

METHOD FOR PREPARING OLEFIN-POLAR MONOMER COPOLYMER

Technical field

The invention belongs to the field of macromolecular polymer preparation, and specifically relates to a method for preparing an olefin-polar monomer copolymer.

Background Art

Polyolefin products are inexpensive and excellent in performance, and have a wide range of applications. Under the condition of retaining the original excellent physical and chemical properties of polyolefin, introducing a polar group into the polyolefin molecular chain through chemical synthesis can improve its chemical inertness, printability, wettability and compatibility with other materials, thereby imposing new characteristics that its raw materials do not possess on the polyolefin. At present, high-pressure free radical polymerization is mostly used in industry to promote the direct copolymerization of olefins and polar monomers, and ethylene-vinyl acetate copolymers, ethylene-methyl methacrylate copolymers, and ethylene-acrylic acid copolymers, for example, are produced by such processes. Although high-pressure free radical copolymerization can directly introduce copolymerizable polar monomers into the polyolefin chain, this method requires high temperature and high pressure conditions, high energy consumption, and expensive equipment.

Ethylene-vinyl alcohol (EVOH or EVAL) copolymer is a novel polymer material that integrates the processability of ethylene polymer and the gas barrier properties of vinyl alcohol polymer. It is currently one of the three major barrier resins industrially produced in the world, and it is widely used to package food, medical solutions and other products. Since vinyl alcohol cannot exist independently as a monomer, ethylene-vinyl alcohol copolymer is usually prepared by preparing an ethylene-vinyl acetate copolymer by free-radical polymerization and then alcoholizing the ethylene-vinyl acetate copolymer. However, a large amount of solvents are needed in the alcoholysis process, and the final saponification product contains a large amount of impurities such as acetic acid and alkali metal salts, which have to be washed off with a large amount of water.

Coordination catalytic copolymerization, as a polymer preparation technology at normal temperature and pressure, has received widespread attention because of its significant role in reducing energy consumption and improving reaction efficiency.

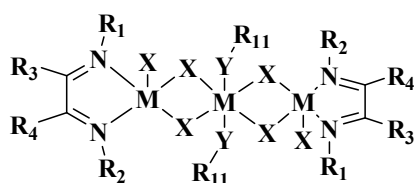
The catalyst's participation in the reaction process greatly reduces the activation energy of the copolymerization of olefin monomers and polar monomers, which is beneficial to obtain functional polymers with higher molecular weights at lower temperatures and pressures. At present, only a small amount of literature reports the use of transition metal complexes to catalyze the copolymerization of olefins with unsaturated alcohols or unsaturated carboxylic acids. However, in the prior art, no matter what method is used for polymerization, the polymer obtained is a viscous block solid, which is prone to fouling in the polymerization equipment, bringing difficulties to the transportation of the polymer, solvent removal, granulation, etc.

Disclosures of the invention

An object of the present invention is to overcome the shortcomings of the prior art and provide a method for preparing olefin-polar monomer copolymers. The method provided by the present invention does not require subsequent processing such as granulation, and can directly obtain spherical and/or spherical-like polymers with good morphology. Therefore, the method of the present invention has good industrial application prospects.

In a first aspect, the present invention provides a method for preparing an olefin-polar monomer copolymer, comprising copolymerizing an olefin and a polar monomer in the presence of a catalyst and optionally a chain transfer agent to produce the olefin-polar monomer copolymer,

wherein, the catalyst comprises a main catalyst and optionally a cocatalyst, the main catalyst comprises a diimine-metal complex represented by Formula I:

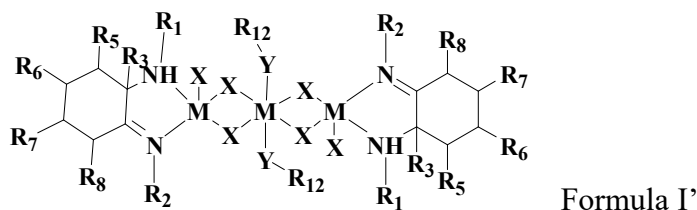


Formula I

wherein, R₁ and R₂ are each independently a C1-C30 hydrocarbyl with or without a substituent Q; R₃ and R₄ are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C20 hydrocarbyl with or without a substituent Q, and adjacent R₃ and R₄ groups are optionally joined to form a ring or ring system; each R₁₁ is independently a C1-C20 hydrocarbyl with or without a substituent Q; each Y is independently a Group VIA non-metal atom; each M is independently a Group VIII metal; each X is independently selected from the group consisting of halogen, C1-C10 hydrocarbyl with or without a substituent Q and C1-C10 hydrocarbyloxy with or

without a substituent Q, or

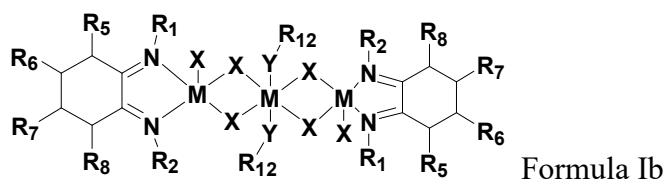
an amino-imine metal complex represented by Formula I':



wherein, R₁ and R₂ are each independently a C1-C30 hydrocarbyl with or without
 5 a substituent Q; each R₃ is independently selected from the group consisting of
 hydrogen and C1-C20 hydrocarbyl with or without a substituent Q; R₅ to R₈ are each
 independently selected from the group consisting of hydrogen, halogen, hydroxy, and
 C1-C20 hydrocarbyl with or without a substituent Q, and R₅ to R₈ groups are
 optionally joined to form a ring or ring system; each R₁₂ is independently a C1-C20
 10 hydrocarbyl with or without a substituent Q; each Y is independently a Group VIA
 non-metal atom; each M is independently a Group VIII metal; each X is independently
 selected from the group consisting of halogen, C1-C10 hydrocarbyl with or without a
 substituent Q and C1-C10 hydrocarbyloxy with or without a substituent Q.

As used herein, the term “polar monomer” refers to a monomer carrying at least
 15 one polar group such as hydroxyl group, carboxyl group, acid anhydride group, and at
 least one coordination polymerizable unsaturated bond. The polar monomer has 2-20
 carbon atoms, for example 2-16 carbon atoms, for example 2-12 carbon atoms, for
 example 2-10 carbon atoms. In some embodiments, the polar monomer is selected
 from the group consisting of olefin monomers carrying one or more hydroxy groups
 20 and/or one or more carboxy groups, preferably from the group consisting of α-olefinic
 monomers (also referred to as vinyl monomers) carrying one or more hydroxy groups
 and/or one or more carboxy groups.

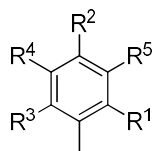
In a subaspect of the inventive method, the polar monomer is selected from the
 group consisting of olefinic monomers carrying one or more hydroxy groups, or the
 25 polar monomer is selected from the group consisting of olefinic monomers carrying
 one or more carboxyl groups, and the main catalyst comprises a diimine metal
 complex represented by Formula Ib:



wherein, R₁ and R₂ are each independently a C1-C30 hydrocarbyl with or without

a substituent Q; R₅-R₈ are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C20 hydrocarbyl with or without a substituent Q, and R₅-R₈ are optionally joined to form a ring or ring system; each R₁₂ is independently a C1-C20 hydrocarbyl with or without a substituent Q; each Y is independently a Group VIA nonmetal atom; each M is independently a Group VIII metal; each X is independently selected from the group consisting of halogen, C1-C10 hydrocarbyl with or without a substituent Q and C1-C10 hydrocarbyloxy with or without a substituent Q.

In some embodiments of this subaspect, in the diimine metal complex, R₁ and R₂ are independently selected from the group consisting of C1-C20 alkyl with or without a substituent Q and C6-C20 aryl with or without a substituent Q. Preferably, R₁ and/or R₂ are/is a group represented by Formula A:



Formula A

wherein R¹-R⁵ are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C20 alkyl with or without a substituent Q, C2-C20 alkenyl with or without a substituent Q, C2-C20 alkynyl with or without a substituent Q, C1-C20 alkoxy with or without a substituent Q, C2-C20 alkenoxy with or without a substituent Q, C2-C20 alkynoxy with or without a substituent Q, C6-C20 aryl with or without a substituent Q, C6-C20 aryloxy with or without a substituent Q, C7-C20 aralkyl with or without a substituent Q, C7-C20 aralkoxy with or without a substituent Q, C7-C20 alkaryl with or without a substituent Q and C7-C20 alkaryloxy with or without a substituent Q, and R¹-R⁵ are optionally joined to form a ring or ring system. Preferably, R¹-R⁵ are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C10 alkyl with or without a substituent Q, C2-C10 alkenyl with or without a substituent Q, C2-C10 alkynyl with or without a substituent Q, C1-C10 alkoxy with or without a substituent Q, C2-C10 alkenoxy with or without a substituent Q, C2-C10 alkynoxy with or without a substituent Q, C6-C15 aryl with or without a substituent Q, C6-C15 aryloxy with or without a substituent Q, C7-C15 aralkyl with or without a substituent Q, C7-C15 aralkoxy with or without a substituent Q, C7-C15 alkaryl with or without a substituent Q and C7-C15 alkaryloxy with or without a substituent Q.

In some embodiments of this subaspect, in the diimine metal complex, each M is

independently selected from the group consisting of nickel and palladium.

In some embodiments of this subaspect, in the diimine metal complex, each Y is independently selected from the group consisting of O and S.

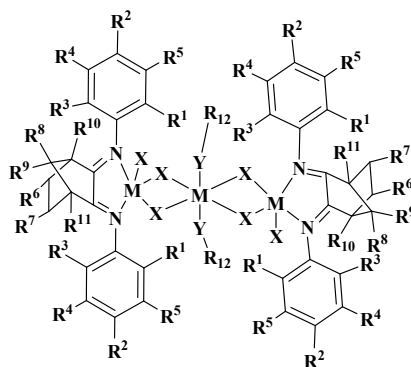
In some embodiments of this subaspect, in the diimine metal complex, each X is
5 independently selected from the group consisting of halogen, C1-C10 alkyl with or without a substituent Q and C1-C10 alkoxy with or without a substituent Q, preferably from the group consisting of halogen, C1-C6 alkyl with or without a substituent Q and C1-C6 alkoxy with or without a substituent Q.

In some embodiments of this subaspect, in the diimine metal complex, each R₁₂ is
10 independently a C1-C20 alkyl with or without a substituent Q, preferably a C1-C10 alkyl with or without a substituent Q, and more preferably a C1-C6 alkyl with or without a substituent Q.

In some embodiments of this subaspect, in the diimine metal complex, the substituent Q is selected from the group consisting of halogen, hydroxy, C1-C10 alkyl,
15 halogenated C1-C10 alkyl, C1-C10 alkoxy and halogenated C1-C10 alkoxy, preferably from the group consisting of halogen, hydroxy, C1-C6 alkyl, halogenated C1-C6 alkyl, C1-C6 alkoxy and halogenated C1-C6 alkoxy. Preferably, the C1-C6 alkyl is selected from the group consisting of methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, n-pentyl, isopentyl, n-hexyl, isohexyl and 3,3-dimethylbutyl. Preferably, the
20 C1-C6 alkoxy is selected from the group consisting of methoxy, ethoxy, n-propoxy, iso-propoxy, n-butoxy, iso-butoxy, n-pentoxy, iso-pentoxy, n-hexoxy, iso-hexoxy and 3,3-dimethylbutoxy.

As used herein, the term “halogen” refers to fluorine, chlorine, bromine or iodine.

In some embodiments of this subaspect, the diimine metal complex is represented
25 by Formula IIIb:



Formula IIIb

wherein, R¹-R¹¹ are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C20 alkyl with or without a substituent Q, C2-C20

alkenyl with or without a substituent Q, C2-C20 alkynyl with or without a substituent Q, C1-C20 alkoxy with or without a substituent Q, C2-C20 alkenoxy with or without a substituent Q, C2-C20 alkynoxy with or without a substituent Q, C6-C20 aryl with or without a substituent Q, C6-C20 aryloxy with or without a substituent Q, C7-C20 aralkyl with or without a substituent Q, C7-C20 aralkoxy with or without a substituent Q, C7-C20 alkaryl with or without a substituent Q and C7-C20 alkaryloxy with or without a substituent Q, and M, X, Y and R₁₂ are as defined above for Formula Ib.

In some preferred embodiments, in the diimine metal complex of Formula IIIb, R¹-R¹¹ are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C10 alkyl with or without a substituent Q, C2-C10 alkenyl with or without a substituent Q, C2-C10 alkynyl with or without a substituent Q, C1-C10 alkoxy with or without a substituent Q, C2-C10 alkenoxy with or without a substituent Q, C2-C10 alkynoxy with or without a substituent Q, C6-C15 aryl with or without a substituent Q, C6-C15 aryloxy with or without a substituent Q, C7-C15 aralkyl with or without a substituent Q, C7-C15 aralkoxy with or without a substituent Q, C7-C15 alkaryl with or without a substituent Q and C7-C15 alkaryloxy with or without a substituent Q. Preferably, R¹-R¹¹ are each independently selected from the group consisting of hydrogen, C1-C10 alkyl, halogenated C1-C10 alkyl, C1-C10 alkoxy, halogenated C1-C10 alkoxy and halogen, more preferably from the group consisting of hydrogen, C1-C6 alkyl, halogenated C1-C6 alkyl, C1-C6 alkoxy, halogenated C1-C6 alkoxy and halogen.

In some embodiments of this subaspect, the diimine metal complex is selected from the group consisting of:

1) the diimine metal complex represented by Formula IIIb, wherein R¹=R³=methyl, R²=R⁴-R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=methyl, R₁₂=ethyl, M=Ni, Y=O, X=Br;

2) the diimine metal complex represented by Formula IIIb, wherein R¹=R³=ethyl, R²=R⁴-R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=methyl, R₁₂=ethyl, M=Ni, Y=O, X=Br;

3) the diimine metal complex represented by Formula IIIb, wherein R¹=R³=isopropyl, R²=R⁴-R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=methyl, R₁₂=ethyl, M=Ni, Y=O, X=Br;

4) the diimine metal complex represented by Formula IIIb, wherein R¹-R³=methyl, R⁴-R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=methyl, R₁₂=ethyl, M=Ni, Y=O, X=Br;

5) the diimine metal complex represented by Formula IIIb, wherein R¹=R³=methyl, R²=Br, R⁴-R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=methyl, R₁₂=ethyl, M=Ni, Y=O, X=Br;

6) the diimine metal complex represented by Formula IIIb, wherein R¹=R³=F, R²=R⁴-R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=methyl, R₁₂=ethyl, M=Ni, Y=O, X=Br;

- 7) the diimine metal complex represented by Formula IIIb, wherein $R^1 = R^3 = \text{Cl}$, $R^2 = R^4 - R^7 = R^{10} = \text{H}$, $R^8 = R^9 = R^{11} = \text{methyl}$, $R_{12} = \text{ethyl}$, $M = \text{Ni}$, $Y = \text{O}$, $X = \text{Br}$;
- 8) the diimine metal complex represented by Formula IIIb, wherein $R^1 = R^3 = \text{Br}$, $R^2 = R^4 - R^7 = R^{10} = \text{H}$, $R^8 = R^9 = R^{11} = \text{methyl}$, $R_{12} = \text{ethyl}$, $M = \text{Ni}$, $Y = \text{O}$, $X = \text{Br}$;
- 5 9) the diimine metal complex represented by Formula IIIb, wherein $R^1 = R^3 = \text{methyl}$, $R^2 = R^4 - R^7 = R^{10} = \text{H}$, $R^8 = R^9 = R^{11} = \text{methyl}$, $R_{12} = \text{isobutyl}$, $M = \text{Ni}$, $Y = \text{O}$, $X = \text{Br}$;
- 10 10) the diimine metal complex represented by Formula IIIb, wherein $R^1 = R^3 = \text{ethyl}$, $R^2 = R^4 - R^7 = R^{10} = \text{H}$, $R^8 = R^9 = R^{11} = \text{methyl}$, $R_{12} = \text{isobutyl}$, $M = \text{Ni}$, $Y = \text{O}$, $X = \text{Br}$;
- 10 11) the diimine metal complex represented by Formula IIIb, wherein $R^1 = R^3 = \text{isopropyl}$, $R^2 = R^4 - R^7 = R^{10} = \text{H}$, $R^8 = R^9 = R^{11} = \text{methyl}$, $R_{12} = \text{isobutyl}$, $M = \text{Ni}$, $Y = \text{O}$, $X = \text{Br}$;
- 12) the diimine metal complex represented by Formula IIIb, wherein $R^1 - R^3 = \text{methyl}$, $R^4 - R^7 = R^{10} = \text{H}$, $R^8 = R^9 = R^{11} = \text{methyl}$, $R_{12} = \text{isobutyl}$, $M = \text{Ni}$, $Y = \text{O}$, $X = \text{Br}$;
- 15 13) the diimine metal complex represented by Formula IIIb, wherein $R^1 = R^3 = \text{methyl}$, $R^2 = \text{Br}$, $R^4 - R^7 = R^{10} = \text{H}$, $R^8 = R^9 = R^{11} = \text{methyl}$, $R_{12} = \text{isobutyl}$, $M = \text{Ni}$, $Y = \text{O}$, $X = \text{Br}$;
- 14) the diimine metal complex represented by Formula IIIb, wherein $R^1 = R^3 = \text{F}$, $R^2 = R^4 - R^7 = R^{10} = \text{H}$, $R^8 = R^9 = R^{11} = \text{methyl}$, $R_{12} = \text{isobutyl}$, $M = \text{Ni}$, $Y = \text{O}$, $X = \text{Br}$;
- 20 15) the diimine metal complex represented by Formula IIIb, wherein $R^1 = R^3 = \text{Cl}$, $R^2 = R^4 - R^7 = R^{10} = \text{H}$, $R^8 = R^9 = R^{11} = \text{methyl}$, $R_{12} = \text{isobutyl}$, $M = \text{Ni}$, $Y = \text{O}$, $X = \text{Br}$;
- 16) the diimine metal complex represented by Formula IIIb, wherein $R^1 = R^3 = \text{Br}$, $R^2 = R^4 - R^7 = R^{10} = \text{H}$, $R^8 = R^9 = R^{11} = \text{methyl}$, $R_{12} = \text{isobutyl}$, $M = \text{Ni}$, $Y = \text{O}$, $X = \text{Br}$;
- 25 17) the diimine metal complex represented by Formula IIIb, wherein $R^1 = R^3 = \text{methyl}$, $R^2 = R^4 - R^7 = R^{10} = \text{H}$, $R^8 = R^9 = \text{methyl}$, $R^{11} = \text{bromomethyl}$, $R_{12} = \text{ethyl}$, $M = \text{Ni}$, $Y = \text{O}$, $X = \text{Br}$;
- 18) the diimine metal complex represented by Formula IIIb, wherein $R^1 = R^3 = \text{ethyl}$, $R^2 = R^4 - R^7 = R^{10} = \text{H}$, $R^8 = R^9 = \text{methyl}$, $R^{11} = \text{bromomethyl}$, $R_{12} = \text{ethyl}$, $M = \text{Ni}$, $Y = \text{O}$, $X = \text{Br}$;
- 30 19) the diimine metal complex represented by Formula IIIb, wherein $R^1 = R^3 = \text{isopropyl}$, $R^2 = R^4 - R^7 = R^{10} = \text{H}$, $R^8 = R^9 = \text{methyl}$, $R^{11} = \text{bromomethyl}$, $R_{12} = \text{ethyl}$, $M = \text{Ni}$, $Y = \text{O}$, $X = \text{Br}$;
- 20) the diimine metal complex represented by Formula IIIb, wherein $R^1 - R^3 = \text{methyl}$, $R^4 - R^7 = R^{10} = \text{H}$, $R^8 = R^9 = \text{methyl}$, $R^{11} = \text{bromomethyl}$, $R_{12} = \text{ethyl}$, $M = \text{Ni}$, $Y = \text{O}$, $X = \text{Br}$;
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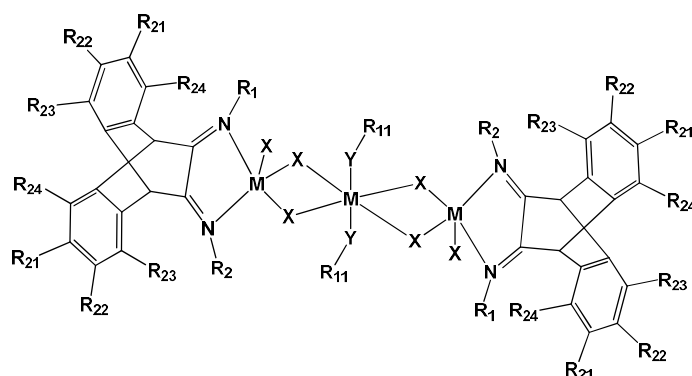
21) the diimine metal complex represented by Formula IIIb, wherein $R^1 = R^3 = \text{methyl}$, $R^2 = \text{Br}$, $R^4 - R^7 = R^{10} = \text{H}$, $R^8 = R^9 = \text{methyl}$, $R^{11} = \text{bromomethyl}$, $R_{12} = \text{ethyl}$, $M = \text{Ni}$, $Y = \text{O}$, $X = \text{Br}$;

22) the diimine metal complex represented by Formula IIIb, wherein $R^1 = R^3 = \text{F}$,
 5 $R^2 = R^4 - R^7 = R^{10} = \text{H}$, $R^8 = R^9 = \text{methyl}$, $R^{11} = \text{bromomethyl}$, $R_{12} = \text{ethyl}$, $M = \text{Ni}$, $Y = \text{O}$, $X = \text{Br}$;

23) the diimine metal complex represented by Formula IIIb, wherein $R^1 = R^3 = \text{Cl}$,
 $R^2 = R^4 - R^7 = R^{10} = \text{H}$, $R^8 = R^9 = \text{methyl}$, $R^{11} = \text{bromomethyl}$, $R_{12} = \text{ethyl}$, $M = \text{Ni}$, $Y = \text{O}$, $X = \text{Br}$;

24) the diimine metal complex represented by Formula IIIb, wherein $R^1 = R^3 = \text{Br}$,
 10 $R^2 = R^4 - R^7 = R^{10} = \text{H}$, $R^8 = R^9 = \text{methyl}$, $R^{11} = \text{bromomethyl}$, $R_{12} = \text{ethyl}$, $M = \text{Ni}$, $Y = \text{O}$,
 $X = \text{Br}$.

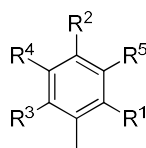
In another subaspect of the inventive method, the polar monomer is selected from the group consisting of olefinic monomers carrying one or more hydroxy groups, or the polar monomer is selected from the group consisting of olefinic monomers carrying one or more carboxyl groups, and the main catalyst comprises a diimine metal
 15 complex represented by Formula Ic:



Formula Ic

wherein, $R_{21} - R_{24}$ are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C20 hydrocarbonyl with or without a substituent Q and C1-C20 hydrocarbyloxy with or without a substituent Q, and $R_{21} - R_{24}$ are optionally
 20 joined to form a ring or ring system; R_1 , R_2 , R_{11} , Y , M and X are as defined above for Formula I.

In some embodiments of this subaspect, in the diimine metal complex represented by Formula Ic, R_1 and R_2 are independently selected from the group consisting of C1-C20 alkyl with or without a substituent Q and C6-C20 aryl with or without a
 25 substituent Q. Preferably, R_1 and/or R_2 are/is a group represented by Formula A:



Formula A

wherein, R^1 - R^5 are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C20 alkyl with or without a substituent Q, C2-C20 alkenyl with or without a substituent Q, C2-C20 alkynyl with or without a substituent Q, C1-C20 alkoxy with or without a substituent Q, C2-C20 alkenoxy with or without a substituent Q, C2-C20 alkynoxy with or without a substituent Q, C6-C20 aryl with or without a substituent Q, C6-C20 aryloxy with or without a substituent Q, C7-C20 aralkyl with or without a substituent Q, C7-C20 aralkoxy with or without a substituent Q, C7-C20 alkaryl with or without a substituent Q and C7-C20 alkaryloxy with or without a substituent Q, and R^1 - R^5 are optionally joined to form a ring or ring system.

Preferably, R^1 - R^5 are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C10 alkyl with or without a substituent Q, C2-C10 alkenyl with or without a substituent Q, C2-C10 alkynyl with or without a substituent Q, C1-C10 alkoxy with or without a substituent Q, C2-C10 alkenoxy with or without a substituent Q, C2-C10 alkynoxy with or without a substituent Q, C6-C15 aryl with or without a substituent Q, C6-C15 aryloxy with or without a substituent Q, C7-C15 aralkyl with or without a substituent Q, C7-C15 aralkoxy with or without a substituent Q, C7-C15 alkaryl with or without a substituent Q and C7-C15 alkaryloxy with or without a substituent Q.

In some embodiments of this subaspect, in the diimine metal complex represented by Formula Ic, each M is independently selected from the group consisting of nickel and palladium.

In some embodiments of this subaspect, in the diimine metal complex represented by Formula Ic, each Y is independently selected from the group consisting of O and S.

In some embodiments of this subaspect, in the diimine metal complex represented by Formula Ic, each X is independently selected from the group consisting of halogen, C1-C10 alkyl with or without a substituent Q and C1-C10 alkoxy with or without a substituent Q, preferably from the group consisting of halogen, C1-C6 alkyl with or without a substituent Q and C1-C6 alkoxy with or without a substituent Q.

In some embodiments of this subaspect, in the diimine metal complex represented by Formula Ic, each R_{11} is independently a C1-C20 alkyl with or without a substituent Q, preferably a C1-C10 alkyl with or without a substituent Q, and more preferably a C1-C6 alkyl with or without a substituent Q.

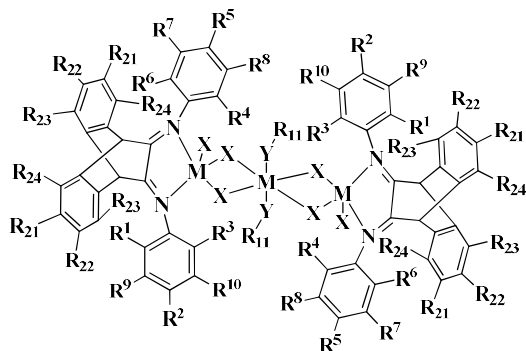
In some embodiments of this subaspect, in the diimine metal complex represented by Formula Ic, the substituent Q is selected from the group consisting of halogen, hydroxy, C1-C10 alkyl, halogenated C1-C10 alkyl, C1-C10 alkoxy and halogenated

C1-C10 alkoxy, preferably from the group consisting of halogen, hydroxy, C1-C6 alkyl, halogenated C1-C6 alkyl, C1-C6 alkoxy and halogenated C1-C6 alkoxy.

Preferably, the C1-C6 alkyl is selected from the group consisting of methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, n-pentyl, isopentyl, n-hexyl, isohexyl and

- 5 3,3-dimethylbutyl. Preferably, the C1-C6 alkoxy is selected from the group consisting of methoxy, ethoxy, n-propoxy, iso-propoxy, n-butoxy, iso-butoxy, n-pentoxy, iso-pentoxy, n-hexoxy, iso-hexoxy and 3,3-dimethylbutoxy.

In some embodiments of this subaspect, the diimine metal complex has a structure represented by Formula IIIc:



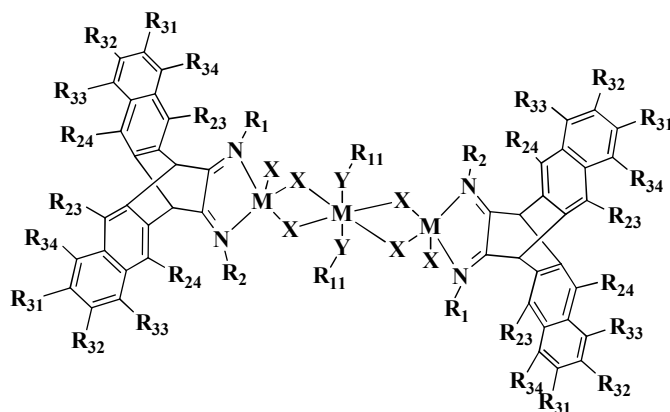
Formula IIIc

10 wherein, R^1 - R^{10} , R_{21} - R_{24} are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C20 alkyl with or without a substituent Q, C2-C20 alkenyl with or without a substituent Q, C2-C20 alkynyl with or without a substituent Q, C1-C20 alkoxy with or without a substituent Q, C2-C20 alkenoxy with
 15 or without a substituent Q, C2-C20 alkynoxy with or without a substituent Q, C6-C20 aryl with or without a substituent Q, C6-C20 aryloxy with or without a substituent Q, C7-C20 aralkyl with or without a substituent Q, C7-C20 aralkoxy with or without a substituent Q, C7-C20 alkaryl with or without a substituent Q and C7-C20 alkaryloxy with or without a substituent Q, and R^1 - R^{10} are optionally joined to form a ring or ring
 20 system, R_{21} - R_{24} are optionally joined to form a ring or ring system; R_{11} , Y, M and X are as defined above for Formula Ic.

In some embodiments of this subaspect, in the diimine metal complex represented by Formula IIIc, R^1 - R^{10} , R_{21} - R_{24} are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C10 alkyl with or without a substituent
 25 Q, C2-C10 alkenyl with or without a substituent Q, C2-C10 alkynyl with or without a substituent Q, C1-C10 alkoxy with or without a substituent Q, C2-C10 alkenoxy with or without a substituent Q, C2-C10 alkynoxy with or without a substituent Q, C6-C15 aryl with or without a substituent Q, C6-C15 aryloxy with or without a substituent Q,

C7-C15 aralkyl with or without a substituent Q, C7-C15 aralkoxy with or without a substituent Q, C7-C15 alkaryl with or without a substituent Q and C7-C15 alkaryloxy with or without a substituent Q. Preferably, R^1 - R^{10} , R_{21} - R_{24} are each independently selected from the group consisting of hydrogen, C1-C10 alkyl, halogenated C1-C10 alkyl, C1-C10 alkoxy, halogenated C1-C10 alkoxy and halogen, more preferably from the group consisting of hydrogen, C1-C6 alkyl, halogenated C1-C6 alkyl, C1-C6 alkoxy, halogenated C1-C6 alkoxy and halogen.

In some embodiments of this subaspect, the diimine metal complex has a structure represented by Formula IIc:



Formula IIc

wherein, R_{31} - R_{34} have the same meanings as R_{21} - R_{24} in Formula Ic, preferably R_{33} and R_{34} are hydrogen; and R_{11} , Y, M and X are as defined above for Formula Ic.

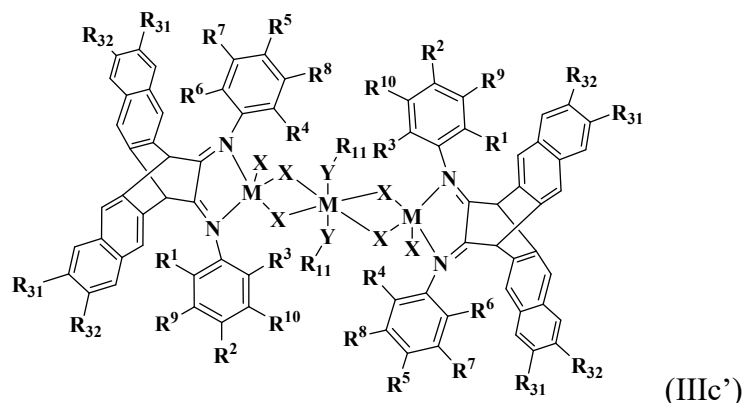
In some embodiments, R_{31} - R_{34} are each independently selected from the group consisting of hydrogen, hydroxy, C1-C20 alkyl with or without a substituent Q, C2-C20 alkenyl with or without a substituent Q, C2-C20 alkynyl with or without a substituent Q, C1-C20 alkoxy with or without a substituent Q, C2-C20 alkenoxy with or without a substituent Q, C2-C20 alkynoxy with or without a substituent Q, C6-C20 aryl with or without a substituent Q, C6-C20 aryloxy with or without a substituent Q, C7-C20 aralkyl with or without a substituent Q, C7-C20 aralkoxy with or without a substituent Q, C7-C20 alkaryl with or without a substituent Q, C7-C20 alkaryloxy with or without a substituent Q and halogen. Preferably, R_{31} - R_{34} are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C10 alkyl with or without a substituent Q, C2-C10 alkenyl with or without a substituent Q, C2-C10 alkynyl with or without a substituent Q, C1-C10 alkoxy with or without a substituent Q, C2-C10 alkenoxy with or without a substituent Q, C2-C10 alkynoxy with or without a substituent Q, C6-C15 aryl with or without a substituent Q, C6-C15 aryloxy with or without a substituent Q, C7-C15 aralkyl with or without a substituent Q,

C7-C15 aralkoxy with or without a substituent Q, C7-C15 alkaryl with or without a substituent Q and C7-C15 alkaryloxy with or without a substituent Q. More preferably, R₃₁-R₃₄ are each independently selected from the group consisting of hydrogen, C1-C10 alkyl, halogenated C1-C10 alkyl, C1-C10 alkoxy, halogenated C1-C10 alkoxy and halogen, more preferably from the group consisting of hydrogen, C1-C6 alkyl, halogenated C1-C6 alkyl, C1-C6 alkoxy, halogenated C1-C6 alkoxy and halogen.

In some embodiments of this subaspect, the diimine metal complex is selected from the group consisting of:

- 1) the complex represented by Formula IIIc, wherein R¹=R³=R⁴=R⁶=isopropyl, R²=R⁵=R⁷-R¹⁰=R₂₁=R₂₂=R₂₃=R₂₄=H, R₁₁=ethyl, M=Ni, Y=O, X=Br;
- 2) the complex represented by Formula IIIc, wherein R¹=R³=R⁴=R⁶=ethyl, R²=R⁵=R⁷-R¹⁰=R₂₁=R₂₂=R₂₃=R₂₄=H, R₁₁=ethyl, M=Ni, Y=O, X=Br;
- 3) the complex represented by Formula IIIc, wherein R¹=R³=R⁴=R⁶=methyl, R²=R⁵=R⁷-R¹⁰=R₂₁=R₂₂=R₂₃=R₂₄=H, R₁₁=ethyl, M=Ni, Y=O, X=Br;
- 4) the complex represented by Formula IIIc, wherein R¹-R⁶=methyl, R⁷-R¹⁰=R₂₁=R₂₂=R₂₃=R₂₄=H, R₁₁=ethyl, M=Ni, Y=O, X=Br;
- 5) the complex represented by Formula IIIc, wherein R¹=R³=R⁴=R⁶=Br, R²=R⁵=R⁷-R¹⁰=R₂₁=R₂₂=R₂₃=R₂₄=H, R₁₁=ethyl, M=Ni, Y=O, X=Br;
- 6) the complex represented by Formula IIIc, wherein R¹=R³=R⁴=R⁶=Cl, R²=R⁵=R⁷-R¹⁰=R₂₁=R₂₂=R₂₃=R₂₄=H, R₁₁=ethyl, M=Ni, Y=O, X=Br;
- 7) the complex represented by Formula IIIc, wherein R¹=R³=R⁴=R⁶=F, R²=R⁵=R⁷-R¹⁰=R₂₁=R₂₂=R₂₃=R₂₄=H, R₁₁=ethyl, M=Ni, Y=O, X=Br;
- 8) the complex represented by Formula IIIc, wherein R¹=R³=R⁴=R⁶=isopropyl, R²=R⁵=R⁷-R¹⁰=R₂₁=R₂₂=R₂₃=R₂₄=H, R₁₁=isobutyl, M=Ni, Y=O, X=Br;
- 9) the complex represented by Formula IIIc, wherein R¹=R³=R⁴=R⁶=ethyl, R²=R⁵=R⁷-R¹⁰=R₂₁=R₂₂=R₂₃=R₂₄=H, R₁₁=isobutyl, M=Ni, Y=O, X=Br;
- 10) the complex represented by Formula IIIc, wherein R¹=R³=R⁴=R⁶=methyl, R²=R⁵=R⁷-R¹⁰=R₂₁=R₂₂=R₂₃=R₂₄=H, R₁₁=isobutyl, M=Ni, Y=O, X=Br;
- 11) the complex represented by Formula IIIc, wherein R¹-R⁶=methyl, R⁷-R¹⁰=R₂₁=R₂₂=R₂₃=R₂₄=H, R₁₁=isobutyl, M=Ni, Y=O, X=Br;
- 12) the complex represented by Formula IIIc, wherein R¹=R³=R⁴=R⁶=Br, R²=R⁵=R⁷-R¹⁰=R₂₁=R₂₂=R₂₃=R₂₄=H, R₁₁=isobutyl, M=Ni, Y=O, X=Br;
- 13) the complex represented by Formula IIIc, wherein R¹=R³=R⁴=R⁶=Cl, R²=R⁵=R⁷-R¹⁰=R₂₁=R₂₂=R₂₃=R₂₄=H, R₁₁=isobutyl, M=Ni, Y=O, X=Br;

- 14) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6=F$,
 $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=R_{23}=R_{24}=H$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 15) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6=isopropyl$,
 $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_{23}=R_{24}=H$, $R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 5 16) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6=ethyl$,
 $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_{23}=R_{24}=H$, $R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 17) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6=methyl$,
 $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_{23}=R_{24}=H$, $R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 18) the complex represented by Formula IIIc, wherein $R^1-R^6=methyl$,
 $R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_{23}=R_{24}=H$, $R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 10 19) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6=Br$,
 $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_{23}=R_{24}=H$, $R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 20) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6=Cl$,
 $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_{23}=R_{24}=H$, $R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 15 21) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6=F$,
 $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_{23}=R_{24}=H$, $R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 22) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6=isopropyl$,
 $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_{23}=R_{24}=H$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 23) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6=ethyl$,
 $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_{23}=R_{24}=H$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 20 24) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6=methyl$,
 $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_{23}=R_{24}=H$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 25) the complex represented by Formula IIIc, wherein $R^1-R^6=methyl$,
 $R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_{23}=R_{24}=H$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 25 26) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6=Br$,
 $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_{23}=R_{24}=H$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 27) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6=Cl$,
 $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_{23}=R_{24}=H$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 28) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6=F$,
 $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_{23}=R_{24}=H$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 30



29) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6$ =isopropyl, $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, R_{11} =ethyl, $M=Ni$, $Y=O$, $X=Br$;

30) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6$ =ethyl,
 5 $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, R_{11} =ethyl, $M=Ni$, $Y=O$, $X=Br$;

31) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6$ =methyl, $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, R_{11} =ethyl, $M=Ni$, $Y=O$, $X=Br$;

32) the complex represented by Formula (IIIc'), wherein R^1-R^6 =methyl, $R^7-R^{10}=R_{31}=R_{32}=H$, R_{11} =ethyl, $M=Ni$, $Y=O$, $X=Br$;

10 33) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6=Br$, $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, R_{11} =ethyl, $M=Ni$, $Y=O$, $X=Br$;

34) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6=Cl$, $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, R_{11} =ethyl, $M=Ni$, $Y=O$, $X=Br$;

15 35) The complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6=F$, $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, R_{11} =ethyl, $M=Ni$, $Y=O$, $X=Br$;

36) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6$ =isopropyl, $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, R_{11} =isobutyl, $M=Ni$, $Y=O$, $X=Br$;

37) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6$ =ethyl, $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, R_{11} =isobutyl, $M=Ni$, $Y=O$, $X=Br$;

20 38) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6$ =methyl, $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, R_{11} =isobutyl, $M=Ni$, $Y=O$, $X=Br$;

39) the complex represented by Formula (IIIc'), wherein R^1-R^6 =methyl, $R^7-R^{10}=R_{31}=R_{32}=H$, R_{11} =isobutyl, $M=Ni$, $Y=O$, $X=Br$;

40) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6=Br$,
 25 $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, R_{11} =isobutyl, $M=Ni$, $Y=O$, $X=Br$;

41) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6=Cl$, $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, R_{11} =isobutyl, $M=Ni$, $Y=O$, $X=Br$;

42) The complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6=F$,

$R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, R_{11} =isobutyl, $M=Ni$, $Y=O$, $X=Br$;

43) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6$ =isopropyl, $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=R_{11}$ =ethyl, $M=Ni$, $Y=O$, $X=Br$;

44) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6$ =ethyl,
5 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=R_{11}$ =ethyl, $M=Ni$, $Y=O$, $X=Br$;

45) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6$ =methyl, $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=R_{11}$ =ethyl, $M=Ni$, $Y=O$, $X=Br$;

46) the complex represented by Formula (IIIc'), wherein R^1-R^6 =methyl, $R^7-R^{10}=H$, $R_{31}=R_{32}=R_{11}$ =ethyl, $M=Ni$, $Y=O$, $X=Br$;

10 47) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6=Br$, $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=R_{11}$ =ethyl, $M=Ni$, $Y=O$, $X=Br$;

48) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6=Cl$, $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=R_{11}$ =ethyl, $M=Ni$, $Y=O$, $X=Br$;

49) The complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6=F$,
15 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=R_{11}$ =ethyl, $M=Ni$, $Y=O$, $X=Br$;

50) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6$ =isopropyl, $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=R_{11}$ =ethyl, $M=Ni$, $Y=O$, $X=Br$;

51) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6$ =ethyl, $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}$ =ethyl, R_{11} =isobutyl, $M=Ni$, $Y=O$, $X=Br$;

20 52) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6$ =methyl, $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}$ =ethyl, R_{11} =isobutyl, $M=Ni$, $Y=O$, $X=Br$;

53) the complex represented by Formula (IIIc'), wherein R^1-R^6 =methyl, $R^7-R^{10}=H$, $R_{31}=R_{32}$ =ethyl, R_{11} =isobutyl, $M=Ni$, $Y=O$, $X=Br$;

54) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6=Br$,
25 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}$ =ethyl, R_{11} =isobutyl, $M=Ni$, $Y=O$, $X=Br$;

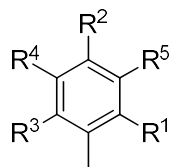
55) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6=Cl$, $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}$ =ethyl, R_{11} =isobutyl, $M=Ni$, $Y=O$, $X=Br$;

56) The complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6=F$,
 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}$ =ethyl, R_{11} =isobutyl, $M=Ni$, $Y=O$, $X=Br$.

30 In another subaspect of the inventive method, the polar monomer is selected from the group consisting of olefinic monomers carrying one or more hydroxy groups, or the polar monomer is selected from the group consisting of olefinic monomers carrying one or more carboxy groups, and the main catalyst comprises the amino-imine metal complex represented by Formula I'.

35 In some embodiments of this subaspect, in the amino-imine metal complex, R_1

and R₂ are independently selected from the group consisting of C1-C20 alkyl with or without a substituent Q and C6-C20 aryl with or without a substituent Q. Preferably, R₁ and/or R₂ are/is a group represented by Formula A:



Formula A

5 wherein, R¹-R⁵ are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C20 alkyl with or without a substituent Q, C2-C20 alkenyl with or without a substituent Q, C2-C20 alkynyl with or without a substituent Q, C1-C20 alkoxy with or without a substituent Q, C2-C20 alkenoxy with or without a substituent Q, C2-C20 alkynoxy with or without a substituent Q, C6-C20 aryl with or without a substituent Q, C6-C20 aryloxy with or without a substituent Q, C7-C20 aralkyl with or without a substituent Q, C7-C20 aralkyloxy with or without a substituent Q, C7-C20 alkaryl with or without a substituent Q and C7-C20 alkaryloxy with or without a substituent Q, and R¹-R⁵ are optionally joined to form a ring or ring system. Preferably, R¹-R⁵ are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C10 alkyl with or without a substituent Q, C2-C10 alkenyl with or without a substituent Q, C2-C10 alkynyl with or without a substituent Q, C1-C10 alkoxy with or without a substituent Q, C2-C10 alkenoxy with or without a substituent Q, C2-C10 alkynoxy with or without a substituent Q, C6-C15 aryl with or without a substituent Q, C6-C15 aryloxy with or without a substituent Q, C7-C15 aralkyl with or without a substituent Q, C7-C15 aralkoxy with or without a substituent Q, C7-C15 alkaryl with or without a substituent Q and C7-C15 alkaryloxy with or without a substituent Q.

In some embodiments of this subaspect, in the amino-imine metal complex, each M is independently selected from the group consisting of nickel and palladium.

25 In some embodiments of this subaspect, in the amino-imine metal complex, each Y is independently selected from the group consisting of O and S.

In some embodiments of this subaspect, in the amino-imine metal complex, each X is independently selected from the group consisting of halogen, C1-C10 alkyl with or without a substituent Q and C1-C10 alkoxy with or without a substituent Q, preferably from the group consisting of halogen, C1-C6 alkyl with or without a substituent Q and C1-C6 alkoxy with or without a substituent Q.

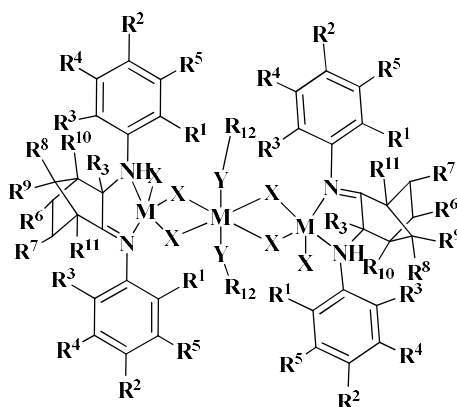
In some embodiments of this subaspect, in the amino-imine metal complex, each

R₁₂ is independently a C1-C20 alkyl with or without a substituent Q, preferably a C1-C10 alkyl with or without a substituent Q, and more preferably a C1-C6 alkyl with or without a substituent Q.

In some embodiments of this subaspect, in the amino-imine metal complex, each
 5 R₃ is independently selected from the group consisting of C1-C20 alkyl with or without a substituent Q, C6-C20 aryl with or without a substituent Q, C7-C20 aralkyl with or without a substituent Q and C7-C20 alkaryl with or without a substituent Q. Preferably, each R₃ is independently selected from the group consisting of C1-C10 alkyl with or without a substituent Q, C6-C10 aryl with or without a substituent Q,
 10 C7-C15 aralkyl with or without a substituent Q and C7-C15 alkaryl with or without a substituent Q. More preferably, each R₃ is independently a C1-C6 alkyl with or without a substituent Q.

In some embodiments of this subaspect, in the amino-imine metal complex, the substituent Q is selected from halogen, hydroxy, C1-C10 alkyl, halogenated C1-C10
 15 alkyl, C1-C10 alkoxy and halogenated C1-C10 alkoxy, preferably from halogen, hydroxy, C1-C6 alkyl, halogenated C1-C6 alkyl, C1-C6 alkoxy and halogenated C1-C6 alkoxy. Preferably, the C1-C6 alkyl is selected from methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, n-pentyl, isopentyl, n-hexyl, isohexyl and 3,3-dimethylbutyl. Preferably, the C1-C6 alkoxy is selected from methoxy, ethoxy,
 20 n-propoxy, isopropoxy, n-butoxy, isobutoxy, n-pentoxy, isopentoxy, n-hexyloxy, isohexyloxy and 3,3-dimethylbutoxy.

In some embodiments of this subaspect, the amino-imine metal complex is represented by Formula III' :



Formula III'

25 wherein, R¹-R¹¹ are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C20 alkyl with or without a substituent Q, C2-C20 alkenyl with or without a substituent Q, C2-C20 alkynyl with or without a substituent

Q, C1-C20 alkoxy with or without a substituent Q, C2-C20 alkenoxy with or without a substituent Q, C2-C20 alkynoxy with or without a substituent Q, C6-C20 aryl with or without a substituent Q, C6-C20 aryloxy with or without a substituent Q, C7-C20 aralkyl with or without a substituent Q, C7-C20 aralkyloxy with or without a substituent Q, C7-C20 alkaryl with or without a substituent Q and C7-C20 alkaryloxy with or without a substituent Q; R₃, R₁₂, Y, M and X are as defined above for Formula I'.

In some embodiments of this subaspect, in the amino-imine metal complex of Formula III', R¹-R¹¹ are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C10 alkyl with or without a substituent Q, C2-C10 alkenyl with or without a substituent Q, C2-C10 alkynyl with or without a substituent Q, C1-C10 alkoxy with or without a substituent Q, C2-C10 alkenoxy with or without a substituent Q, C2-C10 alkynoxy with or without a substituent Q, C6-C15 aryl with or without a substituent Q, C6-C15 aryloxy with or without a substituent Q, C7-C15 aralkyl with or without a substituent Q, C7-C15 aralkoxy with or without a substituent Q, C7-C15 alkaryl with or without a substituent Q and C7-C15 alkaryloxy with or without a substituent Q. Preferably, R¹-R¹¹ are each independently selected from the group consisting of hydrogen, C1-C10 alkyl, halogenated C1-C10 alkyl, C1-C10 alkoxy, halogenated C1-C10 alkoxy and halogen, more preferably from the group consisting of hydrogen, C1-C6 alkyl, halogenated C1-C6 alkyl, C1-C6 alkoxy, halogenated C1-C6 alkoxy and halogen.

In some embodiments of this subaspect, the amino-imine metal complex is selected from the group consisting of:

the complex represented by Formula III', wherein R¹=R³=isopropyl, R²=R⁴=R⁵=R⁶=R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=CH₃, R₃=CH₃, R₁₂=methyl, M=Ni, Y=O, X=Br;

the complex represented by Formula III', wherein R¹=R³=isopropyl, R²=R⁴=R⁵=R⁶=R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=CH₃, R₃=ethyl, R₁₂=methyl, M=Ni, Y=O, X=Br;

the complex represented by Formula III', wherein R¹=R³=ethyl, R²=R⁴=R⁵=R⁶=R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=CH₃, R₃=CH₃, R₁₂=methyl, M=Ni, Y=O, X=Br;

the complex represented by Formula III', wherein R¹=R³=ethyl, R²=R⁴=R⁵=R⁶=R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=CH₃, R₃=ethyl, R₁₂=methyl, M=Ni, Y=O, X=Br;

the complex represented by Formula III', wherein $R^1=R^3$ =methyl, $R^2=R^4=R^5=R^6=R^7=R^{10}$ =H, $R^8=R^9=R^{11}$ =CH₃, R_3 =CH₃, R_{12} =methyl, M=Ni, Y=O, X=Br;

5 the complex represented by Formula III', wherein $R^1=R^3$ =methyl, $R^2=R^4=R^5=R^6=R^7=R^{10}$ =H, $R^8=R^9=R^{11}$ =CH₃, R_3 =ethyl, R_{12} =methyl, M=Ni, Y=O, X=Br;

the complex represented by Formula III', wherein $R^1=R^3$ =isopropyl, $R^2=R^4=R^5=R^6=R^7=R^{10}$ =H, $R^8=R^9=R^{11}$ =CH₃, R_3 =CH₃, R_{12} =ethyl, M=Ni, Y=O, X=Br;

10 the complex represented by Formula III', wherein $R^1=R^3$ =isopropyl, $R^2=R^4=R^5=R^6=R^7=R^{10}$ =H, $R^8=R^9=R^{11}$ =CH₃, R_3 =ethyl, R_{12} =ethyl, M=Ni, Y=O, X=Br;

the complex represented by Formula III', wherein $R^1=R^3$ =ethyl, $R^2=R^4=R^5=R^6=R^7=R^{10}$ =H, $R^8=R^9=R^{11}$ =CH₃, $R_3=CH₃, R_{12} =ethyl, M=Ni, Y=O, X=Br;$

the complex represented by Formula III', wherein $R^1=R^3$ =ethyl, $R^2=R^4=R^5=R^6=R^7=R^{10}$ =H, $R^8=R^9=R^{11}$ =CH₃, R_3 =ethyl, R_{12} =ethyl, M=Ni, Y=O, X=Br;

15 the complex represented by Formula III', wherein $R^1=R^3$ =methyl, $R^2=R^4=R^5=R^6=R^7=R^{10}$ =H, $R^8=R^9=R^{11}$ =CH₃, R_3 =CH₃, R_{12} =ethyl, M=Ni, Y=O, X=Br;

the complex represented by Formula III', wherein $R^1=R^3$ =methyl, $R^2=R^4=R^5=R^6=R^7=R^{10}$ =H, $R^8=R^9=R^{11}$ =CH₃, R_3 =ethyl, R_{12} =ethyl, M=Ni, Y=O, X=Br;

20 the complex represented by Formula III', wherein $R^1=R^3$ =methyl, $R^2=R^4=R^5=R^6=R^7=R^{10}$ =H, $R^8=R^9=R^{11}$ =CH₃, R_3 =CH₃, R_{12} =i-Pr, M=Ni, Y=O, X=Br;

the complex represented by Formula III', wherein R^1 - R^3 =methyl, R^4 - R^7 = R^{10} =H, $R^8=R^9=R^{11}$ =CH₃, R_3 =ethyl, R_{12} =ethyl, M=Ni, Y=O, X=Br;

the complex represented by Formula III', wherein R^1 - R^3 =methyl, R^4 - R^7 = R^{10} =H, $R^8=R^9=R^{11}$ =CH₃, R_3 =CH₃, R_{12} =ethyl, M=Ni, Y=O, X=Br;

25 the complex represented by Formula III', wherein $R^1=R^3$ =methyl, R^2 =Br, R^4 - R^7 = R^{10} =H, $R^8=R^9=R^{11}$ = R_3 =CH₃, R_{12} =ethyl, M=Ni, Y=O, X=Br;

the complex represented by Formula III', wherein $R^1=R^3$ =methyl, R^2 =Br, R^4 - R^7 = R^{10} =H, $R^8=R^9=R^{11}$ =CH₃, R_3 =ethyl, R_{12} =ethyl, M=Ni, Y=O, X=Br;

30 the complex represented by Formula III', wherein $R^1=R^3$ =F, $R^2=R^4$ - R^7 = R^{10} =H, $R^8=R^9=R^{11}$ =CH₃, R_3 =ethyl, R_{12} =ethyl, M=Ni, Y=O, X=Br;

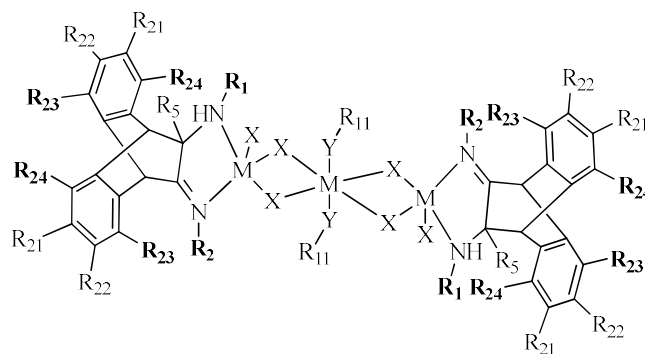
the complex represented by Formula III', wherein $R^1=R^3$ =Cl, $R^2=R^4$ - R^7 = R^{10} =H, $R^8=R^9=R^{11}$ =CH₃, R_3 =ethyl, R_{12} =ethyl, M=Ni, Y=O, X=Br;

the complex represented by Formula III', wherein $R^1=R^3$ =Br, $R^2=R^4$ - R^7 = R^{10} =H, $R^8=R^9=R^{11}$ =CH₃, R_3 =ethyl, R_{12} =ethyl, M=Ni, Y=O, X=Br;

35 the complex represented by Formula III', wherein $R^1=R^3$ =methyl,

- $R^2=R^4-R^7=R^{10}=H$, $R^8=R^9=R^{11}=CH_3$, $R_3=ethyl$, $R_{12}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
the complex represented by Formula III', wherein $R^1=R^3=ethyl$, $R^2=R^4-R^7=R^{10}=H$,
 $R^8=R^9=R^{11}=CH_3$, $R_3=CH_3$, $R_{12}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
the complex represented by Formula III', wherein $R^1=R^3=isopropyl$,
5 $R^2=R^4-R^7=R^{10}=H$, $R^8=R^9=R^{11}=CH_3$, $R_3=CH_3$, $R_{12}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
the complex represented by Formula III', wherein $R^1-R^3=methyl$, $R^4-R^7=R^{10}=H$,
 $R^8=R^9=R^{11}=CH_3$, $R_3=CH_3$, $R_{12}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
the complex represented by Formula III', wherein $R^1=R^3=methyl$, $R^2=Br$,
 $R^4-R^7=R^{10}=H$, $R^8=R^9=R^{11}=methyl$, $R_3=isopropyl$, $R_{12}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
10 the complex represented by Formula III', wherein $R^1=R^3=F$, $R^2=R^4-R^7=R^{10}=H$,
 $R^8=R^9=R^{11}=CH_3$, $R_3=isopropyl$, $R_{12}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
the complex represented by Formula III', wherein $R^1=R^3=Cl$, $R^2=R^4-R^7=R^{10}=H$,
 $R^8=R^9=R^{11}=CH_3$, $R_3=isopropyl$, $R_{12}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
the complex represented by Formula III', wherein $R^1=R^3=Br$, $R^2=R^4-R^7=R^{10}=H$,
15 $R^8=R^9=R^{11}=CH_3$, $R_3=isopropyl$, $R_{12}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
the complex represented by Formula III', wherein $R^1=R^3=methyl$,
 $R^2=R^4-R^7=R^{10}=H$, $R^8=R^9=CH_3$, $R^{11}=bromomethyl$, $R_3=isopropyl$, $R_{12}=ethyl$, $M=Ni$,
 $Y=O$, $X=Br$;
the complex represented by Formula III', wherein $R^1=R^3=ethyl$, $R^2=R^4-R^7=R^{10}=H$,
20 $R^8=R^9=CH_3$, $R^{11}=CH_2Br$, $R_3=isopropyl$, $R_{12}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
the complex represented by Formula III', wherein $R^1=R^3=isopropyl$,
 $R^2=R^4-R^7=R^{10}=H$, $R^8=R^9=CH_3$, $R^{11}=CH_2Br$, $R_3=ethyl$, $R_{12}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
the complex represented by Formula III', wherein $R^1-R^3=methyl$, $R^4-R^7=R^{10}=H$,
 $R^8=R^9=CH_3$, $R^{11}=CH_2Br$, $R_{12}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
25 the complex represented by Formula III', wherein $R^1=R^3=methyl$, $R^2=Br$,
 $R^4-R^7=R^{10}=H$, $R^8=R^9=methyl$, $R_3=ethyl$, $R^{11}=CH_2Br$, $R_{12}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
the complex represented by Formula III', wherein $R^1=R^3=F$, $R^2=R^4-R^7=R^{10}=H$,
 $R^8=R^9=methyl$, $R^{11}=CH_2Br$, $R_3=isobutyl$, $R_{12}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
the complex represented by Formula III', wherein $R^1=R^3=Cl$, $R^2=R^4-R^7=R^{10}=H$,
30 $R^8=R^9=methyl$, $R^{11}=CH_2Br$, $R_3=isobutyl$, $R_{12}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
the complex represented by Formula III', wherein $R^1=R^3=Br$, $R^2=R^4-R^7=R^{10}=H$,
 $R^8=R^9=methyl$, $R^{11}=CH_2Br$, $R_3=isobutyl$, $R_{12}=ethyl$, $M=Ni$, $Y=O$, $X=Br$.

In some embodiments of this subaspect, the amino-imine metal complex has a structure as shown by Formula IV' :

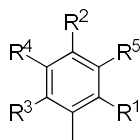


Formula IV'

wherein, R_1 and R_2 are each independently a C1-C30 hydrocarbyl with or without a substituent Q; R_{21} - R_{24} are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C20 hydrocarbyl with or without a substituent Q and C1-C20 hydrocarbyloxy with or without a substituent Q, and R_{21} - R_{24} are optionally joined to form a ring or ring system, preferably a substituted or unsubstituted benzene ring; each R_5 is independently selected from the group consisting of hydrogen and C1-C20 hydrocarbyl with or without a substituent Q; each R_{11} is independently a C1-C20 hydrocarbyl with or without a substituent Q; each Y is independently a Group VIA non-metal atom; each M is independently a Group VIII metal; each X is independently selected from the group consisting of halogen, C1-C10 hydrocarbyl with or without a substituent Q and C1-C10 hydrocarbyloxy with or without a substituent Q.

The term "substituted" as used herein refers to substitution by a substituent Q, for example.

In some embodiments of this subaspect, in the amino-imine metal complex of Formula IV', R_1 and R_2 are independently selected from the group consisting of C1-C20 alkyl with or without a substituent Q and C6-C20 aryl with or without a substituent Q. Preferably, R_1 and/or R_2 are/is a group represented by Formula A:



Formula A

wherein, R^1 - R^5 are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C20 alkyl with or without a substituent Q, C2-C20 alkenyl with or without a substituent Q, C2-C20 alkynyl with or without a substituent Q, C1-C20 alkoxy with or without a substituent Q, C2-C20 alkenoxy with or without a substituent Q, C2-C20 alkynoxy with or without a substituent Q, C6-C20 aryl with or without a substituent Q, C6-C20 aryloxy with or without a substituent Q, C7-C20

aralkyl with or without a substituent Q, C7-C20 aralkyloxy with or without a substituent Q, C7-C20 alkaryl with or without a substituent Q and C7-C20 alkaryloxy with or without a substituent Q, and R¹-R⁵ are optionally joined to form a ring or ring system. Preferably, R¹-R⁵ are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C10 alkyl with or without a substituent Q, C2-C10 alkenyl with or without a substituent Q, C2-C10 alkynyl with or without a substituent Q, C1-C10 alkoxy with or without a substituent Q, C2-C10 alkenoxy with or without a substituent Q, C2-C10 alkynoxy with or without a substituent Q, C6-C15 aryl with or without a substituent Q, C6-C15 aryloxy with or without a substituent Q, C7-C15 aralkyl with or without a substituent Q, C7-C15 aralkoxy with or without a substituent Q, C7-C15 alkaryl with or without a substituent Q and C7-C15 alkaryloxy with or without a substituent Q. More preferably, R¹-R⁵ are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C6 alkyl with or without a substituent Q, C2-C6 alkenyl with or without a substituent Q, C2-C6 alkynyl with or without a substituent Q, C1-C6 alkoxy with or without a substituent Q, C2-C6 alkenyloxy with or without a substituent Q, C2-C6 alkynyloxy with or without a substituent Q, C6-C10 aryl with or without a substituent Q, C7-C10 aralkyl group with or without a substituent Q, C7-C10 alkaryl with or without a substituent Q, C6-C10 aryloxy with or without a substituent Q, C7-C10 aralkyloxy with or without a substituent Q, and C7-C10 alkaryloxy with or without a substituent Q.

In some embodiments of this subaspect, in the amino-imine metal complex of Formula IV', each M is independently selected from the group consisting of nickel and palladium.

In some embodiments of this subaspect, in the amino-imine metal complex of Formula IV', each Y is independently selected from the group consisting of O and S.

In some embodiments of this subaspect, in the amino-imine metal complex of Formula IV', each X is independently selected from the group consisting of halogen, C1-C10 alkyl with or without a substituent Q and C1-C10 alkoxy with or without a substituent Q, preferably from the group consisting of halogen, C1-C6 alkyl with or without a substituent Q and C1-C6 alkoxy with or without a substituent Q.

In some embodiments of this subaspect, in the amino-imine metal complex of Formula IV', each R₁₁ is independently a C1-C20 alkyl with or without a substituent Q, preferably a C1-C10 alkyl with or without a substituent Q, and more preferably a C1-C6 alkyl with or without a substituent Q.

In some embodiments of this subaspect, in the amino-imine metal complex of

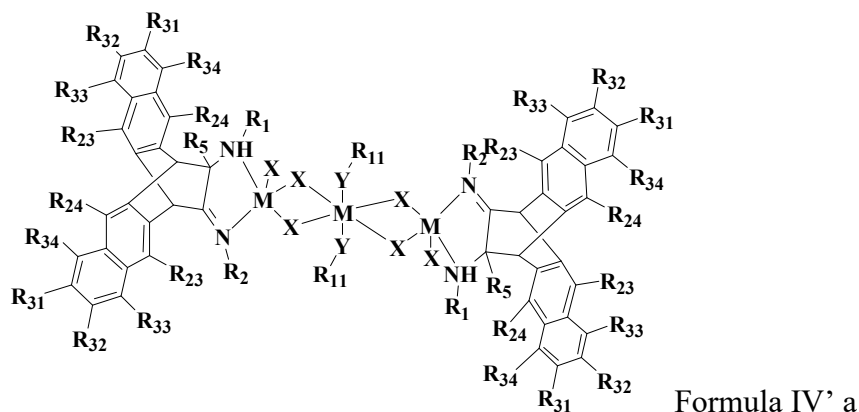
Formula IV', each R₅ is independently selected from the group consisting of C1-C20 alkyl with or without a substituent Q, C6-C20 aryl with or without a substituent Q, C7-C20 aralkyl with or without a substituent Q and C7-C20 alkaryl with or without a substituent Q. Preferably, each R₅ is independently selected from the group consisting of C1-C10 alkyl with or without a substituent Q, C6-C10 aryl with or without a substituent Q, C7-C15 aralkyl with or without a substituent Q and C7-C15 alkaryl with or without a substituent Q. More preferably, each R₅ is independently selected from the group consisting of C1-C6 alkyl with or without a substituent Q.

In some embodiments of this subaspect, in the amino-imine metal complex of Formula IV', the substituent Q is selected from halogen, hydroxy, C1-C10 alkyl, halogenated C1-C10 alkyl, C1-C10 alkoxy and halogenated C1-C10 alkoxy, preferably from halogen, hydroxy, C1-C6 alkyl, halogenated C1-C6 alkyl, C1-C6 alkoxy and halogenated C1-C6 alkoxy. Preferably, the C1-C6 alkyl is selected from methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, n-pentyl, isopentyl, n-hexyl, isohexyl and 3,3-dimethylbutyl. Preferably, the C1-C6 alkoxy is selected from methoxy, ethoxy, n-propoxy, isopropoxy, n-butoxy, isobutoxy, n-pentoxy, isopentoxy, n-hexyloxy, isohexyloxy and 3,3-dimethylbutoxy.

In some embodiments of this subaspect, in the amino-imine metal complex of Formula IV', R₂₁-R₂₄ are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C20 alkyl with or without a substituent Q, C2-C20 alkenyl with or without a substituent Q, C2-C20 alkynyl with or without a substituent Q, C1-C20 alkoxy with or without a substituent Q, C2-C20 alkenoxy with or without a substituent Q, C2-C20 alkynoxy with or without a substituent Q, C6-C20 aryl with or without a substituent Q, C7-C20 aralkyl with or without a substituent Q, C7-C20 alkaryl with or without a substituent Q, C6-C20 aryloxy with or without a substituent Q, C7-C20 aralkyloxy with or without a substituent Q and C7-C20 alkaryloxy with or without a substituent Q, and R₂₁-R₂₄ are optionally joined to form a ring or ring system. Preferably, R₂₁-R₂₄ are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C10 alkyl with or without a substituent Q, C2-C10 alkenyl with or without a substituent Q, C2-C10 alkynyl with or without a substituent Q, C1-C10 alkoxy with or without a substituent Q, C2-C10 alkenoxy with or without a substituent Q, C2-C10 alkynoxy with or without a substituent Q, C6-C15 aryl with or without a substituent Q, C7-C15 aralkyl with or without a substituent Q, C7-C15 alkaryl with or without a substituent Q, C6-C15 aryloxy with or without a substituent Q, C7-C15 aralkoxy with or without a substituent Q and C7-C15 alkaryloxy with or

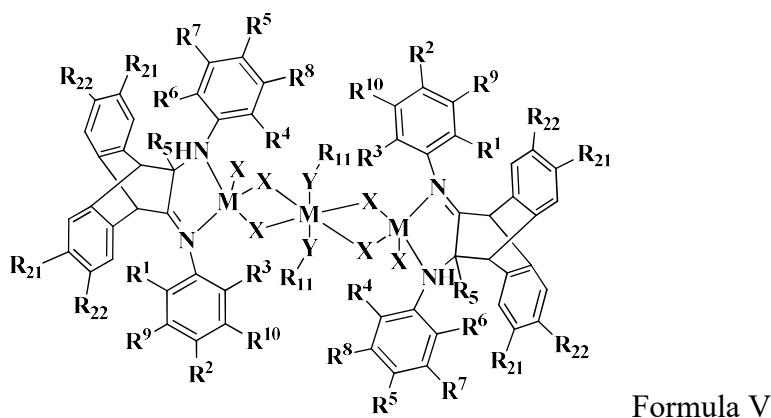
without a substituent Q. More preferably, R₂₁-R₂₄ are each independently selected from the group consisting of hydrogen, C1-C10 alkyl, halogenated C1-C10 alkyl, C1-C10 alkoxy, halogenated C1-C10 alkoxy and halogen, more preferably from the group consisting of hydrogen, C1-C6 alkyl, halogenated C1-C6 alkyl, C1-C6 alkoxy, halogenated C1-C6 alkoxy and halogen.

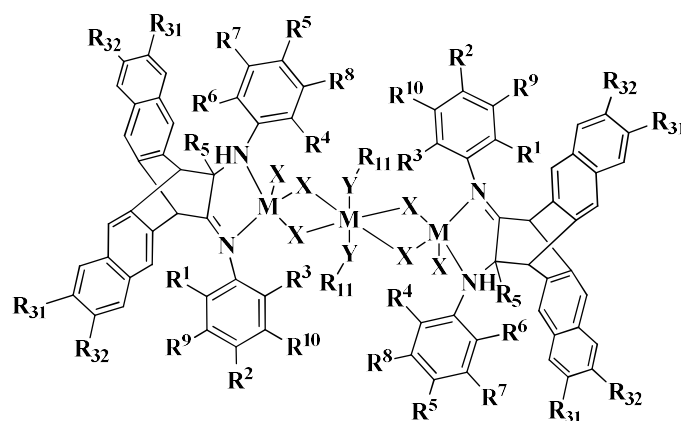
In some embodiments of this subaspect, the amino-imine metal complex has a structure as shown by Formula IV' a:



wherein R₃₁-R₃₄ have the same meanings as R₂₁-R₂₄ in Formula IV', preferably R₃₃ and R₃₄ are hydrogen, and R₁, R₂, R₅, R₁₁, Y, M and X are as defined above for Formula IV'.

In some embodiments of this subaspect, the amino-imine metal complex is represented by the following Formula V or V' :





Formula V'

wherein the individual symbols are as defined above. Preferably, the amino-imine metal complex is selected from the group consisting of:

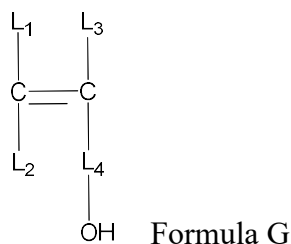
- 1) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6$ =isopropyl,
 $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=CH_3$, R_{11} =ethyl, $M=Ni$, $Y=O$, $X=Br$;
- 2) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6$ =ethyl,
 $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=CH_3$, R_{11} =ethyl, $M=Ni$, $Y=O$, $X=Br$;
- 3) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6$ =methyl,
 $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=CH_3$, R_{11} =ethyl, $M=Ni$, $Y=O$, $X=Br$;
- 4) the complex represented by Formula V, wherein R^1-R^6 =methyl,
 $R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=CH_3$, R_{11} =ethyl, $M=Ni$, $Y=O$, $X=Br$;
- 5) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=Br$,
 $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=CH_3$, R_{11} =ethyl, $M=Ni$, $Y=O$, $X=Br$;
- 6) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=Cl$,
 $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=CH_3$, R_{11} =ethyl, $M=Ni$, $Y=O$, $X=Br$;
- 7) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=F$,
 $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=CH_3$, R_{11} =ethyl, $M=Ni$, $Y=O$, $X=Br$;
- 8) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6$ =isopropyl,
 $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=R_{11}$ =ethyl, $M=Ni$, $Y=O$, $X=Br$;
- 9) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6$ =ethyl,
 $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=R_{11}$ =ethyl, $M=Ni$, $Y=O$, $X=Br$;
- 10) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6$ =methyl,
 $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=R_{11}$ =ethyl, $M=Ni$, $Y=O$, $X=Br$;
- 11) the complex represented by Formula V, wherein R^1-R^6 =methyl,
 $R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=R_{11}$ =ethyl, $M=Ni$, $Y=O$, $X=Br$;
- 12) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=Br$,
 $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=R_{11}$ =ethyl, $M=Ni$, $Y=O$, $X=Br$;

- 13) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=Cl$,
 $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 14) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=F$,
 $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 5 15) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=isopropyl$,
 $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=CH_3$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 16) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=ethyl$,
 $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=CH_3$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 17) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=methyl$,
10 $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=CH_3$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 18) the complex represented by Formula V, wherein $R^1-R^6=methyl$,
 $R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=CH_3$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 19) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=Br$,
 $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=CH_3$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 15 20) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=Cl$,
 $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=CH_3$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 21) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=F$,
 $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=CH_3$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 22) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=isopropyl$,
20 $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_5=CH_3$, $R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 23) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=ethyl$,
 $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_5=CH_3$, $R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 24) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=methyl$,
 $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_5=CH_3$, $R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 25 25) the complex represented by Formula V, wherein $R^1-R^6=methyl$,
 $R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_5=CH_3$, $R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 26) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=Br$,
 $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_5=CH_3$, $R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 27) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=Cl$,
30 $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_5=CH_3$, $R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 28) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=F$,
 $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_5=CH_3$, $R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 29) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=isopropyl$,
 $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_5=CH_3$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 35 30) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=ethyl$,

- $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t\text{-butyl}$, $R_5=CH_3$, $R_{11}=\text{isobutyl}$, $M=Ni$, $Y=O$, $X=Br$;
- 31) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=\text{methyl}$,
 $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t\text{-butyl}$, $R_5=CH_3$, $R_{11}=\text{isobutyl}$, $M=Ni$, $Y=O$, $X=Br$;
- 32) the complex represented by Formula V, wherein $R^1-R^6=\text{methyl}$,
5 $R^7-R^{10}=R_{22}=H$, $R_{21}=t\text{-butyl}$, $R_5=CH_3$, $R_{11}=\text{isobutyl}$, $M=Ni$, $Y=O$, $X=Br$;
- 33) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=Br$,
 $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t\text{-butyl}$, $R_5=CH_3$, $R_{11}=\text{isobutyl}$, $M=Ni$, $Y=O$, $X=Br$;
- 34) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=Cl$,
 $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t\text{-butyl}$, $R_5=CH_3$, $R_{11}=\text{isobutyl}$, $M=Ni$, $Y=O$, $X=Br$;
- 10 35) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=F$,
 $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t\text{-butyl}$, $R_5=CH_3$, $R_{11}=\text{isobutyl}$, $M=Ni$, $Y=O$, $X=Br$;
- 36) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=\text{isopropyl}$,
 $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, $R_5=CH_3$, $R_{11}=\text{ethyl}$, $M=Ni$, $Y=O$, $X=Br$;
- 37) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=\text{ethyl}$,
15 $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, $R_5=CH_3$, $R_{11}=\text{ethyl}$, $M=Ni$, $Y=O$, $X=Br$;
- 38) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=\text{methyl}$,
 $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, $R_5=CH_3$, $R_{11}=\text{ethyl}$, $M=Ni$, $Y=O$, $X=Br$;
- 39) the complex represented by Formula V', wherein $R^1-R^6=\text{methyl}$,
 $R^7-R^{10}=R_{31}=R_{32}=H$, $R_5=CH_3$, $R_{11}=\text{ethyl}$, $M=Ni$, $Y=O$, $X=Br$;
- 20 40) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=Br$,
 $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, $R_5=CH_3$, $R_{11}=\text{ethyl}$, $M=Ni$, $Y=O$, $X=Br$;
- 41) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=Cl$,
 $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, $R_5=CH_3$, $R_{11}=\text{ethyl}$, $M=Ni$, $Y=O$, $X=Br$;
- 42) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=F$,
25 $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, $R_5=CH_3$, $R_{11}=\text{ethyl}$, $M=Ni$, $Y=O$, $X=Br$;
- 43) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=\text{isopropyl}$,
 $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, $R_5=CH_3$, $R_{11}=\text{isobutyl}$, $M=Ni$, $Y=O$, $X=Br$;
- 44) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=\text{ethyl}$,
 $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, $R_5=CH_3$, $R_{11}=\text{isobutyl}$, $M=Ni$, $Y=O$, $X=Br$;
- 30 45) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=\text{methyl}$,
 $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, $R_5=CH_3$, $R_{11}=\text{isobutyl}$, $M=Ni$, $Y=O$, $X=Br$;
- 46) the complex represented by Formula V', wherein $R^1-R^6=\text{methyl}$,
 $R^7-R^{10}=R_{31}=R_{32}=H$, $R_5=CH_3$, $R_{11}=\text{isobutyl}$, $M=Ni$, $Y=O$, $X=Br$;
- 47) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=Br$,
35 $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, $R_5=CH_3$, $R_{11}=\text{isobutyl}$, $M=Ni$, $Y=O$, $X=Br$;

- 48) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=Cl$,
 $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, $R_5=CH_3$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 49) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=F$,
 $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, $R_5=CH_3$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 5 50) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=isopropyl$,
 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=R_{11}=ethyl$, $R_5=CH_3$, $M=Ni$, $Y=O$, $X=Br$;
- 51) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=ethyl$,
 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=R_{11}=ethyl$, $R_5=CH_3$, $M=Ni$, $Y=O$, $X=Br$;
- 52) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=methyl$,
10 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=R_{11}=ethyl$, $R_5=CH_3$, $M=Ni$, $Y=O$, $X=Br$;
- 53) the complex represented by Formula V', wherein $R^1-R^6=methyl$, $R^7-R^{10}=H$,
 $R_{31}=R_{32}=R_{11}=ethyl$, $R_5=CH_3$, $M=Ni$, $Y=O$, $X=Br$;
- 54) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=Br$,
 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=R_{11}=ethyl$, $R_5=CH_3$, $M=Ni$, $Y=O$, $X=Br$;
- 15 55) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=Cl$,
 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=R_{11}=ethyl$, $R_5=CH_3$, $M=Ni$, $Y=O$, $X=Br$;
- 56) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=F$,
 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=R_{11}=ethyl$, $R_5=CH_3$, $M=Ni$, $Y=O$, $X=Br$;
- 57) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=isopropyl$,
20 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=R_{11}=ethyl$, $R_5=CH_3$, $M=Ni$, $Y=O$, $X=Br$;
- 58) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=ethyl$,
 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=ethyl$, $R_5=CH_3$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 59) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=methyl$,
 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=ethyl$, $R_5=CH_3$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 25 60) the complex represented by Formula V', wherein $R^1-R^6=methyl$, $R^7-R^{10}=H$,
 $R_{31}=R_{32}=ethyl$, $R_5=CH_3$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 61) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=Br$,
 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=ethyl$, $R_5=CH_3$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 62) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=Cl$,
30 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=ethyl$, $R_5=CH_3$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 63) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=F$,
 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=ethyl$, $R_5=CH_3$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$.

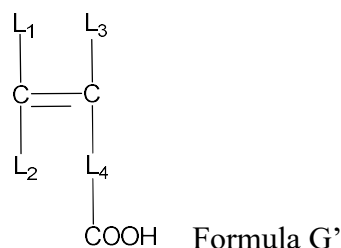
In some embodiments of the invention, the polar monomer is one or more of the olefinic alcohols represented by Formula G:



wherein, L₁-L₃ are each independently selected from the group consisting of H and C₁-C₃₀ alkyl with or without a substituent, L₄ is a C₁-C₃₀ alkylene optionally having a pendant group. Preferably, L₄ is a C₁-C₃₀ alkylene having a pendant group.

5 In some embodiments of the invention, in the copolymer, the content of monomer units derived from the olefinic alcohols represented by Formula G is from 0.4 to 10.0 mol%, based on the total of the monomer units.

In some embodiments of the invention, the polar monomer is one or more of the unsaturated carboxylic acids represented by Formula G' :



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wherein, L₁-L₃ are each independently selected from the group consisting of H and C₁-C₃₀ alkyl with or without a substituent, L₄ is a C₁-C₃₀ alkylene optionally having a pendant group. Preferably, L₄ is a C₁-C₃₀ alkylene having a pendant group.

15 In some embodiments of the invention, in the copolymer, the content of monomer units derived from the unsaturated carboxylic acid represented by Formula G' is from 0.2 to 15.0 mol%, and more preferably from 0.7 to 10.0 mol%, based on the total of the monomer units.

In some embodiments of the invention, in Formula G or G', L₁ and L₂ are H.

20 In some embodiments of the invention, in Formula G or G', L₃ is H or a C₁-C₃₀ alkyl, preferably H or a C₁-C₂₀ alkyl, and more preferably H or a C₁-C₁₀ alkyl.

In some embodiments of the invention, in Formula G or G', L₄ is a C₁-C₃₀ alkylene optionally having a pendant group, preferably a C₁-C₂₀ alkylene optionally having a pendant group, more preferably a C₁-C₁₀ alkylene optionally having a pendant group, and still more preferably a C₁-C₆ alkylene optionally having a pendant group.

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In some embodiments of the invention, the optional substituent in L₁-L₃ is selected from the group consisting of halogen, C₁-C₁₀ alkyl, C₁-C₁₀ alkoxy, C₆-C₁₀ aryl,

cyano and hydroxy, preferably from the group consisting of C1-C6 alkyl, halogen and C1-C6 alkoxy.

In some embodiments of the invention, the optional pendant group in L₄ is selected from the group consisting of halogen, C₆-C₂₀ aryl, C₁-C₂₀ alkyl and C₁-C₂₀ alkoxy, with the C₆-C₂₀ aryl, C₁-C₂₀ alkyl and C₁-C₂₀ alkoxy being optionally substituted by a substituent, which is preferably selected from the group consisting of halogen, C₁-C₁₀ alkyl, C₁-C₁₀ alkoxy, C₆-C₁₀ aryl and hydroxy. Preferably, the optional pendant group in L₄ is selected from the group consisting of halogen, C₆-C₂₀ aryl, C₁-C₂₀ alkyl, hydroxy-substituted C₁-C₂₀ alkyl and alkoxy-substituted C₁-C₂₀ alkyl. More preferably, the optional pendant group is selected from the group consisting of halogen, C₆-C₂₀ aryl, C₁-C₁₀ alkyl, hydroxy-substituted C₁-C₁₀ alkyl and alkoxy-substituted C₁-C₁₀ alkyl; and more preferably, the optional pendant group is selected from the group consisting of halogen, phenyl, C₁-C₆ alkyl and hydroxy-substituted C₁-C₆ alkyl. Examples of the C₁-C₆ alkyl include methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, t-butyl, pentyl and hexyl.

According to a preferred embodiment of the present invention, in Formula G or G', L₁ and L₂ is H, L₃ is H or a C₁-C₃₀ alkyl, L₄ is a C₁-C₃₀ alkylene optionally having a pendant group; the C₁-C₃₀ alkyl is optionally substituted by a substituent, which is preferably selected from the group consisting of halogen, C₁-C₁₀ alkyl, C₁-C₁₀ alkoxy, C₆-C₁₀ aryl, cyano and hydroxy.

According to a preferred embodiment of the present invention, in Formula G or G', L₁ and L₂ are H, L₃ is H, a C₁-C₁₀ alkyl or a halogen-substituted C₁-C₁₀ alkyl, preferably L₃ is H or a C₁-C₁₀ alkyl; L₄ is a C₁-C₂₀ alkylene optionally having a pendant group, for example L₄ is methylene group having a pendant group, ethylene group having a pendant group, propylene group having a pendant group, butylene group having a pendant group, C₅ alkylene having a pendant group, C₆ alkylene having a pendant group, C₇ alkylene having a pendant group, C₈ alkylene having a pendant group, C₉ alkylene having a pendant group, and C₁₀ alkylene having a pendant group, C₁₂ alkylene having a pendant group, C₁₄ alkylene having a pendant group, C₁₈ alkylene having a pendant group, C₂₀ alkylene having a pendant group, preferably a C₁-C₁₀ alkylene having a pendant group.

According to a preferred embodiment of the present invention, in Formula G or G', L₁ and L₂ are H, L₃ is H or a C₁₋₆ alkyl; L₄ is a C₁-C₁₀ alkylene having a pendant group.

In the present invention, the carbon number n of the C_n alkylene group refers to

the number of C atoms on the straight chain, excluding the number of C atoms on the pendant group. For example, isopropylidene ($-\text{CH}_2\text{-CH}(\text{CH}_3)-$) is referred to herein as a C_2 alkylene group with a pendant group (methyl).

According to preferred embodiments of the invention, specific examples of the olefinic alcohol represented by Formula G include, but are not limited to,

5 2-methyl-3-buten-1-ol, 2-ethyl-3-buten-1-ol, 1,1-diphenyl-3-buten-1-ol,
 2-methyl-3-buten-2-ol, 2,2-dimethyl-3-buten-1-ol, 3-methyl-1-penten-3-ol,
 2,4-dimethyl-4-penten-2-ol, 4-penten-2-ol, 4-methyl-4-penten-2-ol,
 2-methyl-4-penten-2-ol, 2-phenyl-4-penten-2-ol, 2-allyl-hexafluoroisopropanol,
 10 2-hydroxy-5-hexene, 3-buten-2-ol, 3-methyl-5-hexen-3-ol,
 2-methyl-2-hydroxy-5-hexene, 1-allylcyclohexanol, 2,3-dimethyl-2-hydroxy-5-hexene,
 1-hepten-4-ol, 4-methyl-1-hepten-4-ol, 4-n-propyl-1-hepten-4-ol, 6-hepten-3-ol,
 2-methyl-2-hydroxy-6-heptene, 5-methyl-2-hydroxy-6-heptene,
 2-hydroxy-3-methyl-6-heptene, 2-hydroxy-3-ethyl-6-heptene,
 15 2-hydroxy-4-methyl-6-heptene, 2-hydroxy-5-methyl-6-heptene,
 2,5-dimethyl-1-hepten-4-ol, 2,6-dimethyl-7-octen-2-ol,
 2-hydroxy-2,4,5-trimethyl-6-heptene, 2-methyl-3-hydroxy-7-octene,
 3-methyl-3-hydroxy-6-heptene, 2-methyl-2-hydroxy-7-octene,
 3-methyl-3-hydroxy-7-octene, 4-methyl-2-hydroxy-7-octene,
 20 4-methyl-3-hydroxy-7-octene, 5-methyl-3-hydroxy-7-octene,
 6-methyl-3-hydroxy-7-octene, 3-ethyl-3-hydroxy-7-octene, 1,2-dihydroxy-7-octene,
 2,6-dimethyl-2,6-dihydroxy-7-octene, 2,6-dimethyl-2,3-dihydroxy-7-octene,
 2-methyl-2-hydroxy-3-chloro-7-octene, 2-methyl-2-hydroxy-3,5-dichloro-7-octene,
 3,4-dimethyl-4-hydroxy-8-nonene, 4-methyl-4-hydroxy-8-nonene,
 25 4-ethyl-4-hydroxy-8-nonene, 4-propyl-4-hydroxy-8-nonene, 7-octene-2-ol,
 3,5-dichloro-2-methyl-7-octen-2-ol, 3-chloro-2-methyl-7-octen-2,3-diol, and
 2,6-dimethyl-7-octen-2,6-diol.

Specific examples of the unsaturated carboxylic acid represented by Formula G' include, but are not limited to, 2-methyl-4-pentenoic acid, 2,3-dimethyl-4-pentenoic acid, 2,2-dimethyl-4-pentenoic acid, 2-ethyl-4-pentenoic acid, 2-isopropyl-4-pentenoic acid, 2,2,3-trimethyl-4-pentenoic acid, 2,3,3-trimethyl-4-pentenoic acid, 2-ethyl-3-methyl-4-pentenoic acid, 2-(2-methylpropyl)-4-pentenoic acid, 2,2-diethyl-4-pentenoic acid, 2-methyl-2-ethyl-4-pentenoic acid, 2,2,3,3-tetramethyl-4-pentenoic acid, 2-methyl-5-hexenoic acid, 2-ethyl-5-hexenoic acid, 2-propyl-5-hexenoic acid, 2,3-dimethyl-5-hexenoic acid,

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2,2-dimethyl-5-hexenoic acid, 2-isopropyl-5-hexenoic acid,
 2-methyl-2-ethyl-5-hexenoic acid, 2-(1-methylpropyl)-5-hexenoic acid,
 2,2,3-trimethyl-5-hexenoic acid, 2,2-diethyl-5-hexenoic acid, 2-methyl-6-heptenoic
 acid, 2-ethyl-6-heptenoic acid, 2-propyl-6-heptenoic acid, 2,3-dimethyl-6-heptenoic
 5 acid, 2,4-dimethyl-6-heptenoic acid, 2,2-dimethyl-6-heptenoic acid,
 2-isopropyl-5-methyl-6-heptenoic acid, 2-isopropyl-6-heptenoic acid,
 2,3,4-trimethyl-6-heptenoic acid, 2-methyl-2-ethyl-6-heptenoic acid,
 2-(1-methylpropyl)-6-heptenoic acid, 2,2,3-trimethyl-6-heptenoic acid,
 2,2-diethyl-6-heptenoic acid, 2-methyl-7-octenoic acid, 2-ethyl-7-octenoic acid,
 10 2-propyl-7-octenoic acid, 2,3-dimethyl-7-octenoic acid, 2,4-dimethyl-7-octenoic acid,
 2,2-dimethyl-7-octenoic acid, 2-isopropyl-5-methyl-7-octenoic acid,
 2-isopropyl-7-octenoic acid, 2,3,4-trimethyl-7-octenoic acid,
 2-methyl-2-ethyl-7-octenoic acid, 2-(1-methylpropyl)-7-octenoic acid,
 2,2,3-trimethyl-7-octenoic acid, 2,2-diethyl-7-octenoic acid, 2-methyl-8-nonenoic acid,
 15 2-ethyl-8-nonenoic acid, 2-propyl-8-nonenoic acid, 2,3-dimethyl-8-nonenoic acid,
 2,4-dimethyl-8-nonenoic acid, 2,2-dimethyl-8-nonenoic acid, 2,2-diethyl-8-nonenoic
 acid, 2-isopropyl-5-methyl-8-nonenoic acid, 2-methyl-9-decenoic acid,
 2,3-dimethyl-9-decenoic acid, 2,4-dimethyl-9-decenoic acid or
 2-methyl-10-undecenoic acid.

20 According to preferred embodiments of the invention, the cocatalyst is selected
 from the group consisting of organoaluminum compounds and/or organoboron
 compounds.

According to preferred embodiments of the invention, the organoaluminum
 compounds are selected from the group consisting of alkylaluminoxanes and
 25 organoaluminum compounds of general formula $AlR_nX^{1}_{3-n}$ (alkylaluminums or alkyl
 aluminum halides), in which R is H, a C_1 - C_{20} saturated or unsaturated hydrocarbyl or a
 C_1 - C_{20} saturated or unsaturated hydrocarbyloxy, preferably a C_1 - C_{20} alkyl, a C_1 - C_{20}
 alkoxy, a C_7 - C_{20} aralkyl or a C_6 - C_{20} aryl; X^1 is a halogen, preferably chlorine or
 bromine; and $0 < n \leq 3$. Specific examples of the organoaluminum compound include,
 30 but are not limited to, trimethylaluminum, triethylaluminum, triisobutylaluminum,
 tri-n-hexylaluminum, trioctylaluminum, diethyl aluminum hydride, diisobutyl
 aluminum hydride, diethyl aluminum chloride, diisobutyl aluminum chloride, ethyl
 aluminum sesquichloride, ethyl aluminum dichloride, methylaluminoxane (MAO), and
 modified methyl aluminoxane (MMAO). Preferably, the organoaluminum compound
 35 is methylaluminoxane (MAO).

According to preferred embodiments of the invention, the organoboron compound is selected from the group consisting of aromatic hydrocarbyl boron compounds and borates. The aromatic hydrocarbyl boron compounds are preferably substituted or unsubstituted phenyl boron, more preferably tris(pentafluorophenyl)boron. The borates are preferably N,N-dimethylanilinium tetrakis(pentafluorophenyl)borate and/or triphenylcarbonium tetrakis(pentafluorophenyl)borate.

According to preferred embodiments of the invention, the concentration of the main catalyst in the reaction system is from 0.00001 to 100 mmol/L, for example, 0.00001 mmol/L, 0.00005 mmol/L, 0.0001 mmol/L, 0.0005 mmol/L, 0.001 mmol/L, 0.005 mmol/L, 0.01 mmol/L, 0.05 mmol/L, 0.1 mmol/L, 0.3 mmol/L, 0.5 mmol/L, 0.8 mmol/L, 1 mmol/L, 5 mmol/L, 8 mmol/L, 10 mmol/L, 20 mmol/L, 30 mmol/L, 50 mmol/L, 70 mmol/L, 80 mmol/L, 100 mmol/L and any value therebetween, preferably from 0.0001 to 1 mmol/L, and more preferably from 0.001 to 0.5 mmol/L.

According to preferred embodiments of the invention, when the cocatalyst is an organoaluminum compound, the molar ratio of aluminum in the cocatalyst to M in the main catalyst is (10^{-10}) :1, for example, 10:1, 20:1, 50:1, 100:1, 200:1, 300:1, 500:1, 700:1, 800:1, 1,000:1, 2,000:1, 3,000:1, 5,000:1, 10,000:1, 100,000:1, 1,000,000:1, 10,000,000:1, and any value therebetween, preferably (10-100,000):1, and more preferably (100-10,000):1; when the cocatalyst is an organoboron compound, the molar ratio of boron in the cocatalyst to M in the main catalyst is (0.1-1,000):1, for example, 0.1:1, 0.2:1, 0.5:1, 0.8:1, 1:1, 1.2:1, 1.4:1, 1.6:1, 1.8:1, 2:1, 2.5:1, 3:1, 4:1, 5:1, 8:1, 10:1, 20:1, 50:1, 100:1, 200:1, 300:1, 500:1, 700:1, 800:1, 1,000:1, and any value therebetween, preferably (0.1-500):1.

According to preferred embodiments of the invention, the olefin include olefins having 2-16 carbon atoms. In some embodiments of the present invention, the olefin includes ethylene or an α -olefin having 3-16 carbon atoms. In other embodiments of the present invention, the olefin is a C_3 - C_{16} cyclic olefin, preferably a 5-membered ring or a 6-membered ring. Preferably, the olefin is ethylene or an α -olefin having 3-16 carbon atoms, more preferably ethylene or C_2 - C_{10} α -olefin, such as ethylene, propylene, 1-butene, 1-pentene, 1-hexene, 1-heptene and 1-octene.

According to preferred embodiments of the invention, the concentration of the polar monomer such as the olefinic alcohol monomer represented by Formula G or the unsaturated carboxylic acid monomer represented by Formula G' in the reaction system is from 0.01 to 6,000 mmol/L, preferably from 0.1 to 1,000 mmol/L, more preferably from 1 to 500 mmol/L, for example, 1 mmol/L, 10 mmol/L, 20 mmol/L, 30

mmol/L, 50 mmol/L, 70 mmol/L, 90 mmol/L, 100 mmol/L, 200 mmol/L, 300 mmol/L, 400 mmol/L, 500 mmol/L and any value therebetween.

According to preferred embodiments of the invention, the chain transfer agent is one or more selected from aluminum alkyls, magnesium alkyls, boron alkyls and zinc alkyls. Some chain transfer agents used herein, such as aluminum alkyls, are also considered scavengers in the art.

According to preferred embodiments of the invention, the chain transfer agent is trialkylaluminum and/or dialkylzinc, preferably one or more selected from trimethylaluminum, triethylaluminum, triisopropylaluminum, and triisobutylaluminum, tri-n-hexyl aluminum, tri-n-octyl aluminum, dimethyl zinc and diethyl zinc.

According to preferred embodiments of the invention, the molar ratio of the chain transfer agent to M in the main catalyst is (0.1-2,000):1, for example, 0.1:1, 0.2:1, 0.5:1, 1:1, 2:1, 3:1, 5:1, 8:1, 10:1, 20:1, 50:1, 100:1, 200:1, 300:1, 500:1, 600:1, 800:1, 1,000:1, 2,000:1 and any value therebetween, and preferably (10-600):1.

According to preferred embodiments of the invention, the polymerization is carried out in an alkane solvent, and the alkane solvent is one or more of C₃-C₂₀ alkanes, preferably C₃-C₁₀ alkanes, for example, one or more of butane, isobutane, pentane, hexane, heptane, octane and cyclohexane, preferably one or more of hexane, heptane and cyclohexane.

According to preferred embodiments of the invention, the polar monomer is at first subjected to pretreatment to remove active hydrogen. Preferably, the above-mentioned cocatalyst or chain transfer agent is used to pretreat the polar monomer to remove its active hydrogen. Preferably, during the pretreatment, the molar ratio of the functional groups in the polar monomers, such as hydroxyl groups and/or carboxyl groups, to the co-catalyst or chain transfer agent is from 10:1 to 1:10.

According to preferred embodiments of the invention, the reaction is carried out under anhydrous and oxygen-free conditions.

According to preferred embodiments of the invention, the reaction conditions include: a reaction temperature of from -50°C to 50°C, preferably from -20 to 50°C, more preferably from 0 to 50°C, for example, 0°C, 10°C, 20°C, 30°C, 40°C, 50°C and any value therebetween; and/or, a reaction time of from 10 to 200 min, preferably from 20 to 60 min. In the present invention, the reaction pressure is not particularly limited, as long as the monomer can undergo a coordination copolymerization reaction. When the olefin is ethylene, from the viewpoint of cost reduction and simplification of

the polymerization process, the pressure of ethylene in the reactor is preferably from 1 to 1000 atm, more preferably from 1 to 200 atm, and more preferably from 1 to 50 atm.

As used herein, the term “reaction system” refers to a whole including the solvent,
5 the olefin, the polar monomer, the catalyst, and the optional chain transfer agent.

The present invention also provides the olefin-polar monomer copolymer prepared by the above preparation method, which comprises spherical and/or spherical-like polymers.

According to preferred embodiments of the invention, the spherical and/or
10 spherical-like polymer has an average particle diameter of from 0.1 to 50.0 mm, for example 0.1 mm, 0.5 mm, 1.0 mm, 2.0 mm, 3.0 mm, 5.0 mm, 8.0 mm, 10.0 mm, 15.0 mm, 20.0 mm, 25.0 mm, 30.0 mm, 35.0 mm, 40.0 mm, 45.0 mm, 50.0 mm and any value therebetween, preferably from 0.5 to 20.0 mm.

According to preferred embodiments of the invention, the content of the structural
15 units derived from the olefinic alcohol represented by Formula G in the olefin-olefinic alcohol copolymer is from 0.4 to 30.0 mol%, for example 0.4 mol%, 0.5 mol%, 0.7 mol%, 0.8 mol%, 1.0 mol%, 1.5 mol%, 2.0 mol%, 5.0 mol%, 8.0 mol%, 10.0 mol%, 15.0 mol%, 20.0 mol%, 25.0 mol%, 30.0 mol% and any value therebetween, preferably from 0.7 to 10.0 mol%.

According to preferred embodiments of the invention, the olefin-olefinic alcohol
20 copolymer has a weight average molecular weight of from 30,000 to 500,000, and preferably from 50,000 to 400,000.

According to preferred embodiments of the invention, the olefin-olefinic alcohol
copolymer has a molecular weight distribution no more than 4.0, for example 0.1, 0.5,
25 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0 and any value therebetween, and preferably from 1.0 to 4.0.

According to preferred embodiments of the invention, the content of the structural
units derived from the unsaturated carboxylic acid represented by Formula G' in the
olefin-unsaturated carboxylic acid copolymer is from 0.2 to 30.0 mol%, for example
30 0.4 mol%, 0.5 mol%, 0.7 mol%, 0.8 mol%, 1.0 mol%, 1.5 mol%, 2.0 mol%, 5.0 mol%, 8.0 mol%, 10.0 mol%, 15.0 mol%, 20.0 mol%, 25.0 mol%, 30.0 mol% and any value therebetween, and preferably from 0.7 to 10.0 mol%.

According to preferred embodiments of the invention, the olefin-unsaturated
carboxylic acid copolymer has a weight average molecular weight of from 30,000 to
35 500,000, and preferably from 50,000 to 400,000.

According to preferred embodiments of the invention, the olefin-unsaturated carboxylic acid copolymer has a molecular weight distribution no more than 4.0, for example 0.1, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0 and any value therebetween, and preferably from 1.0 to 4.0.

5 In the invention, the particle diameter of the spherical or spherical-like polymer is considered herein to be equal to the diameter of a sphere whose volume is equal to the volume of the particle.

According to another aspect of the invention, the use of the olefin-polar monomer copolymer as a polyolefin material is provided.

10 In the present disclosure, the symbols used in different general formulae or structural formulae, such as R^1 , R^2 , R^3 , R^4 , R^5 , R^6 , R^7 , R^8 , R^9 , R^{10} , R^{11} , R_{12} , R_3 , X, M, A, Y, etc. have the same definitions in each general formula or structural formula, unless specifically indicated.

In the present invention, the term "alkyl" refers to straight chain alkyl, branched chain alkyl or cycloalkyl. For example, C_1 - C_{20} alkyl refers to C_1 - C_{20} straight chain alkyl, C_3 - C_{20} branched chain alkyl or C_3 - C_{20} cycloalkyl. Examples of straight chain or branched chain alkyl include, but are not limited to, methyl, ethyl, n-propyl, isopropyl, n-butyl, sec-butyl, isobutyl, t-butyl, n-pentyl, isopentyl, tert-pentyl, neopentyl, n-hexyl, n-heptyl, n-octyl, and n-decyl.

20 Examples of C_3 - C_{20} cycloalkyl include, but are not limited to, cyclopropyl, cyclopentyl, cyclohexyl, 4-methylcyclohexyl, 4-ethylcyclohexyl, 4-n-propylcyclohexyl and 4-n-butylcyclohexyl.

Examples of C_6 - C_{20} aryl include, but are not limited to, phenyl, 4-methylphenyl, 4-ethylphenyl, dimethylphenyl, vinylphenyl.

25 Alkenyl refers to straight chain alkenyl, branched alkenyl or cycloalkenyl. For example, C_2 - C_{20} alkenyl refers to C_1 - C_{20} straight chain alkenyl, C_3 - C_{20} branched alkenyl, or C_3 - C_{20} cycloalkenyl. Examples of alkenyl include, but are not limited to, vinyl, allyl, butenyl.

30 Examples of C_7 - C_{20} aralkyl include, but are not limited to, phenylmethyl, phenylethyl, phenyl-n-propyl, phenylisopropyl, phenyl-n-butyl and phenyl-t-butyl.

Examples of C_7 - C_{20} alkaryl include, but are not limited to, tolyl, ethylphenyl, n-propylphenyl, isopropylphenyl, n-butylphenyl and t-butylphenyl.

The method for preparing a copolymer of an olefin and a polar monomer such as an olefinic alcohol or an unsaturated carboxylic acid provided by the present invention
35 uses a novel catalyst comprising a trinuclear metal complex. The catalyst has not

been reported. Therefore, the technical problem solved by the present invention is to provide a new preparation method of olefin-polar monomer copolymer.

Further, in the method for preparing olefin-olefinic alcohol copolymer provided by the present invention, by selecting the reacted olefinic alcohol monomer, the catalyst, and the suitable polymerization process, a spherical and/or spherical-like polymer with good morphology is directly prepared without subsequent processing steps such as granulation, and the resulting polymerization product is not prone to scale in the reactor and facilitates transportation.

Further, the method for preparing olefin-olefinic alcohol copolymer provided by the present invention eliminates the step of saponification reaction so that the preparation process is simpler than the process for preparing olefin-olefinic alcohol copolymer used in the existing industry.

Further, in the method for preparing olefin-unsaturated carboxylic acid copolymer provided by the present invention, by selecting the unsaturated carboxylic acid monomer, the catalyst, and the suitable polymerization process, a spherical and/or spherical-like polymer with good morphology is directly prepared without subsequent processing steps such as granulation, and the resulting polymerization product is not prone to scale in the reactor and facilitates transportation.

Further, the method for preparing olefin-unsaturated carboxylic acid copolymer provided by the present invention eliminates the step of saponification reaction so that the preparation process is simpler than the process for preparing olefin-unsaturated carboxylic acid copolymer used in the existing industry.

Description of the drawings

Fig. 1 is a structural unit diagram of the nickel complex Ni1 of Example 1 of the invention (for clarity, hydrogen atoms, dichloromethane solvent molecules and atoms for symmetry operations are not marked).

Fig. 2 is a photograph of the spherical and/or spherical-like polymer obtained in Example 2 of the invention.

Fig. 3 is a photograph of the olefin-unsaturated carboxylic acid polymer obtained in Example 20 of the invention.

Fig. 4 is a photograph of the spherical and/or spherical-like polymer obtained in Example 70 of the invention.

Examples

The present invention will be described in detail below in conjunction with examples and drawings, but it should be understood that the examples and drawings are used only to exemplarily illustrate the present invention, and do not constitute any limitation on the protection scope of the present invention. All reasonable alterations and combinations included in the scope of the inventive concept of the present invention fall into the protection scope of the present invention.

The analytical characterization instruments used in the present invention are as follows:

Prior to measurement, the polymer sample is washed with a dilute acid solution to make the metal content in the polymer ≤ 50 ppm.

1. Nuclear magnetic resonance instrument for determining the structure of complex ligand: Bruker DMX 300 (300MHz), with tetramethyl silicon (TMS) as the internal standard, measured at 25°C.

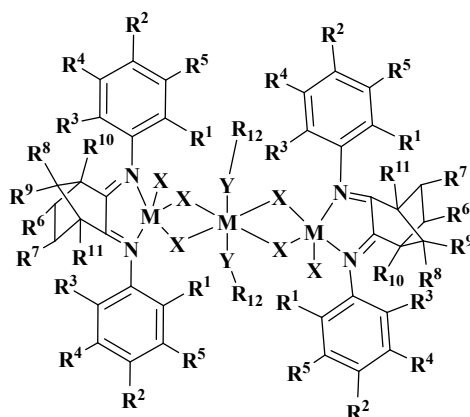
2. Analysis of comonomer content of polymer (the content of structural units derived from the olefinic alcohol represented by Formula G): measured through ^{13}C NMR spectra recorded on a 400MHz Bruker Avance 400 nuclear magnetic resonance spectrometer, using a 10mm PASEX 13 probe, with the polymer sample being dissolved in 1,2,4-trichlorobenzene at 120°C.

3. Analysis of comonomer content of copolymer (the content of structural units derived from the unsaturated carboxylic acid represented by Formula G'): measured through ^{13}C NMR spectra recorded on a 400MHz Bruker Avance 400 nuclear magnetic resonance spectrometer, using a 10mm PASEX 13 probe, with the polymer sample being dissolved in deuterated tetrachloroethane at 130°C.

4. Molecular weight and molecular weight distribution PDI ($\text{PDI} = \text{Mw}/\text{Mn}$) of polymer: PL-GPC220 chromatograph, with trichlorobenzene as solvent, measured at 150°C (standards: PS; flow rate: 1.0mL/min; Column: 3×PLgel 10um M1×ED-B 300×7.5nm).

5. Activity measurement method: gravimetric method, with activity being expressed as polymer weight (g) / nickel (mol) × 2.

The structure of the complexes involved in the following Examples 1-35 is shown by Formula IIIb:



Formula IIIb

Example 1

1) Preparation of ligand L₁:

Under nitrogen atmosphere, 2,6-diethylaniline (2.0 ml, 12 mmol) was dissolved in 20 ml of toluene, and 12 ml of trimethylaluminum (1.0M, 12 mmol) was added dropwise at room temperature. The reaction was refluxed for 2 hours, and the system was cooled to room temperature. Camphorquinone (0.831 g, 5 mmol) was added, and the system was refluxed for 6h. The reaction product was neutralized with aqueous sodium hydroxide solution and extracted with dichloromethane, and combined organic layers were dried over anhydrous magnesium sulfate and concentrated. The residues were then subjected to a column chromatography to afford yellow ligand L₁. Yield: 69.2 %. ¹H-NMR (CDCl₃): δ6.94-6.92 (m, 6H, C_{Ar}-CH₃), 2.56-2.51 (m, 4H, C_{Ar}-CH₃), 2.36-2.31 (m, 4H, C_{Ar}-CH₃), 1.82-1.78 (m, 4H, CH₂), 1.54 (m, 1H), 1.24-1.18 (m, 12H), 1.09 (s, 3H, CH₃), 0.94 (m, 6H, CH₃).

2) Preparation of complex Ni₁ (represented by structural Formula IIIb, wherein R¹, R³ are ethyl; R², R⁴-R⁷, R¹⁰ are hydrogen; R⁸, R⁹ and R¹¹ are methyl; R₁₂ is ethyl; M is nickel, Y is O, and X is Br):

A solution of 0.277g (0.9 mmol) of (DME)NiBr₂ in ethanol (10mL) was added slowly dropwise to a solution of 0.258 g (0.6 mmol) of ligand L₁ in dichloromethane (10mL). The color of the solution immediately changed to deep red, and a large quantity of precipitants was formed. The reaction was stirred at room temperature for 6h, and then anhydrous diethyl ether was added to perform precipitation. A filtration was performed to afford a filter cake, and the filter cake was washed with anhydrous diethyl ether and dried in vacuum to afford Ni₁ as brownish-red powdery solids. Yield: 78.2 %. Elemental analysis (calculated for C₆₄H₉₀Br₆N₄Ni₃O₂): C, 47.96; H, 5.66; N, 3.50; experimental value (%): C, 47.48; H, 6.00; N, 3.26.

3) Polymerization:

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time, 8.0 mg (5.0 µmol) of the complex Ni₁, 15 mmol (2.5 mL) of 2-methyl-2-hydroxy-7-octene, 15mL of AlEt₃ (1.0 mol/L solution in hexane), 6.5 mL of MAO (1.53 mol/L solution in toluene) were added. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 1 below.

Example 2

Copolymerization of ethylene and 2-methyl-2-hydroxy-7-octene was carried out according to the polymerization procedure described in Example 1, except that 30 mmol (5.1 mL) of 2-methyl-2-hydroxy-7-octene and 30mL of AlEt₃ (1.0 mol/L solution in hexane) were used. The polymerization activity and polymer performance parameters are shown in Table 1 below.

Figure 2 shows a photograph of the spherical and/or spherical-like polymer prepared in this Example.

Example 3

Copolymerization of ethylene and 2-methyl-2-hydroxy-7-octene was carried out according to the polymerization procedure described in Example 2, except that the polymerization temperature was 60 °C. The polymerization activity and polymer performance parameters are shown in Table 1 below.

Example 4

Copolymerization of ethylene and 2-methyl-2-hydroxy-7-octene was carried out according to the polymerization procedure described in Example 2, except that 0.5mL of diethyl zinc (1 mol/L solution in hexane) was further added together with the catalyst. The polymerization activity and polymer performance parameters are shown in Table 1 below.

Example 5

Copolymerization of ethylene and 2-methyl-2-hydroxy-7-octene was carried out

according to the polymerization procedure described in Example 4, except that 2 times quantity of the diethylzinc (i.e., 1.0 mL diethylzinc (1 mol/L solution in hexane)) was used. The polymerization activity and polymer performance parameters are shown in Table 1 below.

5

Example 6

Copolymerization of ethylene and 2-methyl-2-hydroxy-7-octene was carried out according to the polymerization procedure described in Example 1, except that 3.33 times quantity of the 2-methyl-2-hydroxy-7-octene (i.e., 50 mmol (8.5 mL) of 2-methyl-2-hydroxy-7-octene) and 3.33 times quantity of AlEt₃ (i.e., 50 mL of AlEt₃ (1.0 mol/L solution in hexane)) were used. The polymerization activity and polymer performance parameters are shown in Table 1 below.

10

Example 7

Copolymerization of ethylene and 2-methyl-2-hydroxy-7-octene was carried out according to the polymerization procedure described in Example 1, except that 6.67 times quantity of the 2-methyl-2-hydroxy-7-octene (i.e., 100 mmol (17.0 mL) of 2-methyl-2-hydroxy-7-octene) and 6.67 times quantity of the AlEt₃ (i.e., 100mL of AlEt₃ (1.0mol/L solution in hexane)) were used. The polymerization activity and polymer performance parameters are shown in Table 1 below.

15

20

Example 8

1) Preparation of ligand L₂:

Under nitrogen atmosphere, 2,6-diisopropylaniline (2.4 ml, 12 mmol) was dissolved in 20 ml of toluene, and 12 ml of trimethylaluminum (1.0M, 12 mmol) was added dropwise at room temperature. The reaction was refluxed for 2 hours, and the system was cooled to room temperature. Camphorquinone (0.831 g, 5 mmol) was added, and the reaction mixture was refluxed for 6h. The reaction product was neutralized with aqueous sodium hydroxide solution and extracted with dichloromethane, and combined organic layers were dried over anhydrous magnesium sulfate and concentrated. The residues were then subjected to a column chromatography to afford yellow ligand L₂. Yield: 41.3%. ¹H NMR (300 MHz, CDCl₃), δ (ppm): 7.06-6.81 (m, 6H, Ar-H), 2.88 (m, 4H, CH(CH₃)₂), 2.36 (m, 1H,), 1.86 (m, 4H, CH₂), 1.24 (d, 24H, CH(CH₃)₂), 0.96 (s, 6H, CH₃), 0.77 (s, 3H, CH₃).

30

35

2) Preparation of complex Ni₂ (represented by structural Formula IIIb, wherein R¹,

R³ are isopropyl; R², R⁴-R⁷, R¹⁰ are hydrogen; R⁸, R⁹ and R¹¹ are methyl; R₁₂ is ethyl; M is nickel, Y is O, and X is Br):

A solution of 0.277 g (0.9 mmol) of (DME)NiBr₂ in ethanol (10 mL) was added slowly dropwise to a solution of 0.291 g (0.6 mmol) of ligand L₂ in dichloromethane (10 mL). The color of the solution immediately changed to deep red, and a large quantity of precipitants was formed. The reaction was stirred at room temperature for 6 h, and then anhydrous diethyl ether was added to perform precipitation. A filtration was performed to afford a filter cake, and the filter cake was washed with anhydrous diethyl ether and dried in vacuum to afford Ni₂ as brownish-red powdery solids.

Yield: 74.0 %. Elemental analysis (calculated for C₇₂H₁₀₆Br₆N₄Ni₃O₂): C, 50.42; H, 6.23; N, 3.27; experimental value (%): C, 50.28; H, 6.42; N, 3.18.

3) Polymerization:

After having been continuously dried at 130 °C for 6 hrs, a 1 L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time, 8.6 mg (5.0 μmol) of the complex Ni₂, 30 mmol (5.1 mL) of 2-methyl-2-hydroxy-7-octene, 30 mL of AlEt₃ (1.0 mol/L solution in hexane), 6.5 mL of MAO (1.53 mol/L solution in toluene) were added. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 1 below.

Example 9

Copolymerization of ethylene and 2-methyl-2-hydroxy-7-octene was carried out according to the polymerization procedure described in Example 8, except that the polymerization temperature was 60 °C. The polymerization activity and polymer performance parameters are shown in Table 1 below.

Example 10

Ethylene copolymerization was carried out according to the polymerization procedure described in Example 8, except that 30 mmol (4.1 mL) of 3-methyl-5-hexen-3-ol was used as a comonomer. The polymerization activity and polymer performance parameters are shown in Table 1 below.

Example 11

1) Preparation of complex Ni₃ (represented by structural Formula IIIb, wherein R¹, R³ are isopropyl; R², R⁴-R⁷, R¹⁰ are hydrogen; R⁸, R⁹ and R¹¹ are methyl; R₁₂ is isobutyl; M is nickel, Y is O, and X is Br):

5 A solution of 0.277g (0.9 mmol) of (DME)NiBr₂ in 2-methyl-1-propanol (10mL) was added slowly dropwise to a solution of 0.291 g (0.6 mmol) of ligand L₂ in dichloromethane (10mL). The color of the solution immediately changed to deep red, and a large quantity of precipitants was formed. The reaction was stirred at room temperature for 6h, and then anhydrous diethyl ether was added to perform
10 precipitation. A filtration was performed to afford a filter cake, and the filter cake was washed with anhydrous diethyl ether and dried in vacuum to afford Ni₃ as brownish-red powdery solids. Yield: 76.0 %. Elemental analysis (calculated for C₇₆H₁₁₄Br₆N₄Ni₃O₂): C, 51.54; H, 6.49; N, 3.16; experimental value (%): C, 51.28; H, 6.82; N, 3.19.

15 2) Polymerization:

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 8.9 mg (5.0 μmol) of the complex Ni₃, 30 mmol (5.1
20 mL) of 2-methyl-2-hydroxy-7-octene, 30 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/L solution in toluene) were added. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer
25 performance parameters are shown in Table 1 below.

Example 12

Ethylene copolymerization was carried out according to the polymerization procedure described in Example 11, except that 30 mmol (4.5 mL) of
30 4-methyl-1-hepten-4-ol as a comonomer was used. The polymerization activity and polymer performance parameters are shown in Table 1 below.

Example 13

1) Preparation of ligand L₃:

35 Under nitrogen atmosphere, 2,4,6-trimethyl-aniline (1.7 ml, 12 mmol) was

dissolved in 20 ml of toluene, and 12 ml of trimethylaluminum (1.0M, 12 mmol) was added dropwise at room temperature. The reaction was refluxed for 2 hours, and the system was cooled to room temperature. Camphorquinone (0.831 g, 5 mmol) was added, and the system was refluxed for 6h. The reaction product was neutralized with aqueous sodium hydroxide solution, extracted with dichloromethane, dried, and concentrated, and then subjected to a column chromatography to afford yellow ligand L₃ in a yield of 62.5%. ¹HNMR (300 MHz, CDCl₃), δ (ppm) [with an isomer ratio of 1.2:1]: major isomer: 6.72 (s, 4H, Ar-H), 2.26-2.13 (m, 12H, C_{Ar}-CH₃), 1.87 (s, 6H, C_{Ar}-CH₃), 1.79 (m, 4H, CH₂), 1.42 (m, 1H), 1.26 (s, 3H, CH₃), 1.07 (s, 6H, CH₃); minor isomer: 6.67 (s, 4H, Ar-H), 2.09-2.01 (m, 12H, C_{Ar}-CH₃), 1.85 (s, 6H, C_{Ar}-CH₃), 1.79 (m, 4H, CH₂), 1.40 (m, 1H), 1.26 (s, 3H, CH₃), 0.94 (s, 6H, CH₃).

2) Preparation of complex Ni₄ (represented by the structural Formula IIIb, wherein R¹-R³ are methyl, R⁴-R⁷ and R¹⁰ are hydrogen, R⁸, R⁹ and R¹¹ are methyl, R₁₂ is ethyl, M is nickel, Y is O, and X is Br):

A solution of 0.277g (0.9 mmol) of (DME)NiBr₂ in ethanol (10mL) was added slowly dropwise to a solution of 0.240 g (0.6 mmol) of ligand L₃ in dichloromethane (10mL). The color of the solution immediately changed to deep red, and a large quantity of precipitants was formed. The reaction was stirred at room temperature for 6h, and then anhydrous diethyl ether was added to perform precipitation. A filtration was performed to afford a filter cake, and the filter cake was washed with anhydrous diethyl ether and dried in vacuum to afford Ni₄ as brownish-red powdery solids in a yield of 78.6 %. Elemental analysis (calculated for C₆₀H₈₂Br₆N₄Ni₃O₂): C, 46.59; H, 5.34; N, 3.62; experimental value (%): C, 46.24; H, 5.67; N, 3.21.

3) Polymerization:

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 7.7 mg (5 μmol) of the complex Ni₄ was added thereto, followed by evacuating and filling with ethylene to perform replacement 3 times. 500 mL of hexane, 30 mmol (5.1 mL) of 2-methyl-2-hydroxy-7-octene, and 30 mL of AlEt₃ (1.0 mol/L solution in hexane) were charged into the autoclave, followed by the addition of 6.5 mL of methylaluminoxane (MAO) (1.53 mol/l solution in toluene). The reaction was vigorously stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The results are shown in Table 1 below.

Example 14

1) Preparation of ligand L₄:

Under nitrogen atmosphere, 2,6-dimethyl-4-bromo-aniline (2.45 g, 12 mmol) was dissolved in 20 ml of toluene, and 12 ml of trimethylaluminum (1.0M, 12 mmol) was added dropwise at room temperature. The reaction was refluxed for 2 hours, and the system was cooled to room temperature. Camphorquinone (0.831 g, 5 mmol) was added, and the system was refluxed for 6h. The reaction product was neutralized with aqueous sodium hydroxide solution, extracted with dichloromethane, dried and concentrated, and then subjected to a column chromatography to afford yellow ligand L₄ in a yield of 60.7%. ¹HNMR (300 MHz, CDCl₃), δ (ppm) [with an isomer ratio of 1.1:1]: major isomer: 7.05 (s, 4H, Ar-H), 2.18 (m, 12H, CAr-CH₃), 1.85 (m, 4H, CH₂), 1.37 (m, 1H), 1.26 (s, 3H, CH₃), 1.06 (s, 6H, CH₃); minor isomer: 7.02 (s, 4H, Ar-H), 2.04 (m, 12H, CAr-CH₃), 1.85 (m, 4H, CH₂), 1.37 (m, 1H), 1.26 (s, 3H, CH₃), 0.96 (s, 6H, CH₃).

2) Preparation of complex Ni₅ (represented by the structural Formula IIIb, wherein R¹ and R³ are methyl, R² is bromine, R⁴-R⁷ and R¹⁰ are hydrogen, R⁸, R⁹ and R¹¹ are methyl, R₁₂ is ethyl, M is nickel, Y is O, and X is Br):

A solution of 0.278 g (0.9 mmol) of (DME)NiBr₂ in ethanol (10mL) was added slowly dropwise to a solution of 0.318 g (0.6 mmol) of ligand L₄ in dichloromethane (10mL). The color of the solution immediately changed to deep red, and a large quantity of precipitants was formed. The reaction was stirred at room temperature for 6h, and then anhydrous diethyl ether was added to perform precipitation. A filtration was performed to afford a filter cake, and the filter cake was washed with anhydrous diethyl ether and dried in vacuum to afford Ni₅ as brownish-red powdery solids in a yield of 74.1 %. Elemental analysis (calculated for C₅₆H₇₀Br₁₀N₄Ni₃O₂): C, 37.24; H, 3.91; N, 3.10; experimental value (%): C, 37.38; H, 4.30; N, 3.03.

3) Polymerization:

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 9.0 mg (5 μmol) of the complex Ni₅ was added thereto, followed by evacuating and filling with ethylene to perform replacement 3 times. 500 mL of hexane, 30 mmol (5.1 mL) of 2-methyl-2-hydroxy-7-octene, and 30 mL of AlEt₃ (1.0 mol/L solution in hexane) were charged into the autoclave, followed by the addition of 6.5 mL of methylaluminoxane

(MAO) (1.53 mol/l solution in toluene). The reaction was vigorously stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The results are shown in Table 1 below.

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Example 15

1) Preparation of ligand L₅:

Under nitrogen atmosphere, 2,6-diisopropyl-aniline (2.30 ml, 12 mmol) was dissolved in 20 ml of toluene, and 12 ml of trimethylaluminum (1.0M, 12 mmol) was added dropwise at room temperature. The reaction was refluxed for 2 hours, and the system was cooled to room temperature. Dione (1.225 g, 5 mmol) was added, and the system was refluxed for 6h. The reaction product was neutralized with aqueous sodium hydroxide solution, extracted with dichloromethane, dried and concentrated, and then subjected to a column chromatography to afford yellow ligand L₅ in a yield of 62.7%. ¹H NMR (300 MHz, CDCl₃), δ (ppm): 7.05-6.83 (m, 6H, Ar-H), 3.30(m, 2H, CH₂), 2.80 (m, 4H, CH(CH₃)₂), 1.55 (m, 1H), 1.83 (m, 4H, CH₂), 1.26 (d, 24H, CH(CH₃)₂), 0.99 (s, 6H, CH₃).

2) Preparation of complex Ni₆ (represented by the structural Formula IIIb, wherein R¹ and R³ are isopropyl, R², R⁴-R⁷ and R¹⁰ are hydrogen, R⁸ and R⁹ are methyl, R¹¹ is CH₂Br, R₁₂ is ethyl, M is nickel, Y is O, and X is Br):

A solution of 0.277 g (0.9 mmol) of (DME)NiBr₂ in ethanol (10mL) was added slowly dropwise to a solution of 0.338 g (0.6 mmol) of ligand L₅ in dichloromethane (10mL). The color of the solution immediately changed to deep red, and a large quantity of precipitants was formed. The reaction was stirred at room temperature for 6h, and then anhydrous diethyl ether was added to perform precipitation. A filtration was performed to afford a filter cake, and the filter cake was washed with anhydrous diethyl ether and dried in vacuum to afford Ni₆ as brownish-red powdery solids in a yield of 80.2 %. Elemental analysis (calculated for C₇₂H₁₀₄Br₈N₄Ni₃O₂): C, 46.17; H, 5.60; N, 2.99; experimental value (%): C, 46.24; H, 5.80; N, 3.13.

3) Polymerization:

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 9.4 mg (5 μmol) of the complex Ni₆ was added thereto, followed by evacuating and filling with ethylene to perform replacement 3 times. 500 mL of hexane, 30 mmol (5.1 mL) of

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2-methyl-2-hydroxy-7-octene, and 30 mL of AlEt₃ (1.0 mol/L solution in hexane) were charged into the autoclave, followed by the addition of 6.5 mL of methylaluminoxane (MAO) (1.53 mol/l solution in toluene). The reaction was vigorously stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The results are shown in Table 1 below.

Example 16

Ethylene copolymerization was carried out according to the polymerization procedure described in Example 2, except that 15 mL of a solution of N,N-dimethylanilinium tetrakis(pentafluorophenyl)borate in toluene (1 mmol/L toluene solution) was used instead of the MAO. The results are shown in Table 1 below.

Example 17

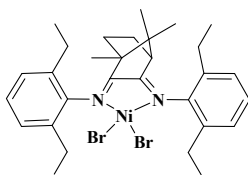
After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 8.0 mg (5.0 μmol) of the complex Ni₁, 30 mmol (6.0 mL) of 10-undecen-1-ol, 30 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/L solution in toluene) were added. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 1 below.

Example 18

Ethylene copolymerization was carried out according to the polymerization procedure described in Example 2, except that 500mL of toluene was used instead of the hexane. The results are shown in Table 1 below.

Comparative Example 1

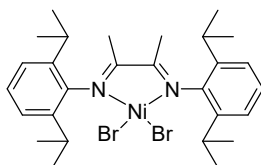
Ethylene copolymerization was carried out according to the polymerization procedure described in Example 1, except that 15 μmol of Comparative Catalyst A was used.



Comparative Catalyst A

Comparative Example 2

Ethylene copolymerization was carried out according to the polymerization
5 procedure described in Example 1, except that 15 μmol of Comparative Catalyst B was used.



Comparative Catalyst B

Table 1

No.	Complex	Polymerization Activity $10^6 \text{g} \cdot \text{mol}^{-1}(\text{Ni}) \cdot \text{h}^{-1}$	Mw ($\times 10^4$)	PDI	Alcohol content (mol %)	Whether is there spherical or spherical-like polymer particles in the copolymer?	Spherical particle diameter (mm)
Example 1	Ni ₁	20.2	34.4	2.02	0.67	Yes	3.5
Example 2	Ni ₁	26.7	48.2	1.92	1.37	Yes	3.8
Example 3	Ni ₁	21.7	20.2	1.98	1.21	No	
Example 4	Ni ₁	15.2	32.4	1.90	1.14	Yes	2.8
Example 5	Ni ₁	12.4	21.7	1.95	1.03	Yes	2.1
Example 6	Ni ₁	28.2	58.2	1.98	2.03	Yes	2.9
Example 7	Ni ₁	15.7	62.4	2.03	3.84	Yes	2.2
Example 8	Ni ₂	21.4	62.7	1.96	1.02	Yes	3.8
Example 9	Ni ₂	20.3	31.6	2.02	0.96	No	
Example 10	Ni ₂	11.7	20.6	2.02	0.98	Yes	3.6
Example 11	Ni ₃	16.4	51.2	2.01	0.94	Yes	3.4
Example 12	Ni ₃	13.3	42.7	2.04	0.93	Yes	3.2
Example 13	Ni ₄	33.2	13.4	2.01	1.48	Yes	2.8
Example 14	Ni ₅	35.1	14.9	1.98	1.46	Yes	2.9
Example 15	Ni ₆	18.4	40.3	2.02	0.94	Yes	3.0
Example 16	Ni ₁	24.2	43.3	2.04	1.36	Yes	3.3

Example 17	Ni ₁	18.2	37.8	2.08	1.52	No	
Example 18	Ni ₁	24.1	44.3	2.02	1.36	No	
Comp. Ex. 1	A	15.2	36.3	2.32	0.97	Yes	3.4
Comp. Ex. 2	B	3.41	64.3	2.35	0.92	No	

Example 19

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 8.0 mg (5.0 µmol) of the complex Ni₁, 15 mmol (2.55g) of 2,2-dimethyl-7-octenoic acid, 15 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/L solution in toluene) were added. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 2 below.

Example 20

Ethylene copolymerization was carried out according to the polymerization procedure described in Example 19, except that 2 times quantity of 2,2-dimethyl-7-octenoic acid and 2 times quantity of AlEt₃ were used. The results are shown in Table 1 below. The polymerization activity and polymer performance parameters are shown in Table 2 below.

Example 21

Ethylene copolymerization was carried out according to the polymerization procedure described in Example 20, except that polymerization temperature was 60 °C. The polymerization activity and polymer performance parameters are shown in Table 2 below.

Example 22

Ethylene copolymerization was carried out according to the polymerization procedure described in Example 20, except that 0.5 mL of diethylzinc (1 mol/L solution in hexane) was further added together with the catalyst. The polymerization

activity and polymer performance parameters are shown in Table 2 below.

Example 23

Ethylene copolymerization was carried out according to the polymerization procedure described in Example 20, except that 1.0 mL of diethylzinc (1 mol/L solution in hexane) was further added together with the catalyst. The polymerization activity and polymer performance parameters are shown in Table 2 below.

Example 24

Ethylene copolymerization was carried out according to the polymerization procedure described in Example 19, except that 3.33 times quantity (i.e., 50 mmol (8.51g)) of 2,2-dimethyl-7-octenoic acid and 3.33 times quantity (i.e., 50 mL) of AlEt_3 (1.0 mol/L solution in hexane) were used. The polymerization activity and polymer performance parameters are shown in Table 2 below.

Example 25

Ethylene copolymerization was carried out according to the polymerization procedure described in Example 19, except that 6.67 times quantity (i.e., 100 mmol (17.02 g)) of 2,2-dimethyl-7-octenoic acid and 6.67 times quantity (i.e., 100 mL) of AlEt_3 (1.0 mol/L solution in hexane) were used. The polymerization activity and polymer performance parameters are shown in Table 2 below.

Example 26

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N_2 gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 8.6 mg (5 μmol) of the complex Ni_2 , 30 mmol (5.10g) of 2,2-dimethyl-7-octenoic acid, 15 mL of AlEt_3 (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/L solution in toluene) were added. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 2 below.

Example 27

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 8.6 mg (5 µmol) of the complex Ni₂, 50 mmol (8.51g) of 2,2-dimethyl-7-octenoic acid, 50 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/L solution in toluene) were added. The reaction was stirred at 60 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 2 below.

Example 28

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 8.6 mg (5 µmol) of the complex Ni₂, 30 mmol (4.69 g) of 2,2-dimethyl-6-heptenoic acid, 30 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/L solution in toluene) were added. The reaction was stirred at 30 °C for 60 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 2 below.

Example 29

Ethylene copolymerization was carried out according to the polymerization procedure described in Example 20, except that 8.9 mg (5 µmol) of the complex Ni₃ was used as a catalyst. The polymerization activity and polymer performance parameters are shown in Table 2 below.

Example 30

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 7.7 mg (5 µmol) of the complex Ni₄ was added thereto, followed by evacuating and filling with ethylene to perform replacement 3 times. 500 mL of hexane, 30 mmol (5.10g) of 2,2-dimethyl-7-octenoic

acid, and 30 mL of AlEt₃ (1.0 mol/L solution in hexane) were charged into the autoclave, followed by the addition of 6.5 mL of methylaluminoxane (MAO) (1.53 mol/l solution in toluene). The reaction was vigorously stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The results are shown in Table 2 below.

Example 31

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 9.0 mg (5 μmol) of the complex Ni₅ was added thereto, followed by evacuating and filling with ethylene to perform replacement 3 times. 500 mL of hexane, 30 mmol (5.10g) of 2,2-dimethyl-7-octenoic acid, and 30 mL of AlEt₃ (1.0 mol/L solution in hexane) were charged into the autoclave, followed by the addition of 6.5 mL of methylaluminoxane (MAO) (1.53 mol/l solution in toluene). The reaction was vigorously stirred at 20 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The results are shown in Table 2 below.

Example 32

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 9.4 mg (5 μmol) of the complex Ni₆ was added thereto, followed by evacuating and filling with ethylene to perform replacement 3 times. 500 mL of hexane, 30 mmol (5.10g) of 2,2-dimethyl-7-octenoic acid, and 30 mL of AlEt₃ (1.0 mol/L solution in hexane) were charged into the autoclave, followed by the addition of 6.5 mL of methylaluminoxane (MAO) (1.53 mol/l solution in toluene). The reaction was vigorously stirred at 50 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The results are shown in Table 2 below.

Example 33

Ethylene copolymerization was carried out according to the polymerization

procedure described in Example 20, except that 15 mL of a solution of N,N-dimethylanilinium tetrakis(pentafluorophenyl)borate in toluene (1 mmol/L toluene solution) was used instead of MAO. The results are shown in Table 2 below.

5 Example 34

Ethylene copolymerization was carried out according to the polymerization procedure described in Example 20, except that 30 mmol (5.53g) of 10-undecenoic acid was used as a comonomer. The polymerization activity and polymer performance parameters are shown in Table 2 below.

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Example 35

Ethylene copolymerization was carried out according to the polymerization procedure described in Example 2, except that 500mL of toluene was used instead of the hexane. The polymerization activity and polymer performance parameters are

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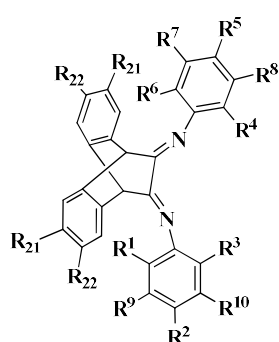
Table 2

No.	Complex	Polymerization Activity $10^6 \text{g} \cdot \text{mol}^{-1}(\text{Ni})\text{h}^{-1}$	Mn ($\times 10^4$)	Comonomer content (mol %)	Whether is there spherical and/or spherical-like polymer particles in the copolymer?
Example 19	Ni ₁	15.3	14.2	0.78	Yes
Example 20	Ni ₁	17.2	16.3	1.24	Yes
Example 21	Ni ₁	16.2	9.3	1.02	No
Example 22	Ni ₁	11.7	10.4	1.21	Yes
Example 23	Ni ₁	9.3	8.4	1.17	Yes
Example 24	Ni ₁	20.7	18.4	2.02	Yes
Example 25	Ni ₁	16.3	16.2	3.72	Yes
Example 26	Ni ₂	15.8	20.6	1.17	Yes
Example 27	Ni ₂	11.3	16.4	1.02	No
Example 28	Ni ₂	15.2	18.9	1.15	Yes
Example 29	Ni ₃	11.3	10.4	1.01	Yes
Example 30	Ni ₄	21.7	8.4	1.53	Yes

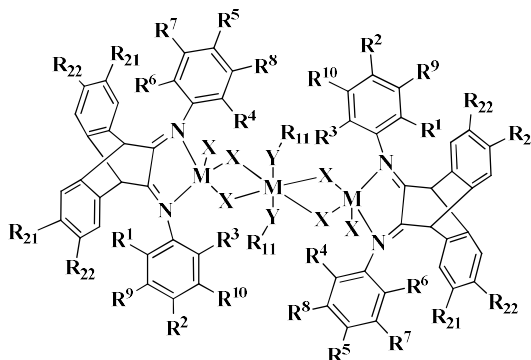
Example 31	Ni ₅	13.2	6.3	1.40	Yes
Example 32	Ni ₆	14.2	17.3	1.02	Yes
Example 33	Ni ₁₁	15.4	14.7	1.21	Yes
Example 34	Ni ₁₁	14.1	13.0	1.13	No
Example 35	Ni ₁₁	17.0	15.4	1.23	No

It can be seen from Table 2 that when the catalyst of the present invention catalyzes the copolymerization of ethylene and an unsaturated carboxylic acid, it exhibits higher polymerization activity, and the resulting polymer has a higher molecular weight. The catalyst of the present invention can have a copolymerization activity of up to $21.7 \times 10^6 \text{ g} \cdot \text{mol}^{-1}(\text{Ni}) \cdot \text{h}^{-1}$, and the molecular weight of the polymer can be adjusted in a wide range by the addition of a chain transfer agent. In addition, by adjusting the polymerization conditions, a copolymer product with good particle morphology can be obtained.

The following structural Formulae of ligands and complexes are mentioned in Example 36-68:



Formula B



Formula IIIc

Example 36

1) Ligand L₁₁ (represented by the structural Formula B, wherein R¹, R³, R⁴, and R⁶ are isopropyl, R², R⁵, R⁷-R¹⁰, R₂₁, and R₂₂ are hydrogen) was prepared by following the literature Organometallics, 2013, 32, 2291–2299.

2) Preparation of complex Ni₁₁ (represented by the structural Formula IIIc, wherein R¹, R³, R⁴, and R⁶ are isopropyl, R², R⁵, R⁷-R¹⁰, R₂₁, and R₂₂ are hydrogen, R₁₁ is ethyl, M is nickel, Y is O, and X is Br):

A solution of 0.277 g (0.9 mmol) of (DME)NiBr₂ in ethanol (10mL) was added slowly dropwise to a solution of 0.332 g (0.6 mmol) of ligand L₁₁ in dichloromethane (10mL). The color of the solution immediately changed to deep red, and a large

quantity of precipitants was formed. The reaction was stirred at room temperature for 6h, and then anhydrous diethyl ether was added to perform precipitation. A filtration was performed to afford a filter cake, and the filter cake was washed with anhydrous diethyl ether and dried in vacuum to afford Ni₁₁ as brownish-red powdery solids in a yield of 78.2 %. Elemental analysis (calculated for C₈₄H₉₈Br₆N₄Ni₃O₂): C, 54.50; H, 5.34; N, 3.03; experimental value (%): C, 54.38; H, 5.72; N, 3.16.

3) Polymerization:

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 9.3 mg (5 µmol) of the complex Ni₁₁, 15 mmol (2.5 mL) of 2-methyl-2-hydroxy-7-octene, 15 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/L solution in toluene) were added. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 3 below.

Example 37

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 9.3 mg (5 µmol) of the complex Ni₁₁, 30 mmol (5.1 mL) of 2-methyl-2-hydroxy-7-octene, 30 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/L solution in toluene) were added. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 3 below.

Example 38

Ethylene copolymerization was carried out according to the polymerization procedure described in Example 37, except that the polymerization temperature was 60 °C. The polymerization activity and polymer performance parameters are shown in Table 3 below.

Example 39

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 9.3 mg (5 µmol) of the complex Ni₁₁, 30 mmol (5.1 mL) of 2-methyl-2-hydroxy-7-octene, 30 mL of AlEt₃ (1.0 mol/L solution in hexane), 0.5 mL of diethylzinc (1mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/L solution in toluene) were added. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 3 below.

Example 40

Ethylene copolymerization was carried out according to the polymerization procedure described in Example 39, except that 2 times quantity (1.0 mL) of diethylzinc (1mol/L solution in hexane) was used. The polymerization activity and polymer performance parameters are shown in Table 3 below.

Example 41

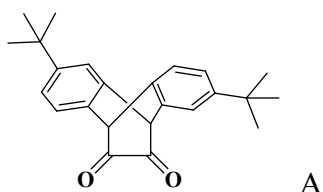
After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 9.3 mg (5 µmol) of the complex Ni₁₁, 50 mmol (8.5 mL) of 2-methyl-2-hydroxy-7-octene, 50 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/L solution in toluene) were added. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 3 below.

Example 42

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it

was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 9.3 mg (5 μmol) of the complex Ni₁₁, 100 mmol (17.0 mL) of 2-methyl-2-hydroxy-7-octene, 100 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/L solution in toluene) were added. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 3 below.

Example 43



1) Ligand L₁₂ (represented by the structural Formula B, wherein R¹, R³, R⁴ and R⁶ are ethyl, R², R⁵, R⁷-R¹⁰ and R₂₂ are hydrogen, and R₂₁ is tert-butyl) was prepared by following the Patent CN106397264 as follows. Compound A (2.7 g, 7.8 mmol) and 2,6-diethylaniline (3.0 ml, 17.4 mmol) were refluxed in the presence of p-toluenesulfonic acid (0.02 g) as a catalyst in 100mL of toluene for 1 day, and then the solvent was filtered off. The residue was dissolved in dichloromethane and then separated by over-basic alumina column chromatography with petroleum ether/ethyl acetate (20:1) as an eluant, with the second fraction being the target product. After removing the solvent, a yellow solid product was obtained at a yield of 81%. ¹H NMR (CDCl₃, δ, ppm): 1.06 (t, 12H, J = 7.0Hz), 1.19 ppm (s, 18H), 2.20 (dd, 8H, J = 7.0Hz), 4.70 (s, 2H), 7.04 (m, 10H), 7.13 (s, 2H).

2) Preparation of complex Ni₁₂ (represented by the structural Formula IIIc, wherein R¹, R³, R⁴ and R⁶ are ethyl, R², R⁵, R⁷-R¹⁰ and R₂₂ are hydrogen, R₂₁ is tert-butyl, R₁₁ is ethyl, M is nickel, Y is O, and X is Br):

A solution of 0.277 g (0.9 mmol) of (DME)NiBr₂ in ethanol (10mL) was added slowly dropwise to a solution of 0.365 g (0.6 mmol) of ligand L₂ in dichloromethane (10mL). The color of the solution immediately changed to deep red, and a large quantity of precipitants was formed. The reaction was stirred at room temperature for 6h, and then anhydrous diethyl ether was added to perform precipitation. A filtration was performed to afford a filter cake, and the filter cake was washed with anhydrous diethyl ether and dried in vacuum to afford Ni₁₂ as brownish-red powdery solids in a

yield of 82.0 %. Elemental analysis (calculated for $C_{92}H_{114}Br_6N_4Ni_3O_2$): C, 56.28; H, 5.85; N, 2.85; experimental value (%): C, 56.43; H, 6.12; N, 3.08.

3) Polymerization:

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N_2 gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 9.8 mg (5 μ mol) of the complex Ni_{12} , 30 mmol (5.1 mL) of 2-methyl-2-hydroxy-7-octene, 30 mL of $AlEt_3$ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/L solution in toluene) were added. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 3 below.

Example 44

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N_2 gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 9.8 mg (5 μ mol) of the complex Ni_{12} , 30 mmol (8.5 mL) of 2-methyl-2-hydroxy-7-octene, 30 mL of $AlEt_3$ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/L solution in toluene) were added. The reaction was stirred at 60 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 3 below.

Example 45

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N_2 gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 9.8 mg (5 μ mol) of the complex Ni_{12} , 30 mmol (4.1 mL) of 3-methyl-5-hexen-3-ol, 30 mL of $AlEt_3$ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/L solution in toluene) were added. The reaction was stirred at 30 °C for 60 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt%

hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 3 below.

Example 46

5 1) Preparation of ligand L₁₃ (represented by the structural Formula B, wherein R¹, R³, R⁴ and R⁶ are methyl, R² and R⁵ are bromine, R⁷-R¹⁰ and R₂₂ are hydrogen, R₂₁ is t-butyl): Compound A (1.77 g, 5.1 mmol) and 2,6-dimethyl-4-bromo-aniline (2.3 g, 11.3 mmol) were refluxed, in the presence of p-toluenesulfonic acid (0.02g) as a catalyst, in 100mL of toluene for 1 day. The solvent was filtered off, and the residue
10 was dissolved in dichloromethane and separated by column chromatography with petroleum ether/ethyl acetate as an eluant, to afford L₁₃ as yellow solids in a yield of 78 %. ¹H NMR (CDCl₃, δ, ppm): 1.84 (s, 12H), 1.19 ppm (s, 18H), 4.70 (s, 2H), 7.04 (8H), 7.12 (s, 2H).

2) Preparation of complex Ni₁₃ (represented by the structural Formula IIIc, wherein R¹, R³, R⁴ and R⁶ are methyl, R² and R⁵ are bromine, R⁷-R¹⁰ and R₂₂ are
15 hydrogen, R₂₁ is tert-butyl, R₁₁ is ethyl, M is nickel, Y is O, and X is Br):

A solution of 0.277 g (0.9 mmol) of (DME)NiBr₂ in ethanol (10mL) was added slowly dropwise to a solution of 0.426 g (0.6 mmol) of ligand L₁₃ in dichloromethane (10mL). The color of the solution immediately changed to deep red, and a large
20 quantity of precipitants was formed. The reaction was stirred at room temperature for 6h, and then anhydrous diethyl ether was added to perform precipitation. A filtration was performed to afford a filter cake, and the filter cake was washed with anhydrous diethyl ether and dried in vacuum to afford Ni₁₃ as brownish-red powdery solids in a yield of 82.0 %. Elemental analysis (calculated for C₈₄H₉₄Br₁₀N₄Ni₃O₂): C, 46.56; H,
25 4.37; N, 2.59; experimental value (%): C, 46.43; H, 4.72; N, 2.98.

3) Polymerization:

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the
30 autoclave, and at the same time 10.8 mg (5 μmol) of the complex Ni₁₃, 30 mmol (5.1 mL) of 2-methyl-2-hydroxy-7-octene, 30 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/L solution in toluene) were added. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10
35 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer

performance parameters are shown in Table 3 below.

Example 47

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 10.8 mg (5 µmol) of the complex Ni₁₃, 30 mmol (4.5mL) of 4-methyl-1-heptene-4-ol, 30 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/L solution in toluene) were added. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 3 below.

Example 48

1) Preparation of complex Ni₁₄ (represented by the structural Formula IIIc, wherein R¹, R³, R⁴ and R⁶ are ethyl, R², R⁵, R⁷-R¹⁰ and R₂₂ are hydrogen, R₂₁ is tert-butyl, R₁₁ is isobutyl, M is nickel, Y is O, and X is Br)

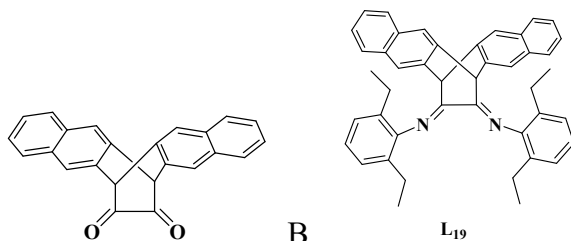
A solution of 0.277 g (0.9 mmol) of (DME)NiBr₂ in 2-methyl-1-propanol (10mL) was added slowly dropwise to a solution of 0.365 g (0.6 mmol) of ligand L₁₂ in dichloromethane (10mL). The color of the solution immediately changed to deep red, and a large quantity of precipitants was formed. The reaction was stirred at room temperature for 6h, and then anhydrous diethyl ether was added to perform precipitation. A filtration was performed to afford a filter cake, and the filter cake was washed with anhydrous diethyl ether and dried in vacuum to afford Ni₁₄ as brownish-red powdery solids in a yield of 83.0 %. Elemental analysis (calculated for C₉₆H₁₂₂Br₆N₄Ni₃O₂): C, 57.09; H, 6.09; N, 2.77; experimental value (%): C, 57.24; H, 6.32; N, 3.04.

2) Polymerization:

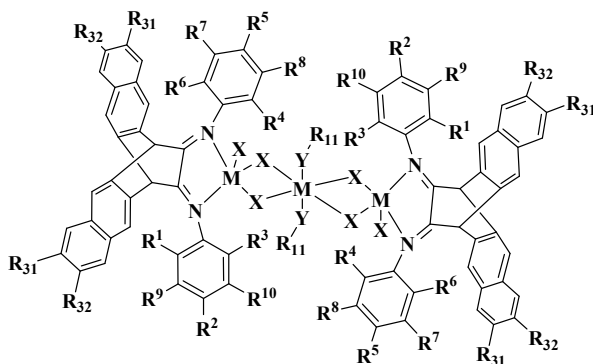
After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 10.1 mg (5 µmol) of the complex Ni₁₄ was added thereto, followed by evacuating and filling with ethylene to perform replacement 3 times. 500 mL of hexane, 30 mmol (5.1 mL) of 2-methyl-2-hydroxy-7-octene, and 30 mL of AlEt₃ (1.0 mol/L solution in hexane) were

charged into the autoclave, followed by the addition of 6.5 mL of methylaluminoxane (MAO) (1.53 mol/l solution in toluene). The reaction was vigorously stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The results are shown in Table 3 below.

Example 49



- 1) Ligand L₁₉ was prepared by following the method disclosed in patent application CN201510462932.2 and by using the compound B as a raw material.
- 2) Preparation of complex Ni₁₅ (represented by Formula IIIc', wherein R¹= R³= R⁴= R⁶=Et, R²= R⁵= R⁷-R¹⁰= R₃₁=R₃₂=H, R₁₁=Et, M=Ni, Y=O, X=Br):



Formula IIIc'

- A solution of 0.277 g (0.9 mmol) of (DME)NiBr₂ in ethanol (10mL) was added slowly dropwise to a solution of 0.358 g (0.6 mmol) of ligand L₁₉ in dichloromethane (10mL). The color of the solution immediately changed to deep red, and a large quantity of precipitants was formed. The reaction was stirred at room temperature for 6h, and then anhydrous diethyl ether was added to perform precipitation. A filtration was performed to afford a filter cake, and the filter cake was washed with anhydrous diethyl ether and dried in vacuum to afford Ni₁₅ as brownish-red powdery solids in a yield of 84.3 %. Elemental analysis (calculated for C₉₂H₉₀Br₆N₄Ni₃O₂): C, 56.98; H, 4.68; N, 2.89; experimental value (%): C, 56.78; H, 4.62; N, 3.18.

3) Polymerization:

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel

polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 9.7 mg (5 μmol) of the complex Ni₁₅ was added thereto, followed by evacuating and filling with ethylene to perform replacement 3 times. 500 mL of hexane, 30 mmol (5.1 mL) of 2-methyl-2-hydroxy-7-octene, and 30 mL of AlEt₃ (1.0 mol/L solution in hexane) were charged into the autoclave, followed by the addition of 6.5 mL of methylaluminoxane (MAO) (1.53 mol/l solution in toluene). The reaction was vigorously stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The results are shown in Table 3 below.

Example 50

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 9.3 mg (5 μmol) of the complex Ni₁₁, 30 mmol (5.1 mL) of 2-methyl-2-hydroxy-7-octene, and 30 mL of AlEt₃ (1.0 mol/L solution in hexane) were added thereto, followed by the addition of 15mL of a solution of N,N-dimethylanilinium tetrakis(pentafluorophenyl)borate in toluene (1 mmol/L toluene solution). The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 3 below.

Example 51

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 9.3 mg (5 μmol) of the complex Ni₁₁, 30 mmol (6.0 mL) of 10-undecen-1-ol, 30 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer

performance parameters are shown in Table 3 below.

Example 52

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of toluene was charged into the autoclave, and at the same time 9.3 mg (5 µmol) of the complex Ni₁₁, 30 mmol (5.1 mL) of 2-methyl-2-hydroxy-7-octene, 30 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 3 below.

Table 3

No.	Complex	Polymerization Activity 10 ⁶ g·mol ⁻¹ (Ni)·h ⁻¹	Mw (x10 ⁴)	PDI	Alcohol content (mol %)	Whether is there spherical and/or spherical-like polymer particles in the copolymer?
Example 36	Ni ₁₁	3.03	63.2	2.13	0.64	Yes
Example 37	Ni ₁₁	4.12	68.2	2.11	1.27	Yes
Example 38	Ni ₁₁	2.37	22.5	2.23	1.08	No
Example 39	Ni ₁₁	2.64	48.3	2.08	1.04	Yes
Example 40	Ni ₁₁	1.92	31.7	2.02	0.96	Yes
Example 41	Ni ₁₁	4.94	71.3	2.04	2.01	Yes
Example 42	Ni ₁₁	2.12	74.0	2.05	3.71	Yes
Example 43	Ni ₁₂	1.96	16.2	2.32	1.33	Yes
Example 44	Ni ₁₂	1.27	8.4	2.36	1.00	No
Example 45	Ni ₁₂	1.15	13.8	2.24	1.16	Yes
Example 46	Ni ₁₃	2.24	6.3	2.42	1.38	Yes
Example 47	Ni ₁₃	2.41	6.8	2.31	1.36	Yes
Example 48	Ni ₁₄	1.53	15.6	2.14	1.17	Yes
Example 49	Ni ₁₅	2.36	17.3	2.10	1.24	Yes
Example 50	Ni ₁₁	3.76	63.2	2.27	1.26	Yes

Example 51	Ni ₁₁	4.42	73.1	2.02	1.26	No
Example 52	Ni ₁₁	4.13	67.0	2.12	1.27	No

It can be seen from Table 3 that the catalyst of the present invention exhibits higher polymerization activity when catalyzing the copolymerization of ethylene and an enol, and the resulting polymer has a higher molecular weight. The catalyst of the invention can have a copolymerization activity of up to $4.94 \times 10^6 \text{ g} \cdot \text{mol}^{-1}(\text{Ni}) \cdot \text{h}^{-1}$. The molecular weight of the polymer can be adjusted in a wide range by the addition of a chain transfer agent. In addition, by adjusting the polymerization conditions, a copolymer product with good particle morphology can be obtained.

10 Example 53

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 9.3 mg (5 μmol) of the complex Ni₁₁, 15 mmol (2.55g) of 2,2-dimethyl-7-octenoic acid, 15 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 4 below.

Example 54

Ethylene copolymerization was carried out according to the procedure described in Example 53, except that 2 times quantity (30 mmol (5.10g)) of 2,2-dimethyl-7-octenoic acid and 2 times quantity (30mL) of AlEt₃ were used. The results are shown in Table 4 below.

Example 55

Ethylene copolymerization was carried out according to the procedure described in Example 54, except that polymerization temperature was 60 °C. The results are shown in Table 4 below.

Example 56

Ethylene copolymerization was carried out according to the procedure described in Example 54, except that 0.5 mL of diethylzinc (1 mol/L solution in hexane) was further added into the autoclave. The results are shown in Table 4 below.

5 Example 57

Ethylene copolymerization was carried out according to the procedure described in Example 54, except that 1.0 mL of diethylzinc (1 mol/L solution in hexane) was further added into the autoclave. The results are shown in Table 4 below.

10 Example 58

Ethylene copolymerization was carried out according to the procedure described in Example 53, except that 3.33 times quantity (50 mmol (8.51g)) of 2,2-dimethyl-7-octenoic acid and 3.33 times quantity (50mL) of AlEt₃ (1.0mol/L solution in hexane) were used. The results are shown in Table 4 below.

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Example 59

Ethylene copolymerization was carried out according to the procedure described in Example 53, except that 6.67 times quantity of 2,2-dimethyl-7-octenoic acid and 6.67 times quantity of AlEt₃ (1.0mol/L solution in hexane) were used. The results are shown in Table 4 below.

20

Example 60

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 9.8 mg (5 μmol) of the complex Ni₁₂, 30 mmol (5.10 g) of 2,2-dimethyl-7-octenoic acid, 30 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 4 below.

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Example 61

35 After having been continuously dried at 130°C for 6hrs, a 1L stainless steel

polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 9.8 mg (5 μmol) of the complex Ni₁₂, 50 mmol (8.51 g) of 2,2-dimethyl-7-octenoic acid, 50 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 60 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 4 below.

Example 62

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 9.8 mg (5 μmol) of the complex Ni₁₂, 30 mmol (4.69 g) of 2,2-dimethyl -6-heptenoic acid, 30 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 60 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 4 below.

Example 63

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 10.8 mg (5 μmol) of the complex Ni₁₃, 30 mmol (5.10 g) of 2,2-dimethyl-7-octenoic acid, 30 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 4 below.

Example 64

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 10.1 mg (5 μmol) of the complex Ni₁₄ was added thereto, followed by evacuating and filling with ethylene to perform replacement 3 times. 500 mL of hexane, 30 mmol (5.10g) of 2,2-dimethyl-7-octenoic acid, and 30 mL of AlEt₃ (1.0 mol/L solution in hexane) were charged into the autoclave, followed by the addition of 6.5 mL of methylaluminoxane (MAO) (1.53 mol/l solution in toluene). The reaction was vigorously stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The results are shown in Table 4 below.

Example 65

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 9.7 mg (5 μmol) of the complex Ni₁₅ was added thereto, followed by evacuating and filling with ethylene to perform replacement 3 times. 500 mL of hexane, 30 mmol (5.10g) of 2,2-dimethyl-7-octenoic acid, and 30 mL of AlEt₃ (1.0 mol/L solution in hexane) were charged into the autoclave, followed by the addition of 6.5 mL of methylaluminoxane (MAO) (1.53 mol/l solution in toluene). The reaction was vigorously stirred at 20 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The results are shown in Table 4 below.

Example 66

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 9.3 mg (5 μmol) of the complex Ni₁₁, 30 mmol (5.10 g) of 2,2-dimethyl-7-octenoic acid, and 30 mL of AlEt₃ (1.0 mol/L solution in hexane) were added thereto, followed by the addition of 15mL of a solution of N,N-dimethylanilinium tetrakis(pentafluorophenyl)borate in toluene (1 mmol/L toluene solution). The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized

with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 4 below.

5 Example 67

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 9.3 mg (5 µmol) of the complex Ni₁₁, 30 mmol (5.53 g) of 10-undecenoic acid, 30 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 4 below.

Example 68

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of toluene was charged into the autoclave, and at the same time 9.3 mg (5 µmol) of the complex Ni₁₁, 30 mmol (5.10 g) of 2,2-dimethyl-7-octenoic acid, 30 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 4 below.

Table 4

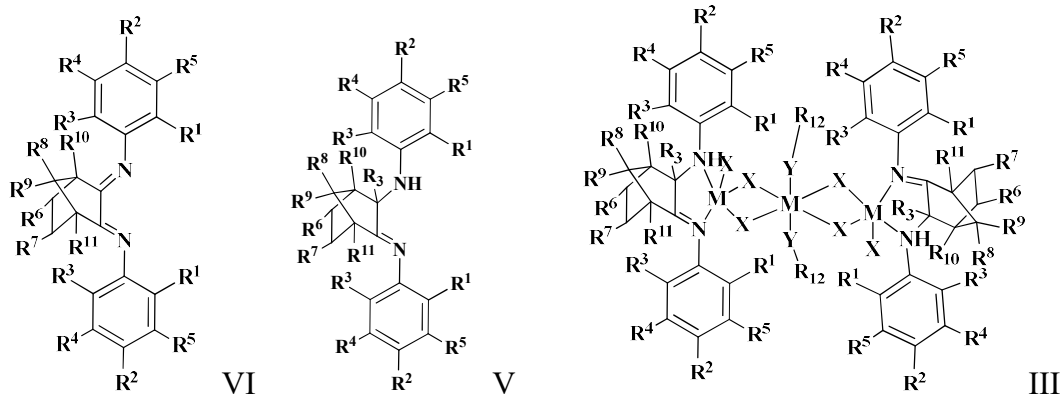
No.	Complex	Polymerization Activity 10 ⁶ g·mol ⁻¹ (Ni)h ⁻¹	Mn (x10 ⁴)	Comonomer content (mol %)	Whether is there spherical and/or spherical-like polymer particles in the copolymer?
Example 53	Ni ₁₁	1.54	18.4	0.72	Yes
Example 54	Ni ₁₁	1.86	22.1	1.10	Yes

Example 55	Ni ₁₁	1.12	10.3	0.92	No
Example 56	Ni ₁₁	1.20	13.4	1.04	Yes
Example 57	Ni ₁₁	0.98	8.4	1.01	Yes
Example 58	Ni ₁₁	2.12	24.4	1.98	Yes
Example 59	Ni ₁₁	1.63	19.2	3.20	Yes
Example 60	Ni ₁₂	1.13	12.6	1.14	Yes
Example 61	Ni ₁₂	1.20	13.4	2.02	No
Example 62	Ni ₁₂	1.22	12.9	1.15	Yes
Example 63	Ni ₁₃	2.42	8.4	1.41	Yes
Example 64	Ni ₁₄	1.06	10.7	1.10	Yes
Example 65	Ni ₁₅	1.37	14.4	1.14	Yes
Example 66	Ni ₁₁	1.70	21.4	1.06	Yes
Example 67	Ni ₁₁	1.35	20.2	1.10	No
Example 68	Ni ₁₁	1.38	20.4	1.09	No

It can be seen from Table 4 that when the catalyst of the present invention catalyzes the copolymerization of ethylene and an unsaturated carboxylic acid, it exhibits higher polymerization activity, and the resulting polymer has a higher molecular weight. The catalyst of the present invention can have a copolymerization activity of up to $2.42 \times 10^6 \text{ g} \cdot \text{mol}^{-1}(\text{Ni}) \cdot \text{h}^{-1}$, and the molecular weight of the polymer can be adjusted in a wide range by the addition of a chain transfer agent. In addition, by adjusting the polymerization conditions, a copolymer product with good particle morphology can be obtained.

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The compounds of the following structural Formulae are mentioned in the following examples:



Diimine Compound A21: α -diimine compound represented by Formula VI, wherein $R^1=R^3=Me$, $R^2=R^4=R^5=R^6=R^7=R^{10}=H$, $R^8=R^9=R^{11}=CH_3$;

Diimine Compound A22: α -diimine compound represented by Formula VI, wherein $R^1=R^3=iPr$, $R^2=R^4=R^5=R^6=R^7=R^{10}=H$, $R^8=R^9=R^{11}=CH_3$;

5 Ligand L21: amino-imine compound represented by Formula V, wherein $R^1=R^3=Me$, $R^2=R^4=R^5=R^6=R^7=R^{10}=H$, $R^8=R^9=R^{11}=CH_3$, $R_3=CH_3$;

Ligand L22: amino-imine compound represented by Formula V, wherein $R^1=R^3=iPr$, $R^2=R^4=R^5=R^6=R^7=R^{10}=H$, $R^8=R^9=R^{11}=CH_3$; $R_3=CH_3$;

10 Ligand L23: amino-imine compound represented by Formula V, wherein $R^1=R^3=iPr$, $R^2=R^4=R^5=R^6=R^7=R^{10}=H$, $R^8=R^9=R^{11}=CH_3$; $R_3=Et$;

Complex Ni21: complex represented by Formula III, wherein $R^1=R^3=Me$, $R^2=R^4=R^5=R^6=R^7=R^{10}=H$, $R^8=R^9=R^{11}=CH_3$, $R_3=CH_3$, $R_{12}=Et$, $M=Ni$, $Y=O$, $X=Br$;

Complex Ni22: complex represented by Formula III, wherein $R^1=R^3=iPr$, $R^2=R^4=R^5=R^6=R^7=R^{10}=H$, $R^8=R^9=R^{11}=CH_3$; $R_3=CH_3$, $R_{12}=Et$, $M=Ni$, $Y=O$, $X=Br$;

15 Complex Ni23: complex represented by Formula III, wherein $R^1=R^3=iPr$, $R^2=R^4=R^5=R^6=R^7=R^{10}=H$, $R^8=R^9=R^{11}=CH_3$; $R_3=Et$, $R_{12}=Et$, $M=Ni$, $Y=O$, $X=Br$.

Example 69

1) Preparation of ligand L21:

20 1.5 mL of 2,6-dimethylaniline (12 mmol) was reacted with 57 ml of 1M trimethylaluminum in toluene under refluxing for 3h. Then, camphorquinone (1.05 g, 5 mmol) was added thereto, and the reaction mixture was refluxed for 8 hours. After cooling, the reaction was terminated with sodium hydroxide/ice water, the reaction mixture was extracted with ethyl acetate, and organic phases were combined and dried over anhydrous magnesium sulfate. The product was separated by column
25 chromatography with petroleum ether/ethyl acetate as an eluent to obtain ligand L21 as colorless crystals in a yield of 70.2%. 1H NMR δ (ppm) 7.00-6.89 (m, 6H, Ar-H), 3.57 (s, 1H, NH), 2.18(s, 6H, CAr-CH₃), 2.05(s, 6H, CH₃), 1.74 (m, 4H, CH₂), 1.44 (s, 3H, CH₃), 1.35 (m, 1H), 1.21 (s, 3H, C H₃), 1.01 (s, 3H, CH₃), 0.87 (s, 3H, CH₃).

2) Preparation of complex Ni21:

30 A solution of (DME)NiBr₂ (277 mg, 0.9 mmol) in ethanol (10 mL) was added dropwise to a solution of ligand L21 (233 mg, 0.6 mmol) in dichloromethane (10 mL), and the resulting mixture was stirred at room temperature for 6h, with precipitants being generated. After filtering, the filter cake was washed with diethyl ether and dried to afford red powdery solids in a yield of 70%. Elemental analysis (calculated

for $C_{58}H_{82}Br_6N_4Ni_3O_2$): C, 45.75; H, 5.43; N, 3.68; experimental value (%): C, 45.56; H, 5.83; N, 3.46.

3) Polymerization:

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N_2 gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 7.6 mg (5 μ mol) of the complex Ni21, 15 mmol (2.5 mL) of 2-methyl-2-hydroxy-7-octene, 15mL of $AlEt_3$ (1.0 mol/L solution in hexane), and 6.5 mL of methylaluminoxane (MAO) (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 5 below.

Example 70

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N_2 gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 7.6 mg (5 μ mol) of the complex Ni21, 30 mmol (5.1 mL) of 2-methyl-2-hydroxy-7-octene, 30 mL of $AlEt_3$ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 5 below.

Fig. 4 shows a photograph of the spherical and/or spherical-like polymer prepared in this example.

Example 71

Ethylene copolymerization was carried out according to the procedure described in Example 70, except that polymerization temperature was 60 °C. The results are shown in Table 5 below.

Example 72

Ethylene copolymerization was carried out according to the procedure described in Example 70, except that 0.5 mL of diethylzinc (1 mol/L solution in hexane) was further added into the autoclave. The results are shown in Table 5 below.

5 Example 73

Ethylene copolymerization was carried out according to the procedure described in Example 70, except that 1.0 mL of diethylzinc (1 mol/L solution in hexane) was further added into the autoclave. The results are shown in Table 5 below.

10 Example 74

Ethylene copolymerization was carried out according to the procedure described in Example 69, except that 3.33 times quantity (50 mmol (8.5 mL)) of 2-methyl-2-hydroxy-7-octene and 3.33 times quantity (50mL) of AlEt₃ (1.0mol/L solution in hexane) were used. The results are shown in Table 5 below.

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Example 75

Ethylene copolymerization was carried out according to the procedure described in Example 69, except that 6.67 times quantity of 2-methyl-2-hydroxy-7-octene and 6.67 times quantity of AlEt₃ (1.0mol/L solution in hexane) were used. The results are shown in Table 5 below.

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Example 76

1) Preparation of ligand L22:

To a reaction flask were successively charged with 3.88 g (8 mmol) of α -diimine compound A22, 30 ml of toluene, and 1M trimethylaluminum (16 ml, 16 mmol), and the contents were allowed to react under reflux for 8 hours. The reaction was terminated with sodium hydroxide/ice water and extracted with ethyl acetate, and organic phases were combined and dried over anhydrous magnesium sulfate. The product was separated by column chromatography with petroleum ether/ethyl acetate as an eluent to obtain ligand L22 as colorless crystals in a yield of 84.2%. ¹HNMR δ (ppm) 7.19-7.06 (m, 6H, Ar-H), 3.42 (s, 1H, NH), 2.98 (m, 2H, CH(CH₃)₂), 2.88 (m, 2H, CH(CH₃)₂), 2.32 (m, 1H), 1.81 (m, 4H, CH₂), 1.50(s, 3H, CH₃), 1.21 (m, 24H, CH₃), 0.92 (s, 3H, CH₃), 0.75 (s, 3H, CH₃), 0.72 (s, 3H, CH₃).

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2) Preparation of complex Ni22:

A solution of (DME)NiBr₂ (277 mg, 0.9 mmol) in ethanol (10mL) was added

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dropwise to a solution of ligand L22 (300 mg, 0.6 mmol) in dichloromethane (10mL), and the resulting mixture was stirred at room temperature for 6h, with precipitants being generated. After filtering, the filter cake was washed with diethyl ether and dried to afford red powdery solids in a yield of 78 %. Elemental analysis (calculated for $C_{74}H_{114}Br_6N_4Ni_3O_2$): C, 50.87; H, 6.58; N, 3.21; experimental value (%): C, 50.57; H, 6.73; N, 3.04.

3) Polymerization:

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N_2 gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 8.7 mg (5 μ mol) of the complex Ni22, 30 mmol (5.1 mL) of 2-methyl-2-hydroxy-7-octene, 30 mL of $AlEt_3$ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 5 below.

Example 77

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N_2 gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 8.7 mg (5 μ mol) of the complex Ni22, 30 mmol (8.5 mL) of 2-methyl-2-hydroxy-7-octene, 30 mL of $AlEt_3$ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 60 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 5 below.

Example 78

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N_2 gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 8.7 mg (5 μ mol) of the complex Ni22, 30 mmol (4.1

mL) of 3-methyl-5-hexen-3-ol, 30 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 60 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 5 below.

Example 79

1) Preparation of ligand L23:

To a reaction flask were successively charged with 3.88 g (8 mmol) of α -diimine compound A22, 30ml of diethyl ether, and 2M diethylzinc (4 ml, 8 mmol), and the contents were stirred at room temperature for 3 hours. The reaction was terminated with ice water, the reaction mixture was extracted with ethyl acetate, and organic phases were combined and dried over anhydrous magnesium sulfate. The product was separated by column chromatography with petroleum ether/ethyl acetate as an eluent to obtain ligand L23 as colorless crystals with a yield of 52.1%. ¹HNMR δ (ppm) 7.17-7.06 (m, 6H, Ar-H), 4.44 (s, 1H, NH), 2.98 (m, 2H, CH(CH₃)₂), 2.87 (m, 2H, CH(CH₃)₂), 2.33 (m, 1H), 1.86 (m, 2H, CH₂), 1.81 (m, 4H, CH₂), 1.21 (m, 24H, CH₃), 1.08 (t, 3H, CH₃), 0.93 (s, 3H, CH₃), 0.75 (s, 3H, CH₃), 0.72 (s, 3H, CH₃).

2) Preparation of complex Ni23:

A solution of (DME)NiBr₂ (277 mg, 0.9 mmol) in ethanol (10 mL) was added dropwise to a solution of ligand L23 (309 mg, 0.6 mmol) in dichloromethane (10 mL), and the resulting mixture was stirred at room temperature for 6h, with precipitants being generated. After filtering, the filter cake was washed with diethyl ether and dried to afford red powdery solids in a yield of 72%. Elemental analysis (calculated for C₇₆H₁₁₈Br₆N₄Ni₃O₂): C, 51.42; H, 6.70; N, 3.16; experimental value (%): C, 51.29; H, 6.98; N, 3.04.

3) Polymerization:

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 8.9 mg (5 μ mol) of the complex Ni23, 30 mmol (5.1 mL) of 2-methyl-2-hydroxy-7-octene, 30 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained

at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 5 below.

5 Example 80

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 8.9 mg (5 µmol) of the complex Ni23, 30 mmol (4.5
10 mL) of 4-methyl-1-hepten-4-ol, 30 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer
15 performance parameters are shown in Table 5 below.

Example 81

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it
20 was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 7.6 mg (5 µmol) of the complex Ni21, 30 mmol (5.1 mL) of 2-methyl-2-hydroxy-7-octene, and 30 mL of AlEt₃ (1.0 mol/L solution in hexane) were added thereto, followed by the addition of 15 mL of a solution of N,N-dimethylanilinium tetrakis(pentafluorophenyl)borate in toluene (1 mmol/L
25 toluene solution). The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table
30 5 below.

Example 82

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the
35 autoclave, and at the same time 7.6 mg (5 µmol) of the complex Ni21, 30 mmol (6.0

mL) of 10-undecen-1-ol, 30 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 5 below.

Example 83

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of toluene was charged into the autoclave, and at the same time 7.6 mg (5 μmol) of the complex Ni21, 30 mmol (5.1 mL) of 2-methyl-2-hydroxy-7-octene, 30 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 5 below.

Table 5

No.	Complex	Polymerization Activity 10 ⁶ g·mol ⁻¹ (Ni)·h ⁻¹	Mw (x10 ⁴)	PDI	Alcohol content (mol %)	Whether is there spherical and/or spherical-like polymer particles in the copolymer?
Example 69	Ni21	2.72	18.4	1.72	0.71	Yes
Example 70	Ni21	3.02	20.1	1.68	1.14	Yes
Example 71	Ni21	1.03	6.4	1.60	0.93	No
Example 72	Ni21	1.63	12.0	1.50	1.02	Yes
Example 73	Ni21	1.07	7.6	1.12	0.96	Yes
Example 74	Ni21	2.96	20.8	1.73	1.42	Yes
Example 75	Ni21	1.54	21.7	1.86	2.37	Yes
Example 76	Ni22	5.17	38.6	1.57	1.02	Yes
Example 77	Ni22	4.12	14.6	1.77	0.92	No
Example 78	Ni22	4.33	33.1	1.64	1.01	Yes

Example 79	Ni23	2.12	18.3	1.67	0.99	Yes
Example 80	Ni23	2.07	16.4	1.70	1.02	Yes
Example 81	Ni21	2.76	18.3	1.65	1.11	Yes
Example 82	Ni21	3.12	21.6	1.66	1.12	No
Example 83	Ni21	3.04	19.6	1.65	1.15	No

It can be seen from Table 5 that when the catalyst of the present invention catalyzes the copolymerization of ethylene and an enol, it exhibits higher polymerization activity, and the resulting polymer has a higher molecular weight. The catalyst of the present invention can have a copolymerization activity of up to $5.17 \times 10^6 \text{ g} \cdot \text{mol}^{-1}(\text{Ni}) \cdot \text{h}^{-1}$, and the molecular weight of the polymer can be adjusted in a wide range by the addition of a chain transfer agent. In addition, by adjusting the polymerization conditions, a copolymer product with good particle morphology can be obtained.

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Example 84

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 7.6 mg (5 μmol) of the complex Ni21, 15 mmol (2.55g) of 2,2-dimethyl-7-octenoic acid, 15mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 6 below.

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Example 85

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 7.6 mg (5 μmol) of the complex Ni21, 30 mmol (5.10 g) of 2,2-dimethyl-7-octenoic acid, 30mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction

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was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 6 below.

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Example 86

Ethylene copolymerization was carried out according to the procedure described in Example 85, except that polymerization temperature was 60 °C. The results are shown in Table 6 below.

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Example 87

Ethylene copolymerization was carried out according to the procedure described in Example 85, except that 0.5 mL of diethylzinc (1 mol/L solution in hexane) was further added into the autoclave. The results are shown in Table 6 below.

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Example 88

Ethylene copolymerization was carried out according to the procedure described in Example 85, except that 1.0 mL of diethylzinc (1 mol/L solution in hexane) was further added into the autoclave. The results are shown in Table 6 below.

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Example 89

Ethylene copolymerization was carried out according to the procedure described in Example 84, except that 3.33 times quantity (50 mmol (8.51g)) of 2,2-dimethyl-7-octenoic acid and 3.33 times quantity (50mL) of AlEt₃ (1.0mol/L solution in hexane) were used. The results are shown in Table 6 below.

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Example 90

Ethylene copolymerization was carried out according to the procedure described in Example 84, except that 6.67 times quantity of 2,2-dimethyl-7-octenoic acid and 6.67 times quantity of AlEt₃ (1.0mol/L solution in hexane) were used. The results are shown in Table 6 below.

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Example 91

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it

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was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 8.7 mg (5 μmol) of the complex Ni22, 30 mmol (5.10 g) of 2,2-dimethyl-7-octenoic acid, 30mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 6 below.

Example 92

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 8.7 mg (5 μmol) of the complex Ni22, 50 mmol (8.51 g) of 2,2-dimethyl-7-octenoic acid, 50mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 60 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 6 below.

Example 93

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 8.7 mg (5 μmol) of the complex Ni22, 30 mmol (4.69 g) of 2,2-dimethyl-6-heptenoic acid, 30mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 60 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 6 below.

Example 94

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel

polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 8.9 mg (5 μmol) of the complex Ni23, 30 mmol (5.10 g) of 2,2-dimethyl-7-octenoic acid, 30mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 6 below.

Example 95

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 8.9 mg (5 μmol) of the complex Ni23, 30 mmol (4.26 g) of 2-isopropyl-4-pentenoic acid, 30mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 6 below.

Example 96

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 7.6 mg (5 μmol) of the complex Ni21, 30 mmol (5.10 g) of 2,2-dimethyl-7-octenoic acid, and 30 mL of AlEt₃ (1.0 mol/L solution in hexane) were added thereto, followed by the addition of 15mL of a solution of N,N-dimethylanilinium tetrakis(pentafluorophenyl)borate in toluene (1 mmol/L toluene solution). The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 6 below.

Example 97

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 7.6 mg (5 µmol) of the complex Ni21, 30 mmol (5.53 g) of 10-undecenoic acid, 30 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 6 below.

Example 98

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of toluene was charged into the autoclave, and at the same time 7.6 mg (5 µmol) of the complex Ni21, 30 mmol (5.10 g) of 2,2-dimethyl-7-octenoic acid, 30 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 6 below.

Table 6

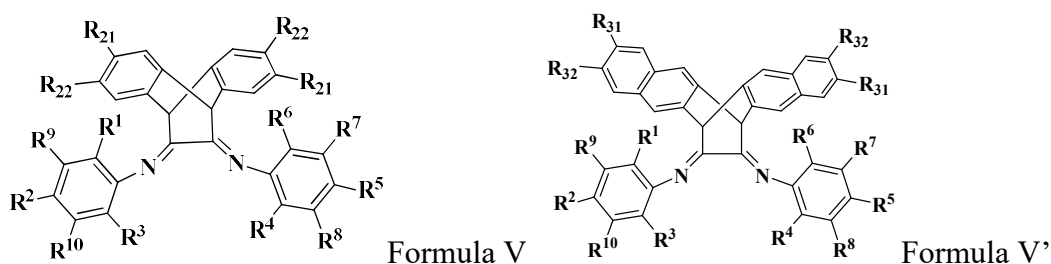
No.	Complex	Polymerization Activity 10 ⁶ g·mol ⁻¹ (Ni)·h ⁻¹	Mn (x10 ⁴)	Comonomer content (mol %)	Whether is there spherical and/or spherical-like polymer particles in the copolymer?
Example 84	Ni21	1.96	5.12	0.67	Yes
Example 85	Ni21	2.02	5.43	1.10	Yes
Example 86	Ni21	1.33	2.52	0.96	No
Example 87	Ni21	1.52	2.72	1.02	Yes
Example 88	Ni21	1.00	1.63	0.97	Yes

Example 89	Ni21	2.12	6.33	1.44	Yes
Example 90	Ni21	1.23	5.10	2.72	Yes
Example 91	Ni22	4.52	14.7	1.13	Yes
Example 92	Ni22	4.17	8.6	0.93	No
Example 93	Ni22	4.07	13.3	1.13	Yes
Example 94	Ni23	2.32	9.3	1.07	Yes
Example 95	Ni23	1.21	5.4	0.96	Yes
Example 96	Ni21	1.97	5.36	1.09	Yes
Example 97	Ni21	2.07	5.53	1.11	No
Example 98	Ni21	2.04	5.36	1.10	No

It can be seen from Table 6 that when the catalyst of the present invention catalyzes the copolymerization of ethylene and an unsaturated carboxylic acid, it exhibits higher polymerization activity, and the resulting polymer has a higher molecular weight. The catalyst of the present invention can have a copolymerization activity of up to $4.52 \times 10^6 \text{ g} \cdot \text{mol}^{-1}(\text{Ni}) \cdot \text{h}^{-1}$, and the molecular weight of the polymer can be adjusted in a wide range by the addition of a chain transfer agent. In addition, by adjusting the polymerization conditions, a copolymer product with good particle morphology can be obtained.

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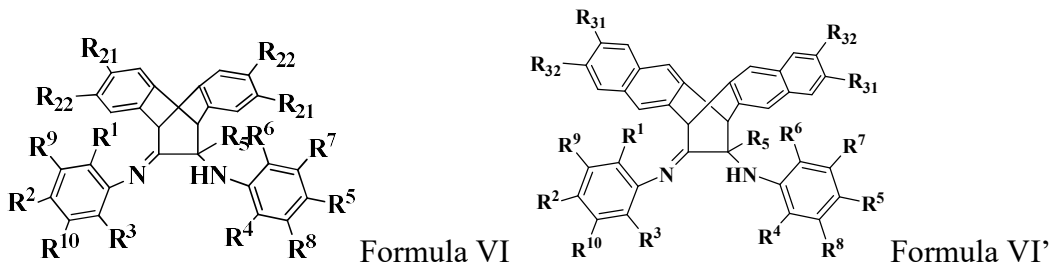
The following compounds, ligands and complexes are mentioned in the following examples:



Diimine Compound A31: α-diimine compound represented by Formula V, wherein $R^1=R^3=R^4=R^6=CH_3$, $R^2=R^5=R^7=R^8=R^9=R^{10}=R_{21}=R_{22}=H$;

Diimine Compound A32: α-diimine compound represented by Formula V, wherein $R^1=R^3=R^4=R^6=i\text{-Pr}$, $R^2=R^5=R^7=R^8=R^9=R^{10}=R_{21}=R_{22}=H$;

Diimine Compound A33: α-diimine compound represented by Formula V', wherein $R^1=R^3=R^4=R^6=Me$, $R^2=R^5=R^7=R^8=R^9=R^{10}=R_{31}=R_{32}=H$;

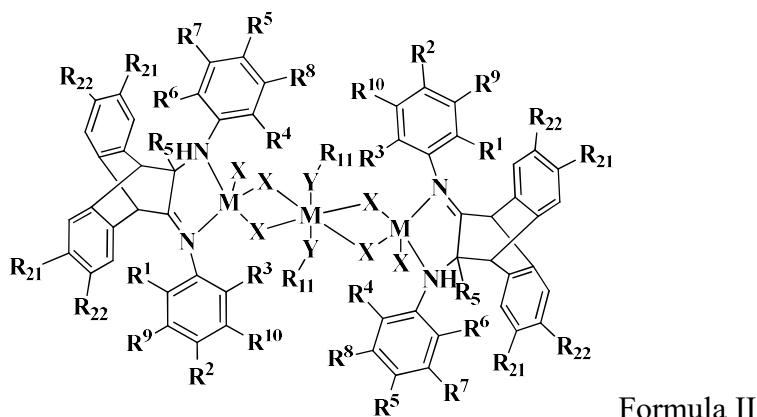


Ligand L31: amino-imine compound represented by Formula VI, wherein R¹=R³=R⁴=R⁶=CH₃, R²=R⁵=R⁷=R⁸=R⁹=R¹⁰=R²¹=R²²=H, R₅=CH₃;

Ligand L32: amino-imine compound represented by Formula VI, wherein R¹=R³=R⁴=R⁶=i-Pr, R²=R⁵=R⁷=R⁸=R⁹=R¹⁰=R²¹=R²²=H, R₅=CH₃;

Ligand L33: amino-imine compound represented by Formula VI, wherein R¹=R³=R⁴=R⁶=CH₃, R²=R⁵=R⁷=R⁸=R⁹=R¹⁰=R²¹=R²²=H, R₅=Et;

Ligand L34: amino-imine compound represented by Formula VI', wherein R¹=R³=R⁴=R⁶=Me, R²=R⁵=R⁷=R⁸=R⁹=R¹⁰=R₃₁=R₃₂=H, R₅=CH₃;



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Formula II

Complex Ni31: complex represented by Formula II, wherein R¹=R³=R⁴=R⁶=CH₃, R²=R⁵=R⁷=R⁸=R⁹=R¹⁰=R²¹=R²²=H, R₅=CH₃, R₁₁=Et, M=Ni, Y=O, X=Br;

Complex Ni32: complex represented by Formula II, wherein R¹=R³=R⁴=R⁶=iPr, R²=R⁵=R⁷=R⁸=R⁹=R¹⁰=R²¹=R²²=H; R₅=CH₃, R₁₁=Et, M=Ni, Y=O, X=Br;

Complex Ni33: complex represented by Formula II, wherein R¹=R³=R⁴=R⁶=iPr, R²=R⁵=R⁷=R⁸=R⁹=R¹⁰=R²¹=R²²=H; R₅=CH₃, R₁₁=isobutyl, M=Ni, Y=O, X=Br;

Complex Ni34: complex represented by Formula II, wherein R¹=R³=R⁴=R⁶=CH₃, R²=R⁵=R⁷=R⁸=R⁹=R¹⁰=R²¹=R²²=H; R₅=Et, R₁₁=Et, M=Ni, Y=O, X=Br;

Complex Ni35: complex represented by Formula II', wherein R¹=R³=R⁴=R⁶=CH₃, R²=R⁵=R⁷=R⁸=R⁹=R¹⁰=R₃₁=R₃₂=H; R₅=Me, R₁₁=Et, M=Ni, Y=O, X=Br.

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Example 99

1) Preparation of ligand L31:

To a reaction flask were successively charged with 3.52 g (8 mmol) of α -diimine compound A1, 30 ml of toluene, and 1M trimethylaluminum (16 mL, 16 mmol), and the reaction mixture was refluxed for 8 hours. The reaction was terminated with sodium hydroxide/ice water, the reaction mixture was extracted with ethyl acetate, and organic phases were combined and dried over anhydrous magnesium sulfate. The product was separated by column chromatography with petroleum ether/ethyl acetate as an eluent to obtain ligand L31 as colorless crystals with a yield of 85.2%. ^1H NMR δ (ppm) 7.23-6.88 (m, 14H), 4.84 (s, 1H), 4.73(s, 1H), 3.85 (s, 1H, NH), 2.02 (s, 3H, CH₃), 1.87 (s, 6H, CH₃), 1.75 (s, 6H, CH₃).

2) Preparation of complex Ni31:

10 mL solution of (DME)NiBr₂ (277 mg, 0.9 mmol) in ethanol was added dropwise to 10 mL solution of ligand L31 (274 mg, 0.6 mmol) in dichloromethane, and the resulting mixture was stirred at room temperature for 6h, with precipitants being generated. After filtering, the filter cake was washed with diethyl ether and dried to afford red powdery solids in a yield of 74 %. Elemental analysis (calculated for C₇₀H₇₄Br₆N₄Ni₃O₂): C, 50.68; H, 4.50; N, 3.38; experimental value (%): C, 50.53; H, 4.73; N, 3.21.

3) After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 8.3 mg (5 μ mol) of the complex Ni31, 15 mmol (2.5 mL) of 2-methyl-2-hydroxy-7-octene, 15mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 7 below.

Example 100

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 8.3 mg (5 μ mol) of the complex Ni31, 30 mmol (5.1 mL) of 2-methyl-2-hydroxy-7-octene, 30 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The

reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 7 below.

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Example 101

Ethylene copolymerization was carried out according to the procedure described in Example 100, except that polymerization temperature was 60 °C. The results are shown in Table 7 below.

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Example 102

Ethylene copolymerization was carried out according to the procedure described in Example 100, except that 0.5 mL of diethylzinc (1 mol/L solution in hexane) was further added into the autoclave. The results are shown in Table 7 below.

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Example 103

Ethylene copolymerization was carried out according to the procedure described in Example 100, except that 1.0 mL of diethylzinc (1 mol/L solution in hexane) was further added into the autoclave. The results are shown in Table 7 below.

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Example 104

Ethylene copolymerization was carried out according to the procedure described in Example 99, except that 3.33 times quantity of 2-methyl-2-hydroxy-7-octene and 3.33 times quantity of AlEt₃ (1.0mol/L solution in hexane) were used. The results are shown in Table 7 below.

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Example 105

Ethylene copolymerization was carried out according to the procedure described in Example 99, except that 6.67 times quantity of 2-methyl-2-hydroxy-7-octene and 6.67 times quantity of AlEt₃ (1.0mol/L solution in hexane) were used. The results are shown in Table 7 below.

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Example 106

1) Preparation of ligand L32:

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To a reaction flask were successively charged with 4.42 g (8 mmol) of α -diimine

compound A32, 30ml of toluene, and 1M trimethylaluminum (16 mL, 16 mmol), and the reaction mixture was refluxed for 8 hours. The reaction was terminated with sodium hydroxide/ice water, the reaction mixture was extracted with ethyl acetate, and organic phases were combined and dried over anhydrous magnesium sulfate. The product was separated by column chromatography with petroleum ether/ethyl acetate as an eluent to obtain ligand L32 as colorless crystals in a yield of 76.2%. ¹HNMR δ(ppm) 7.21-6.95 (m, 14H), 4.96(s, 1H), 4.87(s, 1H), 3.85 (s, 1H, NH), 2.51 (m, 4H, CH(CH₃)₂), 2.02(s, 3H, CH₃), 1.18 (d, 3H, CH₃), 1.11 (d, 3H, CH₃), 1.05 (d, 6H, CH₃), 0.98 (d, 6H, CH₃), 0.60 (d, 6H, CH₃).

2) Preparation of complex Ni32:

10 mL solution of (DME)NiBr₂ (277 mg, 0.9 mmol) in ethanol was added dropwise to 10 mL solution of ligand L2 (341 mg, 0.6 mmol) in dichloromethane, and the resulting mixture was stirred at room temperature for 6h, with precipitants being generated. After filtering, the filter cake was washed with diethyl ether and dried to afford red powdery solids in a yield of 76 %. Elemental analysis (calculated for C₈₆H₁₀₆Br₆N₄Ni₃O₂): C, 54.85; H, 5.67; N, 2.97; experimental value (%): C, 54.61; H, 5.73; N, 3.14.

3) Polymerization:

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 9.4 mg (5 μmol) of the complex Ni32, 30 mmol (5.1 mL) of 2-methyl-2-hydroxy-7-octene, 30 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 7 below.

Example 107

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 9.4 mg (5 μmol) of the complex Ni32, 30 mmol (8.5 mL) of 2-methyl-2-hydroxy-7-octene, 30 mL of AlEt₃ (1.0 mol/L solution in hexane),

and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 60 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 7 below.

Example 108

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 9.4 mg (5 µmol) of the complex Ni32, 30 mmol (4.1 mL) of 3-methyl-5-hexen-3-ol, 30 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 60 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 7 below.

Example 109

A solution of 277 mg (0.9 mmol) of (DME)NiBr₂ in 2-methyl-1-propanol (10mL) was added slowly dropwise to a solution of 341 mg (0.6 mmol) of ligand L32 in dichloromethane (10mL). The color of the solution immediately changed to deep red, and a large quantity of precipitants was formed. The reaction was stirred at room temperature for 6h, and then anhydrous diethyl ether was added to perform precipitation. A filtration was performed to afford a filter cake, and the filter cake was washed with anhydrous diethyl ether and dried in vacuum to afford Ni33 as brownish-red powdery solids in a yield of 84.0 %. FT-IR (KBr disc, cm⁻¹) 2969, 1677, 1628, 1462, 1342, 1109, 794, 760. Elemental analysis (calculated for C₉₀H₁₁₄Br₆N₄Ni₃O₂): C, 55.74; H, 5.92; N, 2.89; experimental value (%): C, 56.08; H, 6.12; N, 3.08.

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 9.7 mg (5 µmol) of the complex Ni33, 30 mmol (5.1 mL) of 2-methyl-2-hydroxy-7-octene, 30 mL of AlEt₃ (1.0 mol/L solution in hexane),

and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 60 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 7 below.

Example 110

1) Preparation of ligand L33:

To a reaction flask were successively charged with 3.52 g (8 mmol) of α -diimine compound A31, 30ml of diethyl ether, and 2M diethylzinc (4 mL, 8 mmol), and the reaction mixture was stirred at room temperature for 3 hours. The reaction was terminated with ice water, the reaction mixture was extracted with ethyl acetate, and organic phases were combined and dried over anhydrous magnesium sulfate. The product was separated by column chromatography with petroleum ether/ethyl acetate as an eluent to obtain ligand L33 as colorless crystals in a yield of 50.1%. ^1H NMR δ (ppm) 7.22-6.86 (m, 14H), 4.82 (s, 1H), 4.73(s, 1H), 3.85(s, 1H, NH), 2.04 (m, 2H, CH_2CH_3), 1.89 (s, 6H, CH_3), 1.74 (s, 6H, CH_3), 0.89 (t, 3H, CH_3).

2) Preparation of complex Ni34:

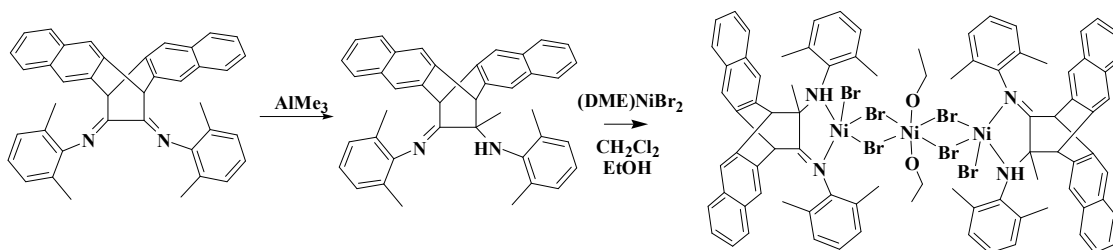
10 mL solution of (DME)NiBr₂ (277 mg, 0.9 mmol) in ethanol was added dropwise to 10 mL solution of ligand L3 (282 mg, 0.6 mmol) in dichloromethane, and the resulting mixture was stirred at room temperature for 6h, with precipitants being generated. After filtering, the filter cake was washed with diethyl ether and dried to afford red powdery solids in a yield 73 %. Elemental analysis (calculated for $\text{C}_{72}\text{H}_{78}\text{Br}_6\text{N}_4\text{Ni}_3\text{O}_2$): C, 51.26; H, 4.66; N, 3.32; experimental value (%): C, 51.39; H, 4.93; N, 3.24.

3) After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 8.4 mg (5 μmol) of the complex Ni34, 30 mmol (5.1 mL) of 2-methyl-2-hydroxy-7-octene, 30 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 7 below.

Example 111

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 8.4 mg (5 μmol) of the complex Ni34, 30 mmol (4.5 mL) of 4-methyl-1-heptene-4-ol, 30 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 7 below.

Example 112



1) Preparation of ligand L34:

To a reaction flask were successively charged with 4.32 g (8 mmol) of α-diimine compound A33, 30ml of toluene, and 1M trimethylaluminum (16 mL, 16 mmol), and the reaction mixture was stirred at room temperature for 3 hours. The reaction was terminated with ice water, the reaction mixture was extracted with ethyl acetate, and organic phases were combined and dried over anhydrous magnesium sulfate. The product was separated by column chromatography with petroleum ether/ethyl acetate as an eluent to obtain ligand L34 as colorless crystals in a yield of 72.1%. ¹HNMR δ(ppm) 7.68-7.54 (m, 8H), 7.37 (m, 4H), 7.11-7.04 (m, 6H), 5.16 (s, 1H), 5.08(s, 1H), 4.05(s, 1H, NH), 1.94 (s, 3H, CH₃), 1.89 (s, 6H, CH₃), 1.73 (s, 6H, CH₃).

2) Preparation of complex Ni35:

10 mL solution of (DME)NiBr₂ (277 mg, 0.9 mmol) in ethanol was added dropwise to 10 mL solution of ligand L34 (334 mg, 0.6 mmol) in dichloromethane, and the resulting mixture was stirred at room temperature for 6h, with precipitants being generated. After filtering, the filter cake was washed with diethyl ether and dried to afford red powdery solids in a yield of 72 %. Elemental analysis (calculated

for $C_{86}H_{82}Br_6N_4Ni_3O_2$): C, 55.56; H, 4.45; N, 3.01; experimental value (%): C, 55.74; H, 4.73; N, 3.14.

3) Polymerization:

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N_2 gas 3 times. 9.3 mg (5 μ mol) of the complex Ni35 was added thereto, followed by evacuating and filling with ethylene to perform replacement 3 times. 500 mL of hexane, 30 mmol (5.1 mL) of 2-methyl-2-hydroxy-7-octene, and 30 mL of $AlEt_3$ (1.0 mol/L solution in hexane) were charged into the autoclave, followed by the addition of 6.5 mL of methylaluminoxane (MAO) (1.53 mol/l solution in toluene). The reaction was vigorously stirred at 60 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The results are shown in Table 7 below.

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Example 113

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N_2 gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 8.3 mg (5 μ mol) of the complex Ni31, 30 mmol (5.1 mL) of 2-methyl-2-hydroxy-7-octene, and 30 mL of $AlEt_3$ (1.0 mol/L solution in hexane) were added thereto, followed by the addition of 15mL of a solution of N,N-dimethylanilinium tetrakis(pentafluorophenyl)borate in toluene (1 mmol/L toluene solution). The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 7 below.

30 Example 114

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N_2 gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 8.3 mg (5 μ mol) of the complex Ni31, 30 mmol (6.0 mL) of 10-undecen-1-ol, 30 mL of $AlEt_3$ (1.0 mol/L solution in hexane), and 6.5 mL

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of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 7 below.

Example 115

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of toluene was charged into the autoclave, and at the same time 8.3 mg (5 µmol) of the complex Ni31, 30 mmol (5.1 mL) of 2-methyl-2-hydroxy-7-octene, 30 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 7 below.

Table 7

No.	Complex	Polymerization Activity 10 ⁵ g·mol ⁻¹ (Ni)·h ⁻¹	Mw (x10 ⁴)	PDI	Alcohol content (mol %)	Whether is there spherical and/or spherical-like polymer particles in the copolymer?
Example 99	Ni31	3.66	15.7	1.54	0.78	Yes
Example 100	Ni31	3.89	16.8	1.42	1.13	Yes
Example 101	Ni31	2.12	10.1	1.96	0.98	No
Example 102	Ni31	3.12	11.7	1.24	1.09	Yes
Example 103	Ni31	2.37	6.9	1.23	1.06	Yes
Example 104	Ni31	4.04	18.9	1.32	1.43	Yes
Example 105	Ni31	3.10	14.8	1.40	2.16	Yes
Example 106	Ni32	5.27	50.4	1.25	1.02	Yes
Example 107	Ni32	3.96	25.7	2.02	0.96	No
Example 108	Ni32	4.88	49.2	1.21	1.02	Yes
Example 109	Ni33	4.16	41.7	1.23	1.01	Yes

Example 110	Ni34	2.02	13.4	1.40	1.10	Yes
Example 111	Ni34	2.04	12.7	1.42	1.11	Yes
Example 112	Ni35	4.46	18.7	1.38	1.19	Yes
Example 113	Ni31	3.64	15.7	1.45	1.13	Yes
Example 114	Ni31	3.84	18.7	1.37	1.16	No
Example 115	Ni31	3.91	16.7	1.40	1.14	No

It can be seen from Table 7 that when the catalyst of the present invention catalyzes the copolymerization of ethylene and an enol, it exhibits higher polymerization activity, and the resulting polymer has a higher molecular weight. The catalyst of the present invention can have a copolymerization activity of up to $5.27 \times 10^5 \text{ g} \cdot \text{mol}^{-1}(\text{Ni}) \cdot \text{h}^{-1}$, and the molecular weight of the polymer can be adjusted in a wide range by the addition of a chain transfer agent. In addition, by adjusting the polymerization conditions, a copolymer product with good particle morphology can be obtained.

Example 116

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 8.3 mg (5 μmol) of the complex Ni31, 15 mmol (2.55 g) of 2,2-dimethyl-7-octenoic acid, 15 mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 8 below.

Example 117

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 8.3 mg (5 μmol) of the complex Ni31, 30 mmol (5.10 g) of 2,2-dimethyl-7-octenoic acid, 30mL of AlEt₃ (1.0 mol/L solution in hexane), and

6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 8 below.

Example 118

Ethylene copolymerization was carried out according to the procedure described in Example 117, except that polymerization temperature was 60 °C. The results are shown in Table 8 below.

Example 119

Ethylene copolymerization was carried out according to the procedure described in Example 117, except that 0.5 mL of diethylzinc (1 mol/L solution in hexane) was further added into the autoclave. The results are shown in Table 8 below.

Example 120

Ethylene copolymerization was carried out according to the procedure described in Example 117, except that 1.0 mL of diethylzinc (1 mol/L solution in hexane) was further added into the autoclave. The results are shown in Table 8 below.

Example 121

Ethylene copolymerization was carried out according to the procedure described in Example 116, except that 3.33 times quantity (50 mmol (8.51g)) of 2,2-dimethyl-7-octenoic acid and 3.33 times quantity (50mL) of AlEt₃ (1.0mol/L solution in hexane) were used. The results are shown in Table 8 below.

Example 122

Ethylene copolymerization was carried out according to the procedure described in Example 116, except that 6.67 times quantity of 2,2-dimethyl-7-octenoic acid and 6.67 times quantity of AlEt₃ (1.0mol/L solution in hexane) were used. The results are shown in Table 8 below.

Example 123

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel

polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 9.4 mg (5 μmol) of the complex Ni32, 30 mmol (5.10 g) of 2,2-dimethyl-7-octenoic acid, 30mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 8 below.

Example 124

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 9.4 mg (5 μmol) of the complex Ni32, 50 mmol (8.51 g) of 2,2-dimethyl-7-octenoic acid, 50mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 60 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 8 below.

Example 125

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 9.4 mg (5 μmol) of the complex Ni32, 30 mmol (4.69 g) of 2,2-dimethyl-6-heptenoic acid, 30mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 8 below.

Example 126

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 9.7 mg (5 µmol) of the complex Ni33, 30 mmol (5.10 g) of 2,2-dimethyl-7-octenoic acid, 30mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 60 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 8 below.

Example 127

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 8.4 mg (5 µmol) of the complex Ni34, 30 mmol (5.10 g) of 2,2-dimethyl-7-octenoic acid, 30mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 8 below.

Example 128

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 8.4 mg (5 µmol) of the complex Ni34, 30 mmol (4.26 g) of 2-isopropyl-4-pentenoic acid, 30mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 8 below.

Example 129

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 9.3 mg (5 µmol) of the complex Ni35, 30 mmol (5.10 g) of 2,2-dimethyl-7-octenoic acid, 30mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 8 below.

Example 130

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 8.3 mg (5 µmol) of the complex Ni31, 30 mmol (5.10 g) of 2,2-dimethyl-7-octenoic acid, 30mL of AlEt₃ (1.0 mol/L solution in hexane), and 15 mL of a solution of N,N-dimethylanilinium tetrakis(pentafluorophenyl)borate in toluene (1 mmol/L toluene solution) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 8 below.

Example 131

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of hexane was charged into the autoclave, and at the same time 8.3 mg (5 µmol) of the complex Ni31, 30 mmol (5.53 g) of 10-undecenoic acid, 30mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer

performance parameters are shown in Table 8 below.

Example 132

After having been continuously dried at 130°C for 6hrs, a 1L stainless steel polymerization autoclave equipped with mechanical stirring was evacuated while it was hot and then filled with N₂ gas 3 times. 500 mL of toluene was charged into the autoclave, and at the same time 8.3 mg (5 µmol) of the complex Ni31, 30 mmol (5.10 g) of 2,2-dimethyl-7-octenoic acid, 30mL of AlEt₃ (1.0 mol/L solution in hexane), and 6.5 mL of MAO (1.53 mol/l solution in toluene) were added thereto. The reaction was stirred at 30 °C for 30 minutes, with ethylene pressure being maintained at 10 atm. The reaction mixture was finally neutralized with an ethanol solution acidified with 10 wt% hydrochloric acid to obtain a polymer. The polymerization activity and polymer performance parameters are shown in Table 8 below.

Table 8

No.	Complex	Polymerization Activity 10 ⁵ g·mol ⁻¹ (Ni)·h ⁻¹	Mn (x10 ⁴)	Comonomer content (mol %)	Whether is there spherical and/or spherical-like polymer particles in the copolymer?
Example 116	Ni31	2.67	6.73	0.72	Yes
Example 117	Ni31	3.08	7.13	1.16	Yes
Example 118	Ni31	2.71	4.64	1.03	No
Example 119	Ni31	2.52	5.37	1.09	Yes
Example 120	Ni31	1.73	2.86	1.04	Yes
Example 121	Ni31	3.32	7.70	1.44	Yes
Example 122	Ni31	2.44	6.21	2.38	Yes
Example 123	Ni32	4.64	17.26	1.02	Yes
Example 124	Ni32	3.27	12.38	0.98	No
Example 125	Ni32	4.41	15.82	1.03	Yes
Example 126	Ni33	4.07	13.24	1.01	Yes
Example 127	Ni34	2.42	4.67	1.02	Yes
Example 128	Ni34	2.13	4.24	1.03	Yes
Example 129	Ni35	3.68	7.96	1.21	Yes
Example 130	Ni31	3.01	7.02	1.14	Yes

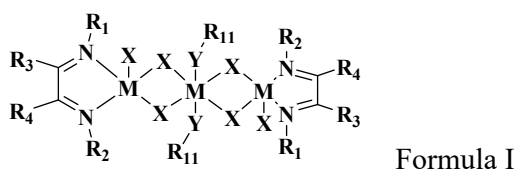
Example 131	Ni31	3.02	7.14	1.15	No
Example 132	Ni31	3.09	7.04	1.15	No

It can be seen from Table 8 that when the catalyst of the present invention catalyzes the copolymerization of ethylene and an unsaturated carboxylic acid, it exhibits higher polymerization activity, and the resulting polymer has a higher molecular weight. The catalyst of the present invention can have a copolymerization activity of up to $4.64 \times 10^5 \text{ g} \cdot \text{mol}^{-1}(\text{Ni}) \cdot \text{h}^{-1}$, and the molecular weight of the polymer can be adjusted in a wide range by the addition of a chain transfer agent. In addition, by adjusting the polymerization conditions, a copolymer product with good particle morphology can be obtained.

It should be noted that the above-described examples are only used to illustrate the present invention and do not constitute any limitation to the present invention. The present invention has been described with reference to typical examples, but it should be understood that the words used therein are descriptive and explanatory words, rather than restrictive words. The present invention may be modified within the scope of the claims of the present invention as stipulated, and the present invention may be revised without departing from the scope and spirit of the present invention. Although the present invention described therein relates to specific methods, materials and embodiments, it does not mean that the present invention is limited to the specific examples disclosed therein. On the contrary, the present invention can be extended to all other methods and applications with the same function.

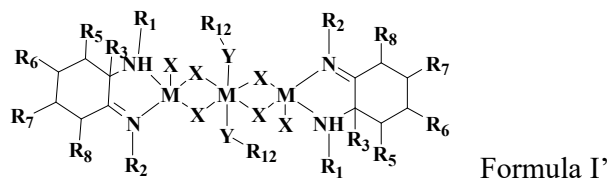
We claim:

1. A method for preparing an olefin-polar monomer copolymer, comprising copolymerizing an olefin and a polar monomer in the presence of a catalyst and optionally a chain transfer agent to produce the olefin-polar monomer copolymer, wherein, the catalyst comprises a main catalyst and optionally a cocatalyst, the main catalyst comprises a diimine-metal complex represented by Formula I:



wherein, R₁ and R₂ are each independently a C1-C30 hydrocarbyl with or without a substituent Q; R₃ and R₄ are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C20 hydrocarbyl with or without a substituent Q, and adjacent R₃ and R₄ groups are optionally joined to form a ring or ring system; each R₁₁ is independently a C1-C20 hydrocarbyl with or without a substituent Q; each Y is independently a Group VIA non-metal atom; each M is independently a Group VIII metal; each X is independently selected from the group consisting of halogen, C1-C10 hydrocarbyl with or without a substituent Q and C1-C10 hydrocarbyloxy with or without a substituent Q, or

an amino-imine metal complex represented by Formula I' :



wherein, R₁ and R₂ are each independently a C1-C30 hydrocarbyl with or without a substituent Q; each R₃ is independently selected from the group consisting of hydrogen and C1-C20 hydrocarbyl with or without a substituent Q; R₅ to R₈ are each independently selected from the group consisting of hydrogen, halogen, hydroxy, and C1-C20 hydrocarbyl with or without a substituent Q, and R₅ to R₈ groups are optionally joined to form a ring or ring system; each R₁₂ is independently a C1-C20 hydrocarbyl with or without a substituent Q; each Y is independently a Group VIA non-metal atom; each M is independently a Group VIII metal; each X is independently selected from the group consisting of halogen, C1-C10 hydrocarbyl with or without a substituent Q and C1-C10 hydrocarbyloxy with or without a substituent Q,

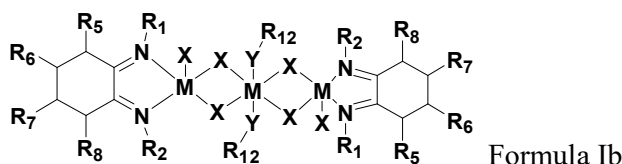
preferably, the polar monomer is a vinyl monomer carrying one or more

hydroxy groups and/or one or more carboxy group, and

wherein the substituent Q is selected from the group consisting of halogen, hydroxy, C1-C10 alkyl, halogenated C1-C10 alkyl, C1-C10 alkoxy and halogenated C1-C10 alkoxy.

2. The method as claimed in claim 1, having at least one of the following features:

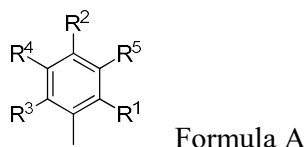
- the polar monomer is a vinyl monomer carrying one or more hydroxy groups, or the polar monomer is a vinyl monomer carrying one or more carboxy groups;
- the main catalyst comprises a diimine metal complex represented by Formula Ib:



wherein, R₁ and R₂ are each independently a C1-C30 hydrocarbyl with or without a substituent Q; R₅-R₈ are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C20 hydrocarbyl with or without a substituent Q, and R₅-R₈ are optionally joined to form a ring or ring system; each R₁₂ is independently a C1-C20 hydrocarbyl with or without a substituent Q; each Y is independently a Group VIA nonmetal atom; each M is independently a Group VIII metal; each X is independently selected from the group consisting of halogen, C1-C10 hydrocarbyl with or without a substituent Q and C1-C10 hydrocarbyloxy with or without a substituent Q.

3. The method as claimed in claim 2, having at least one of the following features:

- R₁ and R₂ are independently selected from the group consisting of C1-C20 alkyl with or without a substituent Q and C6-C20 aryl with or without a substituent Q, preferably R₁ and/or R₂ are/is a group represented by Formula A:



wherein R¹-R⁵ are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C20 alkyl with or without a substituent Q, C2-C20 alkenyl with or without a substituent Q, C2-C20 alkynyl with or without a substituent Q, C1-C20 alkoxy with or without a substituent Q, C2-C20 alkenoxy with or without a substituent Q, C2-C20 alkynoxy with or without a substituent Q, C6-C20 aryl with or

without a substituent Q, C6-C20 aryloxy with or without a substituent Q, C7-C20 aralkyl with or without a substituent Q, C7-C20 aralkoxy with or without a substituent Q, C7-C20 alkaryl with or without a substituent Q and C7-C20 alkaryloxy with or without a substituent Q, and R¹-R⁵ are optionally joined to form a ring or ring system;

preferably, R¹-R⁵ are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C10 alkyl with or without a substituent Q, C2-C10 alkenyl with or without a substituent Q, C2-C10 alkynyl with or without a substituent Q, C1-C10 alkoxy with or without a substituent Q, C2-C10 alkenoxy with or without a substituent Q, C2-C10 alkynoxy with or without a substituent Q, C6-C15 aryl with or without a substituent Q, C6-C15 aryloxy with or without a substituent Q, C7-C15 aralkyl with or without a substituent Q, C7-C15 aralkoxy with or without a substituent Q, C7-C15 alkaryl with or without a substituent Q and C7-C15 alkaryloxy with or without a substituent Q;

- each M is independently selected from the group consisting of nickel and palladium;

- each Y is independently selected from the group consisting of O and S;

- each X is independently selected from the group consisting of halogen, C1-C10 alkyl with or without a substituent Q and C1-C10 alkoxy with or without a substituent Q, preferably from the group consisting of halogen, C1-C6 alkyl with or without a substituent Q and C1-C6 alkoxy with or without a substituent Q;

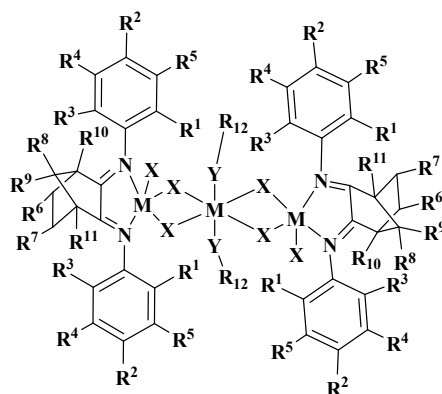
- each R₁₂ is independently a C1-C20 alkyl with or without a substituent Q, preferably a C1-C10 alkyl with or without a substituent Q, and more preferably a C1-C6 alkyl with or without a substituent Q; and

- the substituent Q is selected from the group consisting of halogen, hydroxy, C1-C6 alkyl, halogenated C1-C6 alkyl, C1-C6 alkoxy and halogenated C1-C6 alkoxy;

preferably, the C1-C6 alkyl is selected from the group consisting of methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, n-pentyl, isopentyl, n-hexyl, isohexyl and 3,3-dimethylbutyl;

preferably, the C1-C6 alkoxy is selected from the group consisting of methoxy, ethoxy, n-propoxy, iso-propoxy, n-butoxy, iso-butoxy, n-pentoxy, iso-pentoxy, n-hexoxy, iso-hexoxy and 3,3-dimethylbutoxy.

4. The method as claimed in claim 2 or 3, wherein the diimine metal complex is represented by Formula IIIb:



Formula IIIb

wherein, R^1 - R^{11} are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C20 alkyl with or without a substituent Q, C2-C20 alkenyl with or without a substituent Q, C2-C20 alkynyl with or without a substituent Q, C1-C20 alkoxy with or without a substituent Q, C2-C20 alkenoxy with or without a substituent Q, C2-C20 alkynoxy with or without a substituent Q, C6-C20 aryl with or without a substituent Q, C6-C20 aryloxy with or without a substituent Q, C7-C20 aralkyl with or without a substituent Q, C7-C20 aralkoxy with or without a substituent Q, C7-C20 alkaryl with or without a substituent Q and C7-C20 alkaryloxy with or without a substituent Q,

M, X, Y and R_{12} are as defined in claim 2.

5. The method as claimed in any one of claims 2 to 4, wherein in the diimine metal complex, R^1 - R^{11} are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C10 alkyl with or without a substituent Q, C2-C10 alkenyl with or without a substituent Q, C2-C10 alkynyl with or without a substituent Q, C1-C10 alkoxy with or without a substituent Q, C2-C10 alkenoxy with or without a substituent Q, C2-C10 alkynoxy with or without a substituent Q, C6-C15 aryl with or without a substituent Q, C6-C15 aryloxy with or without a substituent Q, C7-C15 aralkyl with or without a substituent Q, C7-C15 aralkoxy with or without a substituent Q, C7-C15 alkaryl with or without a substituent Q and C7-C15 alkaryloxy with or without a substituent Q;

preferably, R^1 - R^{11} are each independently selected from the group consisting of hydrogen, C1-C10 alkyl, halogenated C1-C10 alkyl, C1-C10 alkoxy, halogenated C1-C10 alkoxy and halogen, more preferably from the group consisting of hydrogen, C1-C6 alkyl, halogenated C1-C6 alkyl, C1-C6 alkoxy, halogenated C1-C6 alkoxy and halogen.

6. The method as claimed in any one of claims 2 to 5, wherein the diimine metal

- 1) the diimine metal complex represented by Formula III, wherein R¹=R³=methyl, R²=R⁴-R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=methyl, R₁₂=ethyl, M=Ni, Y=O, X=Br;
- 2) the diimine metal complex represented by Formula III, wherein R¹=R³=ethyl, R²=R⁴-R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=methyl, R₁₂=ethyl, M=Ni, Y=O, X=Br;
- 3) the diimine metal complex represented by Formula III, wherein R¹=R³=isopropyl, R²=R⁴-R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=methyl, R₁₂=ethyl, M=Ni, Y=O, X=Br;
- 4) the diimine metal complex represented by Formula III, wherein R¹-R³=methyl, R⁴-R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=methyl, R₁₂=ethyl, M=Ni, Y=O, X=Br;
- 5) the diimine metal complex represented by Formula III, wherein R¹=R³=methyl, R²=Br, R⁴-R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=methyl, R₁₂=ethyl, M=Ni, Y=O, X=Br;
- 6) the diimine metal complex represented by Formula III, wherein R¹=R³=F, R²=R⁴-R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=methyl, R₁₂=ethyl, M=Ni, Y=O, X=Br;
- 7) the diimine metal complex represented by Formula III, wherein R¹=R³=Cl, R²=R⁴-R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=methyl, R₁₂=ethyl, M=Ni, Y=O, X=Br;
- 8) the diimine metal complex represented by Formula III, wherein R¹=R³=Br, R²=R⁴-R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=methyl, R₁₂=ethyl, M=Ni, Y=O, X=Br;
- 9) the diimine metal complex represented by Formula III, wherein R¹=R³=methyl, R²=R⁴-R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=methyl, R₁₂=isobutyl, M=Ni, Y=O, X=Br;
- 10) the diimine metal complex represented by Formula III, wherein R¹=R³=ethyl, R²=R⁴-R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=methyl, R₁₂=isobutyl, M=Ni, Y=O, X=Br;
- 11) the diimine metal complex represented by Formula III, wherein R¹=R³=isopropyl, R²=R⁴-R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=methyl, R₁₂=isobutyl, M=Ni, Y=O, X=Br;
- 12) the diimine metal complex represented by Formula III, wherein R¹-R³=methyl, R⁴-R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=methyl, R₁₂=isobutyl, M=Ni, Y=O, X=Br;
- 13) the diimine metal complex represented by Formula III, wherein R¹=R³=methyl, R²=Br, R⁴-R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=methyl, R₁₂=isobutyl, M=Ni, Y=O, X=Br;
- 14) the diimine metal complex represented by Formula III, wherein R¹=R³=F, R²=R⁴-R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=methyl, R₁₂=isobutyl, M=Ni, Y=O, X=Br;
- 15) the diimine metal complex represented by Formula III, wherein R¹=R³=Cl, R²=R⁴-R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=methyl, R₁₂=isobutyl, M=Ni, Y=O, X=Br;
- 16) the diimine metal complex represented by Formula III, wherein R¹=R³=Br, R²=R⁴-R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=methyl, R₁₂=isobutyl, M=Ni, Y=O, X=Br;
- 17) the diimine metal complex represented by Formula III, wherein R¹=R³=methyl, R²=R⁴-R⁷=R¹⁰=H, R⁸=R⁹=methyl, R¹¹=bromomethyl, R₁₂=ethyl, M=Ni, Y=O, X=Br;

18) the diimine metal complex represented by Formula III, wherein $R^1 = R^3 = \text{ethyl}$, $R^2 = R^4 - R^7 = R^{10} = \text{H}$, $R^8 = R^9 = \text{methyl}$, $R^{11} = \text{bromomethyl}$, $R_{12} = \text{ethyl}$, $M = \text{Ni}$, $Y = \text{O}$, $X = \text{Br}$;

19) the diimine metal complex represented by Formula III, wherein $R^1 = R^3 = \text{isopropyl}$, $R^2 = R^4 - R^7 = R^{10} = \text{H}$, $R^8 = R^9 = \text{methyl}$, $R^{11} = \text{bromomethyl}$, $R_{12} = \text{ethyl}$, $M = \text{Ni}$, $Y = \text{O}$, $X = \text{Br}$;

20) the diimine metal complex represented by Formula III, wherein $R^1 - R^3 = \text{methyl}$, $R^4 - R^7 = R^{10} = \text{H}$, $R^8 = R^9 = \text{methyl}$, $R^{11} = \text{bromomethyl}$, $R_{12} = \text{ethyl}$, $M = \text{Ni}$, $Y = \text{O}$, $X = \text{Br}$;

21) the diimine metal complex represented by Formula III, wherein $R^1 = R^3 = \text{methyl}$, $R^2 = \text{Br}$, $R^4 - R^7 = R^{10} = \text{H}$, $R^8 = R^9 = \text{methyl}$, $R^{11} = \text{bromomethyl}$, $R_{12} = \text{ethyl}$, $M = \text{Ni}$, $Y = \text{O}$, $X = \text{Br}$;

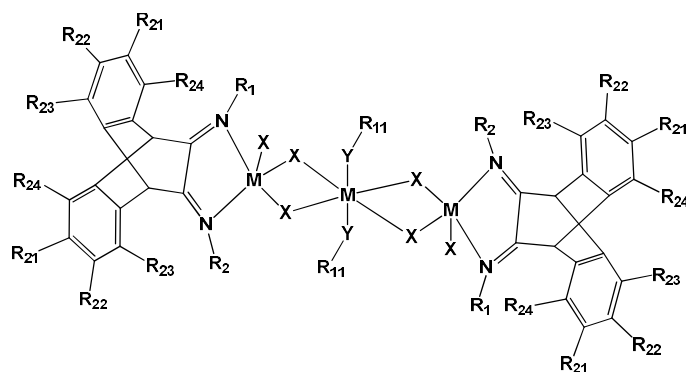
22) the diimine metal complex represented by Formula III, wherein $R^1 = R^3 = \text{F}$, $R^2 = R^4 - R^7 = R^{10} = \text{H}$, $R^8 = R^9 = \text{methyl}$, $R^{11} = \text{bromomethyl}$, $R_{12} = \text{ethyl}$, $M = \text{Ni}$, $Y = \text{O}$, $X = \text{Br}$;

23) the diimine metal complex represented by Formula III, wherein $R^1 = R^3 = \text{Cl}$, $R^2 = R^4 - R^7 = R^{10} = \text{H}$, $R^8 = R^9 = \text{methyl}$, $R^{11} = \text{bromomethyl}$, $R_{12} = \text{ethyl}$, $M = \text{Ni}$, $Y = \text{O}$, $X = \text{Br}$;

24) the diimine metal complex represented by Formula III, wherein $R^1 = R^3 = \text{Br}$, $R^2 = R^4 - R^7 = R^{10} = \text{H}$, $R^8 = R^9 = \text{methyl}$, $R^{11} = \text{bromomethyl}$, $R_{12} = \text{ethyl}$, $M = \text{Ni}$, $Y = \text{O}$, $X = \text{Br}$.

7. The method as claimed in claim 1, having at least one of the following features:

- the polar monomer is a vinyl monomer carrying one or more hydroxy groups, or the polar monomer is a vinyl monomer carrying one or more carboxy groups;
- the main catalyst comprises a diimine metal complex represented by Formula Ic:



Formula Ic

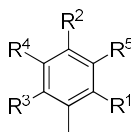
wherein, $R_{21} - R_{24}$ are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C20 hydrocarbyl with or without a substituent Q and C1-C20 hydrocarbyloxy with or without a substituent Q, and $R_{21} - R_{24}$ are optionally joined to form a ring or ring system;

R_1, R_2, R_{11}, Y, M and X are as defined in claim 1.

8. The method as claimed in claim 7, having at least one of the following

features:

- R₁ and R₂ are independently selected from the group consisting of C1-C20 alkyl with or without a substituent Q and C6-C20 aryl with or without a substituent Q, preferably R₁ and/or R₂ are/is a group represented by Formula A:



Formula A

wherein, R¹-R⁵ are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C20 alkyl with or without a substituent Q, C2-C20 alkenyl with or without a substituent Q, C2-C20 alkynyl with or without a substituent Q, C1-C20 alkoxy with or without a substituent Q, C2-C20 alkenoxy with or without a substituent Q, C2-C20 alkynoxy with or without a substituent Q, C6-C20 aryl with or without a substituent Q, C6-C20 aryloxy with or without a substituent Q, C7-C20 aralkyl with or without a substituent Q, C7-C20 aralkoxy with or without a substituent Q, C7-C20 alkaryl with or without a substituent Q and C7-C20 alkaryloxy with or without a substituent Q, and R¹-R⁵ are optionally joined to form a ring or ring system;

preferably, R¹-R⁵ are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C10 alkyl with or without a substituent Q, C2-C10 alkenyl with or without a substituent Q, C2-C10 alkynyl with or without a substituent Q, C1-C10 alkoxy with or without a substituent Q, C2-C10 alkenoxy with or without a substituent Q, C2-C10 alkynoxy with or without a substituent Q, C6-C15 aryl with or without a substituent Q, C6-C15 aryloxy with or without a substituent Q, C7-C15 aralkyl with or without a substituent Q, C7-C15 aralkoxy with or without a substituent Q, C7-C15 alkaryl with or without a substituent Q and C7-C15 alkaryloxy with or without a substituent Q;

- each M is independently selected from the group consisting of nickel and palladium;

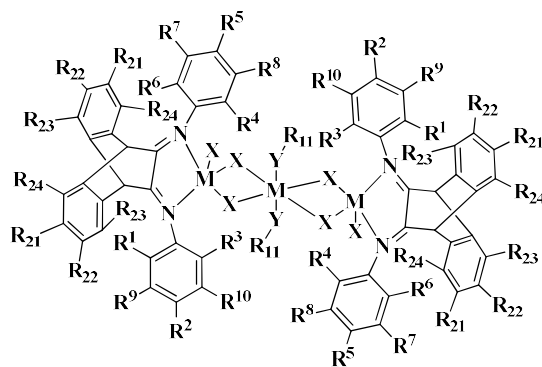
- each Y is independently selected from the group consisting of O and S;

- each X is independently selected from the group consisting of halogen, C1-C10 alkyl with or without a substituent Q and C1-C10 alkoxy with or without a substituent Q, preferably from the group consisting of halogen, C1-C6 alkyl with or without a substituent Q and C1-C6 alkoxy with or without a substituent Q;

- each R₁₁ is independently a C1-C20 alkyl with or without a substituent Q, preferably a C1-C10 alkyl with or without a substituent Q, more preferably a C1-C6 alkyl with or without a substituent Q; and

- the substituent Q is selected from the group consisting of halogen, hydroxy, C1-C6 alkyl, halogenated C1-C6 alkyl, C1-C6 alkoxy and halogenated C1-C6 alkoxy, preferably, the C1-C6 alkyl is selected from the group consisting of methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, n-pentyl, isopentyl, n-hexyl, isohexyl and 3,3-dimethylbutyl; preferably, the C1-C6 alkoxy is selected from the group consisting of methoxy, ethoxy, n-propoxy, iso-propoxy, n-butoxy, iso-butoxy, n-pentoxy, iso-pentoxy, n-hexoxy, iso-hexoxy and 3,3-dimethylbutoxy.

9. The method as claimed in claim 7 or 8, wherein the diimine metal complex has a structure represented by Formula IIIc:



Formula IIIc

wherein, R^1 - R^{10} , R_{21} - R_{24} are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C20 alkyl with or without a substituent Q, C2-C20 alkenyl with or without a substituent Q, C2-C20 alkynyl with or without a substituent Q, C1-C20 alkoxy with or without a substituent Q, C2-C20 alkenoxy with or without a substituent Q, C2-C20 alkynoxy with or without a substituent Q, C6-C20 aryl with or without a substituent Q, C6-C20 aryloxy with or without a substituent Q, C7-C20 aralkyl with or without a substituent Q, C7-C20 aralkoxy with or without a substituent Q, C7-C20 alkaryl with or without a substituent Q and C7-C20 alkaryloxy with or without a substituent Q, and R^1 - R^{10} are optionally joined to form a ring or ring system, R_{21} - R_{24} are optionally joined to form a ring or ring system;

R_{11} , Y, M and X are as defined in claim 7.

10. The method as claimed in any one of claims 7 to 9, wherein in the diimine metal complex, R^1 - R^{10} , R_{21} - R_{24} are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C10 alkyl with or without a substituent Q, C2-C10 alkenyl with or without a substituent Q, C2-C10 alkynyl with or without a substituent Q, C1-C10 alkoxy with or without a substituent Q, C2-C10 alkenoxy with or without a substituent Q, C2-C10 alkynoxy with or without a substituent Q, C6-C15 aryl

with or without a substituent Q, C6-C15 aryloxy with or without a substituent Q, C7-C15 aralkyl with or without a substituent Q, C7-C15 aralkoxy with or without a substituent Q, C7-C15 alkaryl with or without a substituent Q and C7-C15 alkaryloxy with or without a substituent Q;

preferably, R^1 - R^{10} , R_{21} - R_{24} are each independently selected from the group consisting of hydrogen, C1-C10 alkyl, halogenated C1-C10 alkyl, C1-C10 alkoxy, halogenated C1-C10 alkoxy and halogen, more preferably from the group consisting of hydrogen, C1-C6 alkyl, halogenated C1-C6 alkyl, C1-C6 alkoxy, halogenated C1-C6 alkoxy and halogen.

11. The method as claimed in any one of claims 7 to 10, wherein the diimine metal complex is selected from the group consisting of:

1) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6$ =isopropyl, $R^2=R^5=R^7$ - $R^{10}=R_{21}=R_{22}=R_{23}=R_{24}$ =H, R_{11} =ethyl, M =Ni, Y =O, X =Br;

2) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6$ =ethyl, $R^2=R^5=R^7$ - $R^{10}=R_{21}=R_{22}=R_{23}=R_{24}$ =H, R_{11} =ethyl, M =Ni, Y =O, X =Br;

3) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6$ =methyl, $R^2=R^5=R^7$ - $R^{10}=R_{21}=R_{22}=R_{23}=R_{24}$ =H, R_{11} =ethyl, M =Ni, Y =O, X =Br;

4) the complex represented by Formula IIIc, wherein R^1 - R^6 =methyl, R^7 - $R^{10}=R_{21}=R_{22}=R_{23}=R_{24}$ =H, R_{11} =ethyl, M =Ni, Y =O, X =Br;

5) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6$ =Br, $R^2=R^5=R^7$ - $R^{10}=R_{21}=R_{22}=R_{23}=R_{24}$ =H, R_{11} =ethyl, M =Ni, Y =O, X =Br;

6) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6$ =Cl, $R^2=R^5=R^7$ - $R^{10}=R_{21}=R_{22}=R_{23}=R_{24}$ =H, R_{11} =ethyl, M =Ni, Y =O, X =Br;

7) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6$ =F, $R^2=R^5=R^7$ - $R^{10}=R_{21}=R_{22}=R_{23}=R_{24}$ =H, R_{11} =ethyl, M =Ni, Y =O, X =Br;

8) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6$ =isopropyl, $R^2=R^5=R^7$ - $R^{10}=R_{21}=R_{22}=R_{23}=R_{24}$ =H, R_{11} =isobutyl, M =Ni, Y =O, X =Br;

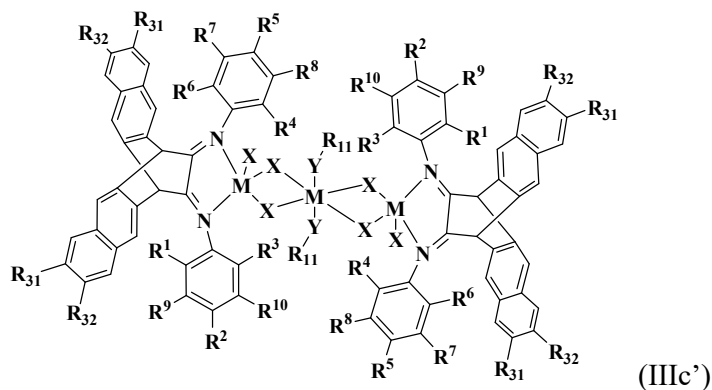
9) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6$ =ethyl, $R^2=R^5=R^7$ - $R^{10}=R_{21}=R_{22}=R_{23}=R_{24}$ =H, R_{11} =isobutyl, M =Ni, Y =O, X =Br;

10) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6$ =methyl, $R^2=R^5=R^7$ - $R^{10}=R_{21}=R_{22}=R_{23}=R_{24}$ =H, R_{11} =isobutyl, M =Ni, Y =O, X =Br;

11) the complex represented by Formula IIIc, wherein R^1 - R^6 =methyl, R^7 - $R^{10}=R_{21}=R_{22}=R_{23}=R_{24}$ =H, R_{11} =isobutyl, M =Ni, Y =O, X =Br;

12) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6$ =Br, $R^2=R^5=R^7$ - $R^{10}=R_{21}=R_{22}=R_{23}=R_{24}$ =H, R_{11} =isobutyl, M =Ni, Y =O, X =Br;

- 13) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6=Cl$, $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=R_{23}=R_{24}=H$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 14) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6=F$, $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=R_{23}=R_{24}=H$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 15) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6=isopropyl$, $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_{23}=R_{24}=H$, $R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 16) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6=ethyl$, $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_{23}=R_{24}=H$, $R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 17) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6=methyl$, $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_{23}=R_{24}=H$, $R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 18) the complex represented by Formula IIIc, wherein $R^1-R^6=methyl$, $R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_{23}=R_{24}=H$, $R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 19) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6=Br$, $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_{23}=R_{24}=H$, $R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 20) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6=Cl$, $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_{23}=R_{24}=H$, $R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 21) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6=F$, $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_{23}=R_{24}=H$, $R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 22) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6=isopropyl$, $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_{23}=R_{24}=H$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 23) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6=ethyl$, $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_{23}=R_{24}=H$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 24) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6=methyl$, $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_{23}=R_{24}=H$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 25) the complex represented by Formula IIIc, wherein $R^1-R^6=methyl$, $R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_{23}=R_{24}=H$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 26) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6=Br$, $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_{23}=R_{24}=H$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 27) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6=Cl$, $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_{23}=R_{24}=H$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 28) the complex represented by Formula IIIc, wherein $R^1=R^3=R^4=R^6=F$, $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_{23}=R_{24}=H$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;



29) the complex represented by Formula (IIIc'), wherein

$R^1=R^3=R^4=R^6$ =isopropyl, $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, R_{11} =ethyl, $M=Ni$, $Y=O$, $X=Br$;

30) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6$ =ethyl,

$R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, R_{11} =ethyl, $M=Ni$, $Y=O$, $X=Br$;

31) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6$ =methyl,

$R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, R_{11} =ethyl, $M=Ni$, $Y=O$, $X=Br$;

32) the complex represented by Formula (IIIc'), wherein R^1-R^6 =methyl, R^7-

$R^{10}=R_{31}=R_{32}=H$, R_{11} =ethyl, $M=Ni$, $Y=O$, $X=Br$;

33) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6=Br$,

$R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, R_{11} =ethyl, $M=Ni$, $Y=O$, $X=Br$;

34) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6=Cl$,

$R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, R_{11} =ethyl, $M=Ni$, $Y=O$, $X=Br$;

35) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6=F$,

$R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, R_{11} =ethyl, $M=Ni$, $Y=O$, $X=Br$;

36) the complex represented by Formula (IIIc'), wherein

$R^1=R^3=R^4=R^6$ =isopropyl, $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, R_{11} =isobutyl, $M=Ni$, $Y=O$, $X=Br$;

37) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6$ =ethyl,

$R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, R_{11} =isobutyl, $M=Ni$, $Y=O$, $X=Br$;

38) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6$ =methyl,

$R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, R_{11} =isobutyl, $M=Ni$, $Y=O$, $X=Br$;

39) the complex represented by Formula (IIIc'), wherein R^1-R^6 =methyl, R^7-

$R^{10}=R_{31}=R_{32}=H$, R_{11} =isobutyl, $M=Ni$, $Y=O$, $X=Br$;

40) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6=Br$,

$R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, R_{11} =isobutyl, $M=Ni$, $Y=O$, $X=Br$;

41) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6=Cl$,

$R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, R_{11} =isobutyl, $M=Ni$, $Y=O$, $X=Br$;

42) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6=F$,
 $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, R_{11} =isobutyl, $M=Ni$, $Y=O$, $X=Br$;

43) the complex represented by Formula (IIIc'), wherein
 $R^1=R^3=R^4=R^6$ =isopropyl, $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=R_{11}$ =ethyl, $M=Ni$, $Y=O$, $X=Br$;

44) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6$ =ethyl,
 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=R_{11}$ =ethyl, $M=Ni$, $Y=O$, $X=Br$;

45) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6$ =methyl,
 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=R_{11}$ =ethyl, $M=Ni$, $Y=O$, $X=Br$;

46) the complex represented by Formula (IIIc'), wherein R^1-R^6 =methyl, R^7 -
 $R^{10}=H$, $R_{31}=R_{32}=R_{11}$ =ethyl, $M=Ni$, $Y=O$, $X=Br$;

47) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6=Br$,
 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=R_{11}$ =ethyl, $M=Ni$, $Y=O$, $X=Br$;

48) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6=Cl$,
 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=R_{11}$ =ethyl, $M=Ni$, $Y=O$, $X=Br$;

49) The complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6=F$,
 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=R_{11}$ =ethyl, $M=Ni$, $Y=O$, $X=Br$;

50) the complex represented by Formula (IIIc'), wherein
 $R^1=R^3=R^4=R^6$ =isopropyl, $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=R_{11}$ =ethyl, $M=Ni$, $Y=O$, $X=Br$;

51) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6$ =ethyl,
 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}$ =ethyl, R_{11} =isobutyl, $M=Ni$, $Y=O$, $X=Br$;

52) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6$ =methyl,
 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}$ =ethyl, R_{11} =isobutyl, $M=Ni$, $Y=O$, $X=Br$;

53) the complex represented by Formula (IIIc'), wherein R^1-R^6 =methyl, R^7 -
 $R^{10}=H$, $R_{31}=R_{32}$ =ethyl, R_{11} =isobutyl, $M=Ni$, $Y=O$, $X=Br$;

54) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6=Br$,
 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}$ =ethyl, R_{11} =isobutyl, $M=Ni$, $Y=O$, $X=Br$;

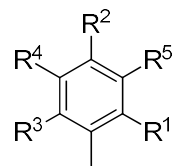
55) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6=Cl$,
 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}$ =ethyl, R_{11} =isobutyl, $M=Ni$, $Y=O$, $X=Br$;

56) the complex represented by Formula (IIIc'), wherein $R^1=R^3=R^4=R^6=F$,
 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}$ =ethyl, R_{11} =isobutyl, $M=Ni$, $Y=O$, $X=Br$.

12. The method as claimed in claim 1, wherein the polar monomer is a vinyl monomer carrying one or more hydroxy groups, or the polar monomer is a vinyl monomer carrying one or more carboxy groups, and wherein the main catalyst comprises the amino-imine metal complex represented by Formula I'.

13. The method as claimed in claim 1, wherein the amino-imine metal complex has at least one of the following features:

- R₁ and R₂ are independently selected from the group consisting of C1-C20 alkyl with or without a substituent Q and C6-C20 aryl with or without a substituent Q, preferably R₁ and/or R₂ are/is a group represented by Formula A:



Formula A

wherein, R¹-R⁵ are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C20 alkyl with or without a substituent Q, C2-C20 alkenyl with or without a substituent Q, C2-C20 alkynyl with or without a substituent Q, C1-C20 alkoxy with or without a substituent Q, C2-C20 alkenoxy with or without a substituent Q, C2-C20 alkynoxy with or without a substituent Q, C6-C20 aryl with or without a substituent Q, C6-C20 aryloxy with or without a substituent Q, C7-C20 aralkyl with or without a substituent Q, C7-C20 aralkyloxy with or without a substituent Q, C7-C20 alkaryl with or without a substituent Q and C7-C20 alkaryloxy with or without a substituent Q, and R¹-R⁵ are optionally joined to form a ring or ring system;

preferably, R¹-R⁵ are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C10 alkyl with or without a substituent Q, C2-C10 alkenyl with or without a substituent Q, C2-C10 alkynyl with or without a substituent Q, C1-C10 alkoxy with or without a substituent Q, C2-C10 alkenoxy with or without a substituent Q, C2-C10 alkynoxy with or without a substituent Q, C6-C15 aryl with or without a substituent Q, C6-C15 aryloxy with or without a substituent Q, C7-C15 aralkyl with or without a substituent Q, C7-C15 aralkoxy with or without a substituent Q, C7-C15 alkaryl with or without a substituent Q and C7-C15 alkaryloxy with or without a substituent Q;

- each M is independently selected from the group consisting of nickel and palladium;

- each Y is independently selected from the group consisting of O and S;

- each X is independently selected from the group consisting of halogen, C1-C10 alkyl with or without a substituent Q and C1-C10 alkoxy with or without a substituent Q, preferably from the group consisting of halogen, C1-C6 alkyl with or without a substituent Q and C1-C6 alkoxy with or without a substituent Q;

- each R₁₂ is independently a C1-C20 alkyl with or without a substituent Q,

preferably a C1-C10 alkyl with or without a substituent Q, more preferably a C1-C6 alkyl with or without a substituent Q;

- each R₃ is selected from the group consisting of C1-C20 alkyl with or without a substituent Q, C6-C20 aryl with or without a substituent Q, C7-C20 aralkyl with or without a substituent Q and C7-C20 alkaryl with or without a substituent Q;

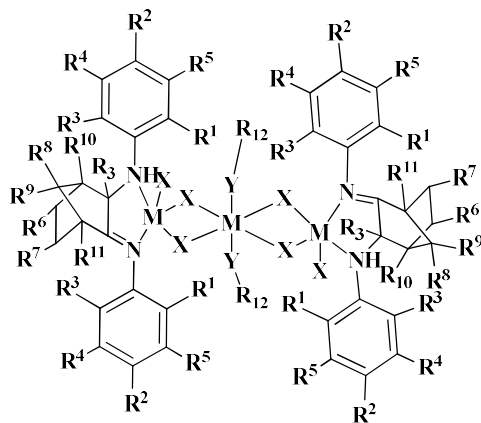
preferably, each R₃ is selected from the group consisting of C1-C10 alkyl with or without a substituent Q, C6-C10 aryl with or without a substituent Q, C7-C15 aralkyl with or without a substituent Q and C7-C15 alkaryl with or without a substituent Q; and more preferably, each R₃ is a C1-C6 alkyl with or without a substituent Q;

- the substituent Q is selected from the group consisting of halogen, hydroxy, C1-C6 alkyl, halogenated C1-C6 alkyl, C1-C6 alkoxy and halogenated C1-C6 alkoxy;

preferably, the C1-C6 alkyl is selected from methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, n-pentyl, isopentyl, n-hexyl, isohexyl and 3,3-dimethylbutyl;

preferably, the C1-C6 alkoxy is selected from methoxy, ethoxy, n-propoxy, isopropoxy, n-butoxy, isobutoxy, n-pentoxy, isopentoxy, n-hexyloxy, isohexyloxy and 3,3-dimethylbutoxy.

14. The method as claimed in claim 12 or 13, wherein the amino-imine metal complex is represented by Formula III':



Formula III'

wherein, R¹-R¹¹ are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C20 alkyl with or without a substituent Q, C2-C20 alkenyl with or without a substituent Q, C2-C20 alkynyl with or without a substituent Q, C1-C20 alkoxy with or without a substituent Q, C2-C20 alkenoxy with or without a substituent Q, C2-C20 alkynoxy with or without a substituent Q, C6-C20 aryl with or without a substituent Q, C6-C20 aryloxy with or without a substituent Q, C7-C20 aralkyl with or without a substituent Q, C7-C20 aralkyloxy with or without a substituent Q, C7-C20 alkaryl with or without a substituent Q and C7-C20 alkaryloxy

with or without a substituent Q;

R₃, R₁₂, Y, M and X are as defined in claim 12.

15. The method as claimed in claim 14, wherein in the amino-imine metal complex, R¹-R¹¹ are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C10 alkyl with or without a substituent Q, C2-C10 alkenyl with or without a substituent Q, C2-C10 alkynyl with or without a substituent Q, C1-C10 alkoxy with or without a substituent Q, C2-C10 alkenoxy with or without a substituent Q, C2-C10 alkynoxy with or without a substituent Q, C6-C15 aryl with or without a substituent Q, C6-C15 aryloxy with or without a substituent Q, C7-C15 aralkyl with or without a substituent Q, C7-C15 aralkoxy with or without a substituent Q, C7-C15 alkaryl with or without a substituent Q and C7-C15 alkaryloxy with or without a substituent Q; preferably, R¹-R¹¹ are each independently selected from the group consisting of hydrogen, C1-C10 alkyl, halogenated C1-C10 alkyl, C1-C10 alkoxy, halogenated C1-C10 alkoxy and halogen, and more preferably from the group consisting of hydrogen, C1-C6 alkyl, halogenated C1-C6 alkyl, C1-C6 alkoxy, halogenated C1-C6 alkoxy and halogen.

16. The method as claimed in any one of claims 12 to 15, wherein the amino-imine metal complex is selected from the group consisting of:

the complex represented by Formula III', wherein R¹=R³=isopropyl, R²=R⁴=R⁵=R⁶=R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=CH₃, R₃=CH₃, R₁₂=methyl, M=Ni, Y=O, X=Br;

the complex represented by Formula III', wherein R¹=R³=isopropyl, R²=R⁴=R⁵=R⁶=R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=CH₃, R₃=ethyl, R₁₂=methyl, M=Ni, Y=O, X=Br;

the complex represented by Formula III', wherein R¹=R³=ethyl, R²=R⁴=R⁵=R⁶=R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=CH₃, R₃=CH₃, R₁₂=methyl, M=Ni, Y=O, X=Br;

the complex represented by Formula III', wherein R¹=R³=ethyl, R²=R⁴=R⁵=R⁶=R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=CH₃, R₃=ethyl, R₁₂=methyl, M=Ni, Y=O, X=Br;

the complex represented by Formula III', wherein R¹=R³=methyl, R²=R⁴=R⁵=R⁶=R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=CH₃, R₃=CH₃, R₁₂=methyl, M=Ni, Y=O, X=Br;

the complex represented by Formula III', wherein R¹=R³=methyl, R²=R⁴=R⁵=R⁶=R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=CH₃, R₃=ethyl, R₁₂=methyl, M=Ni, Y=O, X=Br;

the complex represented by Formula III', wherein R¹=R³=isopropyl, R²=R⁴=R⁵=R⁶=R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=CH₃, R₃=CH₃, R₁₂=ethyl, M=Ni, Y=O, X=Br;

the complex represented by Formula III', wherein R¹=R³=isopropyl, R²=R⁴=R⁵=R⁶=R⁷=R¹⁰=H, R⁸=R⁹=R¹¹=CH₃, R₃=ethyl, R₁₂=ethyl, M=Ni, Y=O, X=Br;

the complex represented by Formula III', wherein R¹=R³=ethyl,

$R^2=R^4=R^5=R^6=R^7=R^{10}=H$, $R^8=R^9=R^{11}=CH_3$, $R_3=CH_3$, $R_{12}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
 the complex represented by Formula III', wherein $R^1=R^3=ethyl$,
 $R^2=R^4=R^5=R^6=R^7=R^{10}=H$, $R^8=R^9=R^{11}=CH_3$, $R_3=ethyl$, $R_{12}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
 the complex represented by Formula III', wherein $R^1=R^3=methyl$,
 $R^2=R^4=R^5=R^6=R^7=R^{10}=H$, $R^8=R^9=R^{11}=CH_3$, $R_3=CH_3$, $R_{12}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
 the complex represented by Formula III', wherein $R^1=R^3=methyl$,
 $R^2=R^4=R^5=R^6=R^7=R^{10}=H$, $R^8=R^9=R^{11}=CH_3$, $R_3=ethyl$, $R_{12}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
 the complex represented by Formula III', wherein $R^1=R^3=methyl$,
 $R^2=R^4=R^5=R^6=R^7=R^{10}=H$, $R^8=R^9=R^{11}=CH_3$, $R_3=CH_3$, $R_{12}=i-Pr$, $M=Ni$, $Y=O$, $X=Br$;
 the complex represented by Formula III', wherein $R^1-R^3=methyl$, $R^4-R^7=R^{10}=H$,
 $R^8=R^9=R^{11}=CH_3$, $R_3=ethyl$, $R_{12}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
 the complex represented by Formula III', wherein $R^1-R^3=methyl$, $R^4-R^7=R^{10}=H$,
 $R^8=R^9=R^{11}=CH_3$, $R_3=CH_3$, $R_{12}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
 the complex represented by Formula III', wherein $R^1=R^3=methyl$, $R^2=Br$, $R^4-R^7=R^{10}=H$,
 $R^8=R^9=R^{11}=R_3=CH_3$, $R_{12}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
 the complex represented by Formula III', wherein $R^1=R^3=methyl$, $R^2=Br$, $R^4-R^7=R^{10}=H$,
 $R^8=R^9=R^{11}=CH_3$, $R_3=ethyl$, $R_{12}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
 the complex represented by Formula III', wherein $R^1=R^3=F$, $R^2=R^4-R^7=R^{10}=H$,
 $R^8=R^9=R^{11}=CH_3$, $R_3=ethyl$, $R_{12}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
 the complex represented by Formula III', wherein $R^1=R^3=Cl$, $R^2=R^4-R^7=R^{10}=H$,
 $R^8=R^9=R^{11}=CH_3$, $R_3=ethyl$, $R_{12}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
 the complex represented by Formula III', wherein $R^1=R^3=Br$, $R^2=R^4-R^7=R^{10}=H$,
 $R^8=R^9=R^{11}=CH_3$, $R_3=ethyl$, $R_{12}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
 the complex represented by Formula III', wherein $R^1=R^3=methyl$, $R^2=R^4-R^7=R^{10}=H$,
 $R^8=R^9=R^{11}=CH_3$, $R_3=ethyl$, $R_{12}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
 the complex represented by Formula III', wherein $R^1=R^3=ethyl$, $R^2=R^4-R^7=R^{10}=H$,
 $R^8=R^9=R^{11}=CH_3$, $R_3=CH_3$, $R_{12}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
 the complex represented by Formula III', wherein $R^1=R^3=isopropyl$, $R^2=R^4-R^7=R^{10}=H$,
 $R^8=R^9=R^{11}=CH_3$, $R_3=CH_3$, $R_{12}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
 the complex represented by Formula III', wherein $R^1-R^3=methyl$, $R^4-R^7=R^{10}=H$,
 $R^8=R^9=R^{11}=CH_3$, $R_3=CH_3$, $R_{12}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
 the complex represented by Formula III', wherein $R^1=R^3=methyl$, $R^2=Br$, $R^4-R^7=R^{10}=H$,
 $R^8=R^9=R^{11}=methyl$, $R_3=isopropyl$, $R_{12}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
 the complex represented by Formula III', wherein $R^1=R^3=F$, $R^2=R^4-R^7=R^{10}=H$,
 $R^8=R^9=R^{11}=CH_3$, $R_3=isopropyl$, $R_{12}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;

the complex represented by Formula III', wherein $R^1=R^3=Cl$, $R^2=R^4-R^7=R^{10}=H$, $R^8=R^9=R^{11}=CH_3$, R_3 =isopropyl, R_{12} =isobutyl, $M=Ni$, $Y=O$, $X=Br$;

the complex represented by Formula III', wherein $R^1=R^3=Br$, $R^2=R^4-R^7=R^{10}=H$, $R^8=R^9=R^{11}=CH_3$, R_3 =isopropyl, R_{12} =isobutyl, $M=Ni$, $Y=O$, $X=Br$;

the complex represented by Formula III', wherein $R^1=R^3$ =methyl, $R^2=R^4-R^7=R^{10}=H$, $R^8=R^9=CH_3$, R^{11} =bromomethyl, R_3 =isopropyl, R_{12} =ethyl, $M=Ni$, $Y=O$, $X=Br$;

the complex represented by Formula III', wherein $R^1=R^3$ =ethyl, $R^2=R^4-R^7=R^{10}=H$, $R^8=R^9=CH_3$, $R^{11}=CH_2Br$, R_3 =isopropyl, R_{12} =ethyl, $M=Ni$, $Y=O$, $X=Br$;

the complex represented by Formula III', wherein $R^1=R^3$ =isopropyl, $R^2=R^4-R^7=R^{10}=H$, $R^8=R^9=CH_3$, $R^{11}=CH_2Br$, R_3 =ethyl, R_{12} =ethyl, $M=Ni$, $Y=O$, $X=Br$;

the complex represented by Formula III', wherein R^1-R^3 =methyl, $R^4-R^7=R^{10}=H$, $R^8=R^9=CH_3$, $R^{11}=CH_2Br$, R_{12} =ethyl, $M=Ni$, $Y=O$, $X=Br$;

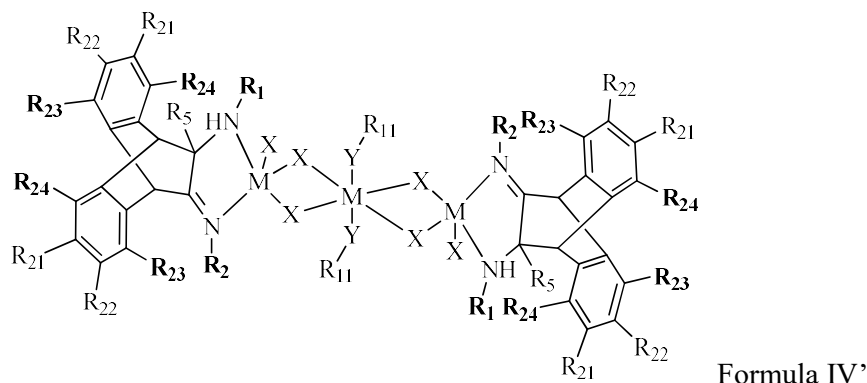
the complex represented by Formula III', wherein $R^1=R^3$ =methyl, $R^2=Br$, $R^4-R^7=R^{10}=H$, $R^8=R^9$ =methyl, R_3 =ethyl, $R^{11}=CH_2Br$, R_{12} =ethyl, $M=Ni$, $Y=O$, $X=Br$;

the complex represented by Formula III', wherein $R^1=R^3=F$, $R^2=R^4-R^7=R^{10}=H$, $R^8=R^9$ =methyl, $R^{11}=CH_2Br$, R_3 =isobutyl, R_{12} =ethyl, $M=Ni$, $Y=O$, $X=Br$;

the complex represented by Formula III', wherein $R^1=R^3=Cl$, $R^2=R^4-R^7=R^{10}=H$, $R^8=R^9$ =methyl, $R^{11}=CH_2Br$, R_3 =isobutyl, R_{12} =ethyl, $M=Ni$, $Y=O$, $X=Br$;

the complex represented by Formula III', wherein $R^1=R^3=Br$, $R^2=R^4-R^7=R^{10}=H$, $R^8=R^9$ =methyl, $R^{11}=CH_2Br$, R_3 =isobutyl, R_{12} =ethyl, $M=Ni$, $Y=O$, $X=Br$.

17. The method as claimed in claim 12, wherein the amino-imine metal complex has a structure represented by Formula IV':

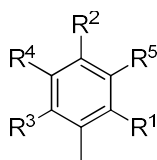


wherein, R_1 and R_2 are each independently a C1-C30 hydrocarbyl with or without a substituent Q; R_{21} - R_{24} are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C20 hydrocarbyl with or without a substituent Q and

C1-C20 hydrocarbyloxy with or without a substituent Q, and R₂₁-R₂₄ are optionally joined to form a ring or ring system, preferably a substituted or unsubstituted benzene ring; each R₅ is independently selected from the group consisting of hydrogen and C1-C20 hydrocarbyl with or without a substituent Q; each R₁₁ is independently a C1-C20 hydrocarbyl with or without a substituent Q; each Y is independently a Group VIA nonmetal atom; each M is independently a Group VIII metal; each X is independently selected from the group consisting of halogen, C1-C10 hydrocarbyl with or without a substituent Q and C1-C10 hydrocarbyloxy with or without a substituent Q.

18. The method as claimed in claim 17, wherein the amino-imine metal complex has at least one of the following features:

- R₁ and R₂ are independently selected from the group consisting of C1-C20 alkyl with or without a substituent Q and C6-C20 aryl with or without a substituent Q, preferably R₁ and/or R₂ are/is a group represented by Formula A:



Formula A

wherein, R¹-R⁵ are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C20 alkyl with or without a substituent Q, C2-C20 alkenyl with or without a substituent Q, C2-C20 alkynyl with or without a substituent Q, C1-C20 alkoxy with or without a substituent Q, C2-C20 alkenoxy with or without a substituent Q, C2-C20 alkynoxy with or without a substituent Q, C6-C20 aryl with or without a substituent Q, C6-C20 aryloxy with or without a substituent Q, C7-C20 aralkyl with or without a substituent Q, C7-C20 aralkyloxy with or without a substituent Q, C7-C20 alkaryl with or without a substituent Q and C7-C20 alkaryloxy with or without a substituent Q, and R¹-R⁵ are optionally joined to form a ring or ring system;

preferably, R¹-R⁵ are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C10 alkyl with or without a substituent Q, C2-C10 alkenyl with or without a substituent Q, C2-C10 alkynyl with or without a substituent Q, C1-C10 alkoxy with or without a substituent Q, C2-C10 alkenoxy with or without a substituent Q, C2-C10 alkynoxy with or without a substituent Q, C6-C15 aryl with or without a substituent Q, C6-C15 aryloxy with or without a substituent Q, C7-C15 aralkyl with or without a substituent Q, C7-C15 aralkoxy with or without a substituent Q, C7-C15 alkaryl with or without a substituent Q and C7-C15 alkaryloxy with or without a substituent Q;

more preferably, R^1 - R^5 are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C6 alkyl with or without a substituent Q, C2-C6 alkenyl with or without a substituent Q, C2-C6 alkynyl with or without a substituent Q, C1-C6 alkoxy with or without a substituent Q, C2-C6 alkenyloxy with or without a substituent Q, C2-C6 alkynyloxy with or without a substituent Q, C6-C10 aryl with or without a substituent Q, C7-C10 aralkyl group with or without a substituent Q, C7-C10 alkaryl with or without a substituent Q, C6-C10 aryloxy with or without a substituent Q, C7-C10 aralkyloxy with or without a substituent Q, and C7-C10 alkaryloxy with or without a substituent Q;

- each M is independently selected from the group consisting of nickel and palladium;

- each Y is independently selected from the group consisting of O and S;

- each X is independently selected from the group consisting of halogen, C1-C10 alkyl with or without a substituent Q and C1-C10 alkoxy with or without a substituent Q, preferably from the group consisting of halogen, C1-C6 alkyl with or without a substituent Q and C1-C6 alkoxy with or without a substituent Q;

- each R_{11} is independently a C1-C20 alkyl with or without a substituent Q, preferably a C1-C10 alkyl with or without a substituent Q, and more preferably a C1-C6 alkyl with or without a substituent Q;

- each R_5 is independently selected from the group consisting of C1-C20 alkyl with or without a substituent Q, C6-C20 aryl with or without a substituent Q, C7-C20 aralkyl with or without a substituent Q and C7-C20 alkaryl with or without a substituent Q; preferably, each R_5 is independently selected from the group consisting of C1-C10 alkyl with or without a substituent Q, C6-C10 aryl with or without a substituent Q, C7-C15 aralkyl with or without a substituent Q and C7-C15 alkaryl with or without a substituent Q, and more preferably each R_5 is a C1-C6 alkyl with or without a substituent Q; and

- the substituent Q is selected from the group consisting of halogen, hydroxy, C1-C6 alkyl, halogenated C1-C6 alkyl, C1-C6 alkoxy and halogenated C1-C6 alkoxy; preferably, the C1-C6 alkyl is selected from methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, n-pentyl, isopentyl, n-hexyl, isohexyl and 3,3-dimethylbutyl; preferably, the C1-C6 alkoxy is selected from methoxy, ethoxy, n-propoxy, isopropoxy, n-butoxy, isobutoxy, n-pentoxy, isopentoxy, n-hexyloxy, isohexyloxy and 3,3-dimethylbutoxy; preferably, the halogen is selected from fluorine, chlorine, bromine and iodine;

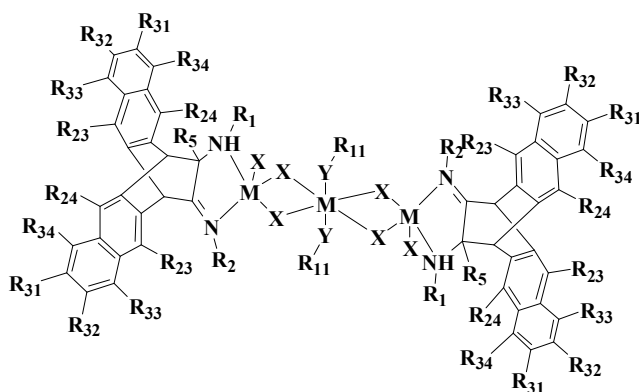
- R_{21} - R_{24} are each independently selected from the group consisting of hydrogen,

halogen, hydroxy, C1-C20 alkyl with or without a substituent Q, C2-C20 alkenyl with or without a substituent Q, C2-C20 alkynyl with or without a substituent Q, C1-C20 alkoxy with or without a substituent Q, C2-C20 alkenoxy with or without a substituent Q, C2-C20 alkynoxy with or without a substituent Q, C6-C20 aryl with or without a substituent Q, C7-C20 aralkyl with or without a substituent Q, C7-C20 alkaryl with or without a substituent Q, C6-C20 aryloxy with or without a substituent Q, C7-C20 aralkyloxy with or without a substituent Q and C7-C20 alkaryloxy with or without a substituent Q, and R₂₁-R₂₄ are optionally joined to form a ring or ring system;

preferably, R₂₁-R₂₄ are each independently selected from the group consisting of hydrogen, halogen, hydroxy, C1-C10 alkyl with or without a substituent Q, C2-C10 alkenyl with or without a substituent Q, C2-C10 alkynyl with or without a substituent Q, C1-C10 alkoxy with or without a substituent Q, C2-C10 alkenoxy with or without a substituent Q, C2-C10 alkynoxy with or without a substituent Q, C6-C15 aryl with or without a substituent Q, C7-C15 aralkyl with or without a substituent Q, C7-C15 alkaryl with or without a substituent Q, C6-C15 aryloxy with or without a substituent Q, C7-C15 aralkoxy with or without a substituent Q and C7-C15 alkaryloxy with or without a substituent Q;

more preferably, R₂₁-R₂₄ are each independently selected from the group consisting of hydrogen, C1-C10 alkyl, halogenated C1-C10 alkyl, C1-C10 alkoxy, halogenated C1-C10 alkoxy and halogen, more preferably from the group consisting of hydrogen, C1-C6 alkyl, halogenated C1-C6 alkyl, C1-C6 alkoxy, halogenated C1-C6 alkoxy and halogen.

19. The method as claimed in any one of claims 17 to 18, wherein the amino-imine metal complex has a structure represented by Formula IV' A:

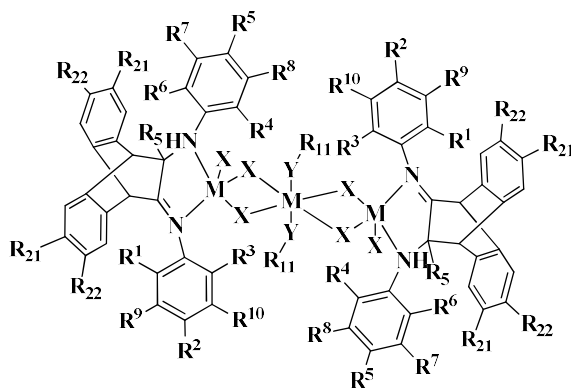


Formula IV' A

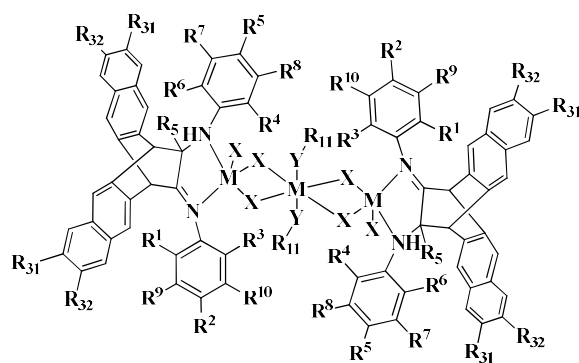
wherein R₃₁-R₃₄ have the same meanings as R₂₁-R₂₄ in Formula IV', preferably R₃₃ and R₃₄ are hydrogen, and R₁, R₂, R₅, R₁₁, Y, M and X are as defined for Formula

IV' in claim 17.

20. The method as claimed in any one of claims 17 to 19, wherein the amino-imine metal complex is represented by the following Formula V or V':



Formula V



Formula V'

wherein the individual symbols are as defined above,

preferably, the amino-imine metal complex is selected from the group consisting of:

- 1) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6$ =isopropyl, $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=CH_3$, R_{11} =ethyl, $M=Ni$, $Y=O$, $X=Br$;
- 2) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6$ =ethyl, $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=CH_3$, R_{11} =ethyl, $M=Ni$, $Y=O$, $X=Br$;
- 3) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6$ =methyl, $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=CH_3$, R_{11} =ethyl, $M=Ni$, $Y=O$, $X=Br$;
- 4) the complex represented by Formula V, wherein R^1-R^6 =methyl, $R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=CH_3$, R_{11} =ethyl, $M=Ni$, $Y=O$, $X=Br$;
- 5) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=Br$, $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=CH_3$, R_{11} =ethyl, $M=Ni$, $Y=O$, $X=Br$;
- 6) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=Cl$, $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=CH_3$, R_{11} =ethyl, $M=Ni$, $Y=O$, $X=Br$;

- 7) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=F$, $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=CH_3$, $R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 8) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=isopropyl$, $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 9) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=ethyl$, $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 10) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=methyl$, $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 11) the complex represented by Formula V, wherein $R^1-R^6=methyl$, $R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 12) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=Br$, $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 13) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=Cl$, $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 14) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=F$, $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 15) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=isopropyl$, $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=CH_3$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 16) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=ethyl$, $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=CH_3$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 17) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=methyl$, $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=CH_3$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 18) the complex represented by Formula V, wherein $R^1-R^6=methyl$, $R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=CH_3$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 19) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=Br$, $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=CH_3$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 20) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=Cl$, $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=CH_3$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 21) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=F$, $R^2=R^5=R^7-R^{10}=R_{21}=R_{22}=H$, $R_5=CH_3$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 22) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=isopropyl$, $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_5=CH_3$, $R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 23) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=ethyl$, $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t-butyl$, $R_5=CH_3$, $R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 24) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=methyl$,

$R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t\text{-butyl}$, $R_5=CH_3$, $R_{11}=\text{ethyl}$, $M=Ni$, $Y=O$, $X=Br$;

25) the complex represented by Formula V, wherein $R^1-R^6=\text{methyl}$, $R^7-R^{10}=R_{22}=H$, $R_{21}=t\text{-butyl}$, $R_5=CH_3$, $R_{11}=\text{ethyl}$, $M=Ni$, $Y=O$, $X=Br$;

26) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=Br$, $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t\text{-butyl}$, $R_5=CH_3$, $R_{11}=\text{ethyl}$, $M=Ni$, $Y=O$, $X=Br$;

27) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=Cl$, $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t\text{-butyl}$, $R_5=CH_3$, $R_{11}=\text{ethyl}$, $M=Ni$, $Y=O$, $X=Br$;

28) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=F$, $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t\text{-butyl}$, $R_5=CH_3$, $R_{11}=\text{ethyl}$, $M=Ni$, $Y=O$, $X=Br$;

29) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=\text{isopropyl}$, $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t\text{-butyl}$, $R_5=CH_3$, $R_{11}=\text{isobutyl}$, $M=Ni$, $Y=O$, $X=Br$;

30) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=\text{ethyl}$, $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t\text{-butyl}$, $R_5=CH_3$, $R_{11}=\text{isobutyl}$, $M=Ni$, $Y=O$, $X=Br$;

31) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=\text{methyl}$, $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t\text{-butyl}$, $R_5=CH_3$, $R_{11}=\text{isobutyl}$, $M=Ni$, $Y=O$, $X=Br$;

32) the complex represented by Formula V, wherein $R^1-R^6=\text{methyl}$, $R^7-R^{10}=R_{22}=H$, $R_{21}=t\text{-butyl}$, $R_5=CH_3$, $R_{11}=\text{isobutyl}$, $M=Ni$, $Y=O$, $X=Br$;

33) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=Br$, $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t\text{-butyl}$, $R_5=CH_3$, $R_{11}=\text{isobutyl}$, $M=Ni$, $Y=O$, $X=Br$;

34) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=Cl$, $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t\text{-butyl}$, $R_5=CH_3$, $R_{11}=\text{isobutyl}$, $M=Ni$, $Y=O$, $X=Br$;

35) the complex represented by Formula V, wherein $R^1=R^3=R^4=R^6=F$, $R^2=R^5=R^7-R^{10}=R_{22}=H$, $R_{21}=t\text{-butyl}$, $R_5=CH_3$, $R_{11}=\text{isobutyl}$, $M=Ni$, $Y=O$, $X=Br$;

29) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=\text{isopropyl}$, $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, $R_5=CH_3$, $R_{11}=\text{ethyl}$, $M=Ni$, $Y=O$, $X=Br$;

30) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=\text{ethyl}$, $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, $R_5=CH_3$, $R_{11}=\text{ethyl}$, $M=Ni$, $Y=O$, $X=Br$;

31) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=\text{methyl}$, $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, $R_5=CH_3$, $R_{11}=\text{ethyl}$, $M=Ni$, $Y=O$, $X=Br$;

32) the complex represented by Formula V', wherein $R^1-R^6=\text{methyl}$, $R^7-R^{10}=R_{31}=R_{32}=H$, $R_5=CH_3$, $R_{11}=\text{ethyl}$, $M=Ni$, $Y=O$, $X=Br$;

33) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=Br$, $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, $R_5=CH_3$, $R_{11}=\text{ethyl}$, $M=Ni$, $Y=O$, $X=Br$;

34) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=Cl$, $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, $R_5=CH_3$, $R_{11}=\text{ethyl}$, $M=Ni$, $Y=O$, $X=Br$;

- 35) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=F$,
 $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, $R_5=CH_3$, $R_{11}=ethyl$, $M=Ni$, $Y=O$, $X=Br$;
- 36) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=isopropyl$,
 $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, $R_5=CH_3$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 37) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=ethyl$,
 $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, $R_5=CH_3$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 38) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=methyl$,
 $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, $R_5=CH_3$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 39) the complex represented by Formula V', wherein $R^1-R^6=methyl$, $R^7-R^{10}=R_{31}=R_{32}=H$, $R_5=CH_3$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 40) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=Br$,
 $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, $R_5=CH_3$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 41) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=Cl$,
 $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, $R_5=CH_3$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 42) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=F$,
 $R^2=R^5=R^7-R^{10}=R_{31}=R_{32}=H$, $R_5=CH_3$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 43) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=isopropyl$,
 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=R_{11}=ethyl$, $R_5=CH_3$, $M=Ni$, $Y=O$, $X=Br$;
- 44) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=ethyl$,
 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=R_{11}=ethyl$, $R_5=CH_3$, $M=Ni$, $Y=O$, $X=Br$;
- 45) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=methyl$,
 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=R_{11}=ethyl$, $R_5=CH_3$, $M=Ni$, $Y=O$, $X=Br$;
- 46) the complex represented by Formula V', wherein $R^1-R^6=methyl$, $R^7-R^{10}=H$,
 $R_{31}=R_{32}=R_{11}=ethyl$, $R_5=CH_3$, $M=Ni$, $Y=O$, $X=Br$;
- 47) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=Br$,
 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=R_{11}=ethyl$, $R_5=CH_3$, $M=Ni$, $Y=O$, $X=Br$;
- 48) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=Cl$,
 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=R_{11}=ethyl$, $R_5=CH_3$, $M=Ni$, $Y=O$, $X=Br$;
- 49) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=F$,
 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=R_{11}=ethyl$, $R_5=CH_3$, $M=Ni$, $Y=O$, $X=Br$;
- 50) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=isopropyl$,
 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=R_{11}=ethyl$, $R_5=CH_3$, $M=Ni$, $Y=O$, $X=Br$;
- 51) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=ethyl$,
 $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=ethyl$, $R_5=CH_3$, $R_{11}=isobutyl$, $M=Ni$, $Y=O$, $X=Br$;
- 52) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=methyl$,

$R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=\text{ethyl}$, $R_5=\text{CH}_3$, $R_{11}=\text{isobutyl}$, $M=\text{Ni}$, $Y=\text{O}$, $X=\text{Br}$;

53) the complex represented by Formula V', wherein $R^1-R^6=\text{methyl}$, $R^7-R^{10}=H$, $R_{31}=R_{32}=\text{ethyl}$, $R_5=\text{CH}_3$, $R_{11}=\text{isobutyl}$, $M=\text{Ni}$, $Y=\text{O}$, $X=\text{Br}$;

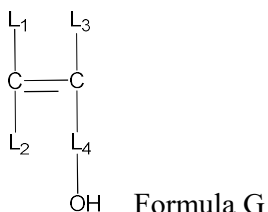
54) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=\text{Br}$, $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=\text{ethyl}$, $R_5=\text{CH}_3$, $R_{11}=\text{isobutyl}$, $M=\text{Ni}$, $Y=\text{O}$, $X=\text{Br}$;

55) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=\text{Cl}$, $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=\text{ethyl}$, $R_5=\text{CH}_3$, $R_{11}=\text{isobutyl}$, $M=\text{Ni}$, $Y=\text{O}$, $X=\text{Br}$;

56) the complex represented by Formula V', wherein $R^1=R^3=R^4=R^6=\text{F}$, $R^2=R^5=R^7-R^{10}=H$, $R_{31}=R_{32}=\text{ethyl}$, $R_5=\text{CH}_3$, $R_{11}=\text{isobutyl}$, $M=\text{Ni}$, $Y=\text{O}$, $X=\text{Br}$.

21. The method as claimed in any one of claims 1 to 20, having at least one of the following features:

- the olefin is an olefin, preferably an α -olefin, having 2 to 16 carbon atoms,
- the polar monomer is one or more of olefinic alcohols represented by Formula G:



wherein, L_1-L_3 are each independently selected from the group consisting of H and C_1-C_{30} alkyl with or without a substituent, L_4 is a C_1-C_{30} alkylene optionally having a pendant group;

preferably, in the copolymer, the content of the structure units derived from the olefinic alcohol represented by Formula G is from 0.4 to 10.0 mol%;

preferably, L_1 and L_2 are H, L_3 is H or a C_1-C_{30} alkyl, L_4 is a C_1-C_{30} alkylene having a pendant group;

more preferably, L_1 and L_2 are H, L_3 is H or a C_1-C_{20} alkyl, L_4 is a C_1-C_{20} alkylene having a pendant group;

still more preferably, L_1 and L_2 are H, L_3 is H or a C_1-C_{10} alkyl, L_4 is a C_1-C_{10} alkylene having a pendant group;

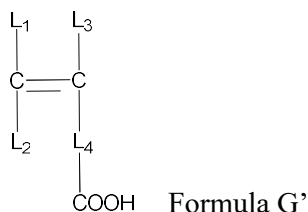
still more preferably, L_1 and L_2 are H, L_3 is H or a C_1-C_{10} alkyl, L_4 is a C_1-C_6 alkylene having a pendant group.

22. The method as claimed in claim 21, wherein the substituent in L_1-L_3 is one or more selected from the group consisting of halogen, C_1-C_{10} alkyl, C_1-C_{10} alkoxy, C_6-C_{10} aryl, cyano and hydroxy; more preferably the substituent in L_1-L_3 is one or more selected from the group consisting of C_1-C_6 alkyl, halogen and C_1-C_6 alkoxy;

the pendant group in L₄ is one or more selected from the group consisting of halogen, C₆-C₂₀ aryl, C₁-C₂₀ alkyl and C₁-C₂₀ alkoxy, the C₆-C₂₀ aryl, C₁-C₂₀ alkyl and C₁-C₂₀ alkoxy being optionally substituted by a substituent, which is preferably one or more selected from the group consisting of halogen, C₁-C₁₀ alkyl, C₁-C₁₀ alkoxy, C₆-C₁₀ aryl and hydroxy.

23. The method as claimed in any one of claims 1 to 20, having at least one of the following features:

- the olefin is an olefin, preferably an α -olefin, having 2-16 carbon atoms,
- the polar monomer is an unsaturated carboxylic acid represented by Formula G':



wherein, L₁-L₃ are each independently selected from the group consisting of H and C₁-C₃₀ alkyl with or without a substituent, L₄ is a C₁-C₃₀ alkylene having a pendant group;

preferably, in the copolymer, the content of the structure units derived from the unsaturated carboxylic acid represented by Formula G' is from 0.2 to 15.0 mol%, and more preferably from 0.7 to 10.0 mol%;

preferably, L₁ and L₂ are H, L₃ is H or a C₁-C₃₀ alkyl, L₄ is a C₁-C₃₀ alkylene having a pendant group;

more preferably, L₁ and L₂ are H, L₃ is H or a C₁-C₂₀ alkyl, L₄ is a C₁-C₂₀ alkylene having a pendant group;

still more preferably, L₁ and L₂ are H, L₃ is H or a C₁-C₁₀ alkyl, L₄ is a C₁-C₁₀ alkylene having a pendant group;

still more preferably, L₁ and L₂ are H, L₃ is H or a C₁-C₁₀ alkyl, L₄ is a C₁-C₆ alkylene having a pendant group.

24. The method as claimed in claim 23, characterized in that the substituent in L₁-L₃ is one or more selected from the group consisting of halogen, C₁-C₁₀ alkyl, C₁-C₁₀ alkoxy, C₆-C₁₀ aryl, cyano and hydroxy; and more preferably the substituent in L₁-L₃ is one or more selected from the group consisting of C₁-C₆ alkyl, halogen and C₁-C₆ alkoxy;

the pendant group in L₄ is one or more selected from the group consisting of halogen, C₆-C₂₀ aryl, C₁-C₂₀ alkyl and C₁-C₂₀ alkoxy, the C₆-C₂₀ aryl, C₁-C₂₀ alkyl and

C₁-C₂₀ alkoxy being optionally substituted by a substituent, which is preferably one or more selected from the group consisting of halogen, C₁-C₁₀ alkyl, C₁-C₁₀ alkoxy, C₆-C₁₀ aryl and hydroxy.

25. The method as claimed in any one of claims 1 to 24, wherein the cocatalyst is selected from the group consisting of organoaluminum compounds and organoboron compounds; the organoaluminum compounds are selected from the group consisting of alkylaluminoxanes, aluminum alkyls and alkyl aluminum halides; the organoboron compounds are selected from the group consisting of aromatic hydrocarbyl boron compounds and borates; the chain transfer agent is selected from the group consisting of aluminum alkyls, magnesium alkyls, boron alkyls and zinc alkyls;

preferably, when the cocatalyst is the organoaluminum compound, a molar ratio of aluminum in the cocatalyst to M in the diimine metal complex is (10-10⁷):1, preferably (10-100000):1, and more preferably (100-10000):1; when the cocatalyst is the organoboron compound, a molar ratio of boron in the cocatalyst to M in the diimine metal complex is (0.1-1000):1, and preferably (0.1-500):1; and a molar ratio of the chain transfer agent to M in the diimine metal complex is (0.1-5000):1, and preferably (1.0-1,000):1.

26. An olefin-polar monomer copolymer prepared by the method as claimed in any one of claims 1 to 25, which is of spherical and/or spherical-like shape, and/or which has a particle diameter of from 0.1 to 50 mm.