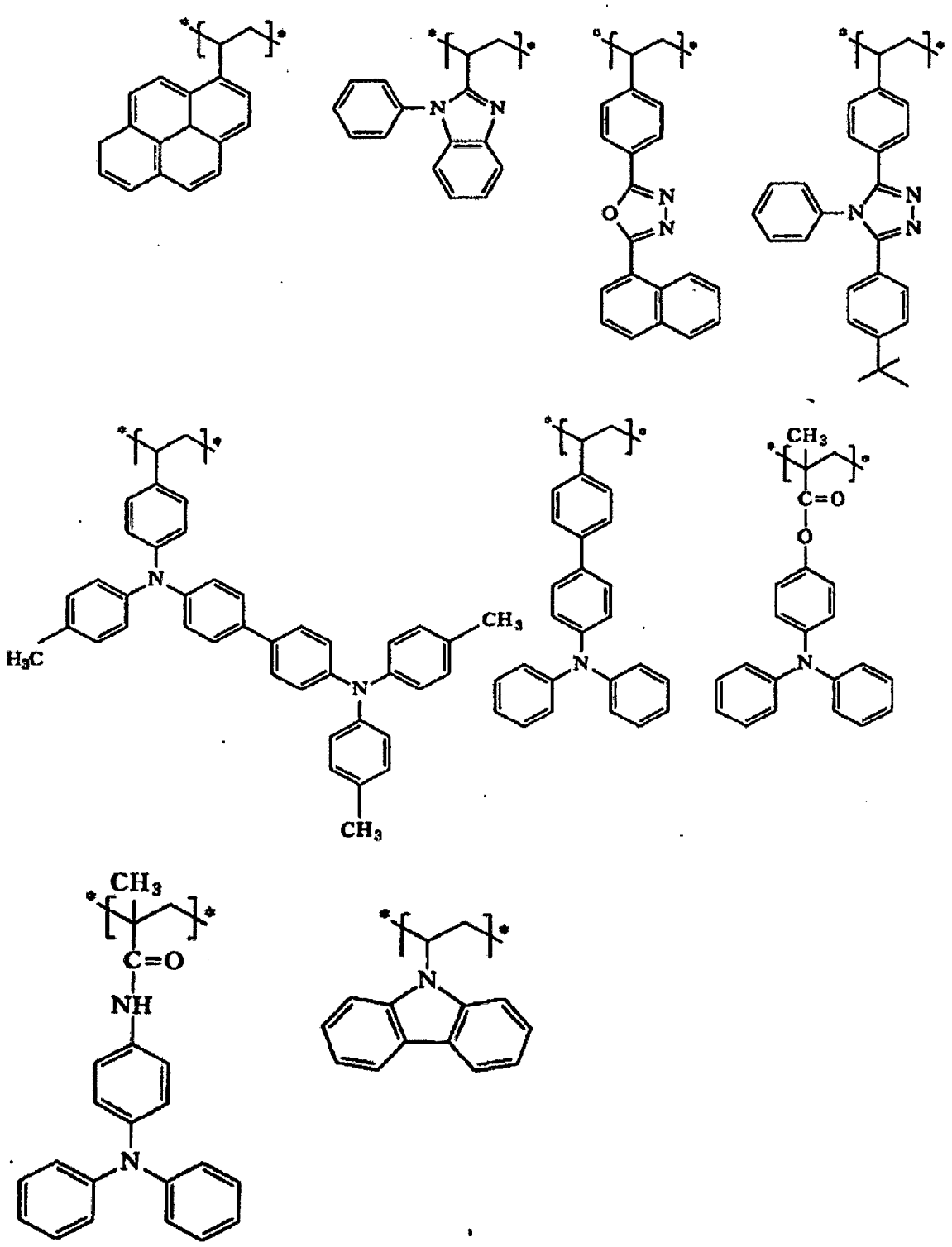
9. Polymère selon la revendication 4, dans lequel le monomère représenté par la Formule 3 est représenté par la Formule 9 ci-après.

[Formule 9]



10. Polymère selon la revendication 4, dans lequel le motif répétitif représenté par la Formule 4 est un motif répétitif représenté par la Formule 10 ci-après.

[Formule 10]

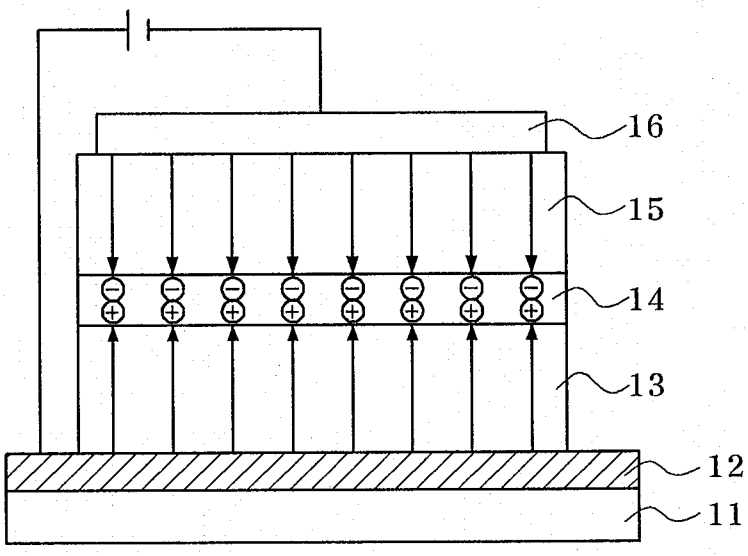


11. Polymère selon l'une quelconque des revendications 1, 2, 3 ou 4, le polymère ayant une masse moléculaire moyenne en masse de 1000 à 5 000 000.

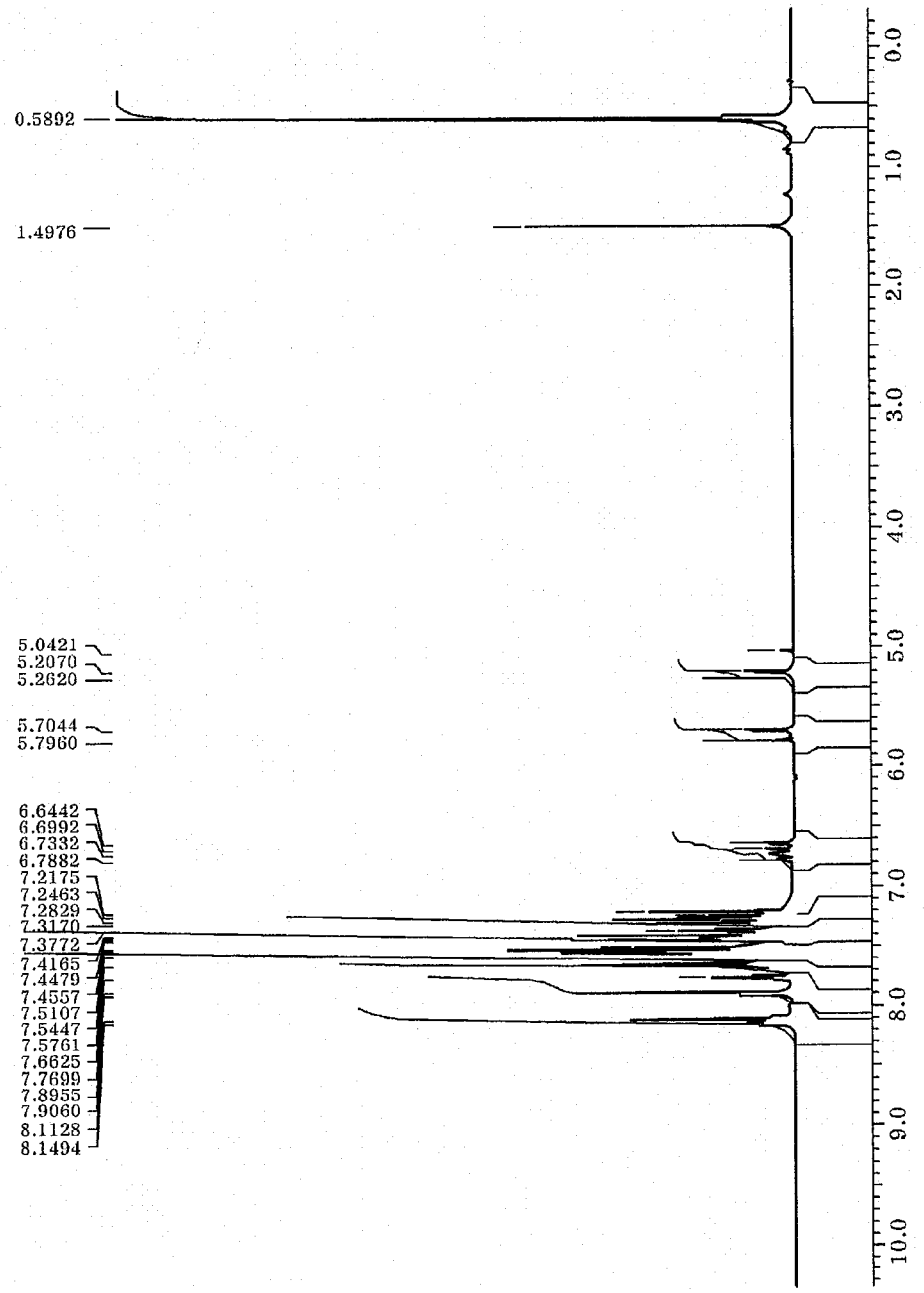
12. Polymère selon l'une des revendications 1, 2, 3 ou 4, le polymère ayant une masse moléculaire moyenne en nombre de 500 à 2 000 000.

13. Diode électroluminescente organique comprenant une paire d'électrodes, et une couche organique contenant, en tant qu'un composant, le polymère selon l'une quelconque des revendications 1 à 12.

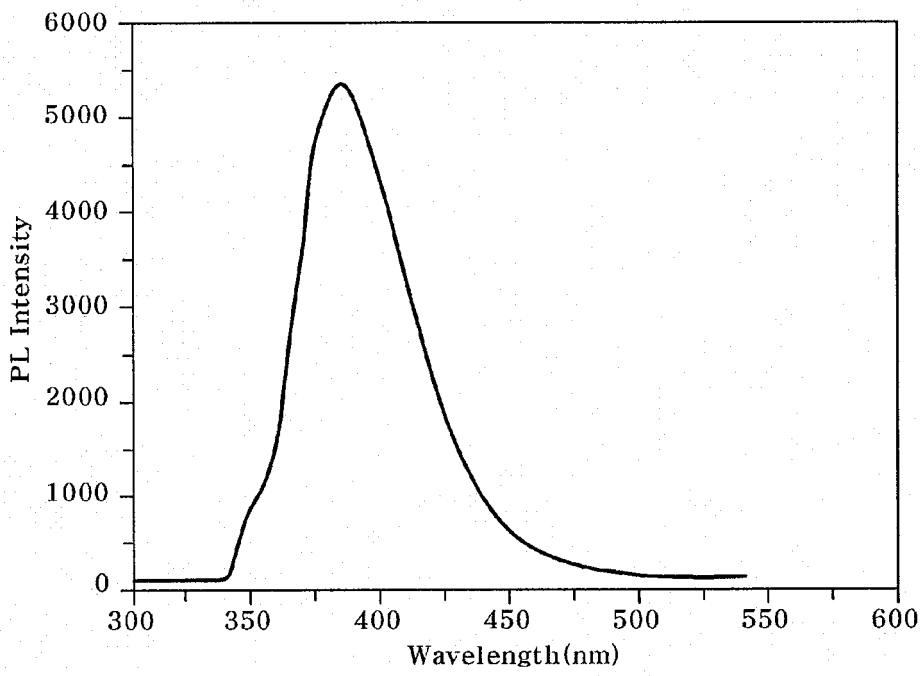
[FIG. 1]



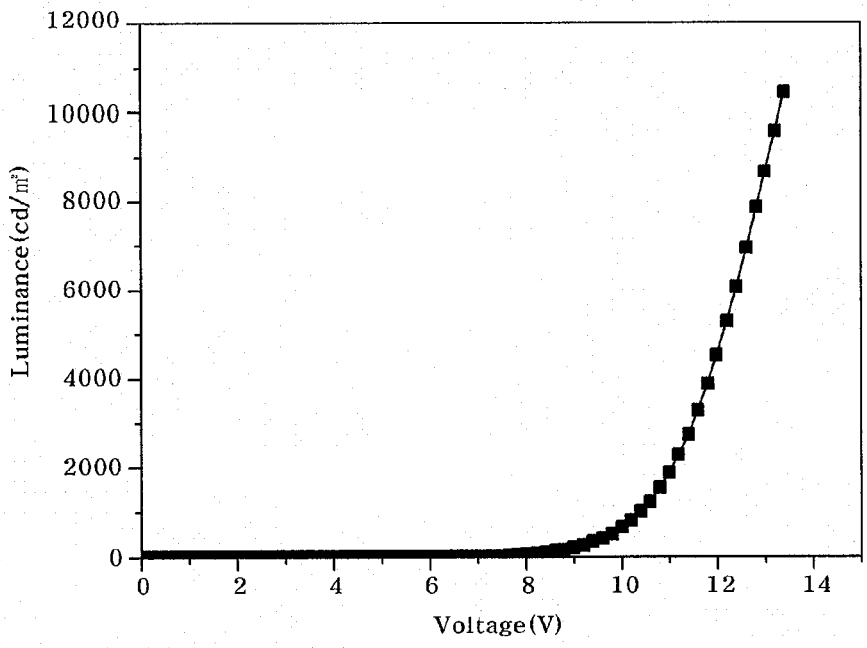
[FIG. 2]


0.5892
1.4976
5.0421
5.2070
5.2620
5.7044
5.7960
6.6442
6.6992
6.7332
6.7882
7.2175
7.2463
7.2829
7.3170
7.3772
7.4165
7.4479
7.4557
7.5107
7.5447
7.5761
7.6625
7.7699
7.8955
7.9060
8.1128
8.1494
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0

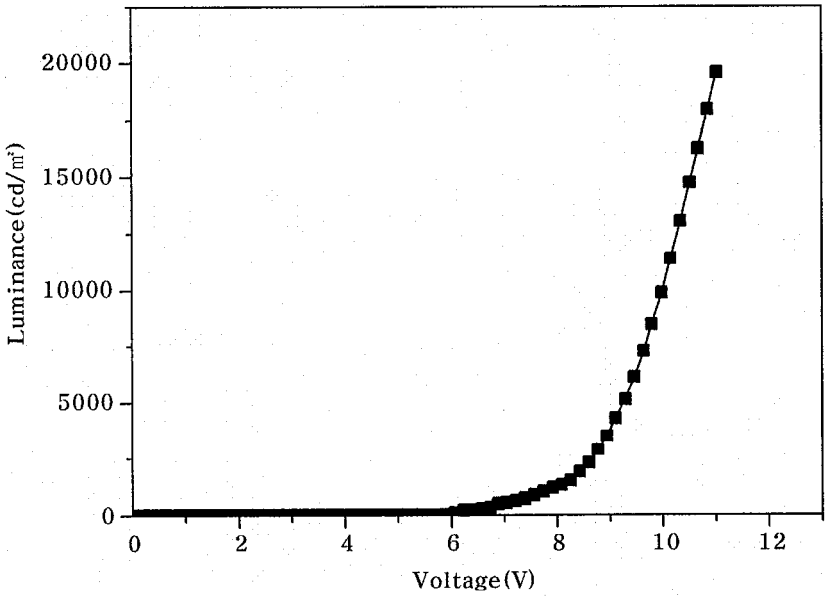
[FIG. 3]


6000
5000
4000
3000
2000
1000
0
PL Intensity
300
350
400
450
500
550
600
Wavelength(nm)

[FIG. 4]


12000
10000
8000
6000
4000
2000
0
Luminance(cd/㎡)
0
2
4
6
8
10
12
14
Voltage(V)

[FIG. 5]


20000
15000
10000
5000
0
Luminance(cd/㎡)
0
2
4
6
8
10
12
Voltage(V)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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Non-patent literature cited in the description

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专利名称(译)	具有硅或/和锡的乙烯基聚合物和使用其的有机发光二极管		
公开(公告)号	EP2144973A4	公开(公告)日	2011-06-29
申请号	EP2007851779	申请日	2007-12-26
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申请(专利权)人(译)	第一毛织INC.		
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IPC分类号	C09K11/06 C09B57/00 C09B69/10 H01L51/00 H01L51/50 H05B33/20		
CPC分类号	C09B57/00 C09B57/007 C09B69/109 C09K11/06 C09K2211/14 C09K2211/1416 C09K2211/1425 C09K2211/1433 C09K2211/1466 H01L51/0037 H01L51/004 H01L51/0042 H01L51/008 H01L51/0081 H01L51/0085 H01L51/0094 H01L51/5012 H01L51/5016 H01L51/5048 H05B33/20		
优先权	1020070048246 2007-05-17 KR		
其他公开文献	EP2144973A1 EP2144973B1		
外部链接	Espacenet		

摘要(译)

本文公开了一种基于乙烯基的聚合物，其具有用于OLED的有机层的硅和/或锡。该聚合物可溶于有机溶剂中，并且可以发射从红色到蓝色波长的荧光和磷光，从而用于OLED中的有机发光层的主体材料。