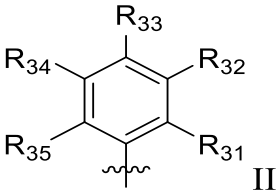
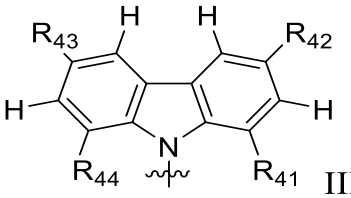
structure, with such ring structures having from 3 to 50 atoms in the ring, excluding any hydrogen atoms. In one embodiment, the sum of the non-hydrogen atoms for R^{17-19} is larger than 1, and/or the sum of the non-hydrogen atoms for R^{20-22} is larger than 1.

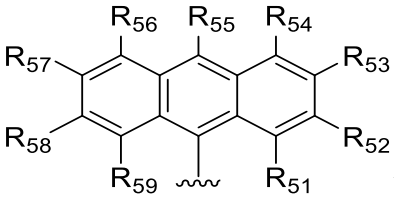
[0010] At least R^1, R^{16}, or both comprise formula (II), formula (III), or formula (IV):



II



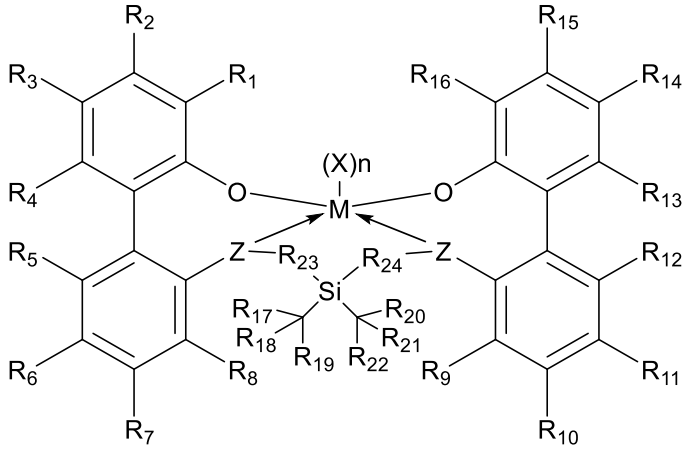
III



IV

[0011] In some embodiments, R^{31-35}, R^{41-44}, and R^{51-59} are independently chosen from a (C_1-C_{40})hydrocarbyl, (C_1-C_{40})heterohydrocarbyl, $Si(R^C)_3$, $P(R^P)_2$, $N(R^N)_2$, OR^C, SR^C, NO_2, CN, CF_3, $R^CS(O)–$, $R^CS(O)_2–$, $(R^C)_2C{=}N–$, $R^CC(O)O–$, $R^COC(O)–$, $R^CC(O)N(R)–$, $(R^C)_2NC(O)–$, halogen atom, hydrogen atom, and combinations thereof; and wherein independently each R^C is unsubstituted (C_1-C_{18})hydrocarbyl, each R^P is unsubstituted (C_1-C_{18})hydrocarbyl, and each R^N is unsubstituted (C_1-C_{18})hydrocarbyl or absent. When R^N is absent then N comprises –N=.

[0011a] In one aspect, the present disclosure refers to a metal ligand complex comprising a structure defined by formula (I):



(I)

wherein:

M is titanium, zirconium, or hafnium, each independently being in a formal oxidation state of +2, +3, or +4; and n is an integer of from 0 to 3, and wherein when n is 0, X is absent; and each X independently is a monodentate ligand that is neutral, monoanionic, or dianionic; or two Xs are taken together to form a bidentate ligand that is neutral, monoanionic, or dianionic; and X and n are chosen in such a way that the metal ligand complex of formula (I) is, overall, neutral; and each Z independently is O, S, N(C_1-C_{40})hydrocarbyl, or P(C_1-C_{40})hydrocarbyl;

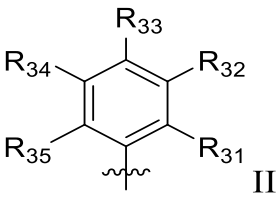
R^{1-7} and R^{10-16} are selected from the group consisting of a (C_1-C_{40})hydrocarbyl, (C_1-C_{40})heterohydrocarbyl, $Si(R^C)_3$, $P(R^P)_2$, $N(R^N)_2$, OR^C, SR^C, NO_2, CN, CF_3, $R^CS(O)$—, $R^CS(O)_2$—, $(R^C)_2C$═N—, $R^CC(O)O$—, $R^COC(O)$—, $R^CC(O)N(R)$—, $(R^C)_2NC(O)$—, halogen atom, hydrogen atom, and combinations thereof;

R^8 and R^9 consist of hydrogen atoms;

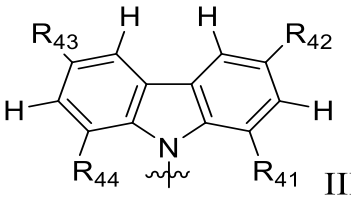
R^{23} and R^{24} are –CH_2–;

R^{17-22} are independently selected from a hydrogen atom, a (C_1-C_{40})hydrocarbyl, or two or more groups selected from R^{17-22} can combine together into a ring structure, with such ring structures having from 3 to 50 atoms in the ring, excluding any hydrogen atoms and the sum of the non-hydrogen atoms for R^{17-19} is larger than 1, and/or the sum of the non-hydrogen atoms for R^{20-22} is larger than 1;

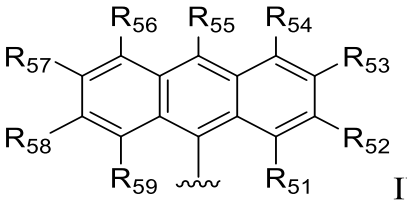
at least R^1, R^{16}, or both comprise formula (II), formula (III), or formula (IV):



II



III



IV

R^{31-35}, R^{41-44}, and R^{51-59} are independently chosen from a (C_1-C_{40})hydrocarbyl, (C_1-C_{40})heterohydrocarbyl, $Si(R^C)_3$, $P(R^P)_2$, $N(R^N)_2$, OR^C, SR^C, NO_2, CN, CF_3, $R^CS(O)$—,

$R^CS(O)_2$—, $(R^C)_2C$═N—, $R^CC(O)O$—, $R^COC(O)$—, $R^CC(O)N(R)$—, $(R^C)_2NC(O)$—, halogen atom, hydrogen atom, and combinations thereof; and

wherein independently selected each R^C is (C_1-C_{30})hydrocarbyl, each R^P is (C_1-C_{30})hydrocarbyl; and each R^N is (C_1-C_{30})hydrocarbyl or absent.

[0011b] In another aspect, the present disclosure refers to a polymerization process for producing an ethylene-based polymer comprising:

polymerizing ethylene and at least one additional α-olefin in the presence of a catalyst system, wherein the catalyst system comprises a pro-catalyst defined by the metal ligand complex as described herein, wherein the polymer comprises:

a density from 0.850 to 0.950 g/cc according to ASTM D792;

a melt flow ratio (I_{10}/I_2) from 5 to 15, wherein melt index I_2 is measured according to ASTM D1238 at 190 °C and 2.16 kg load, and melt index I_{10} is measured according to ASTM D1238 at 190 °C and 10 kg load;

a molecular weight distribution (MWD) from 1 to 10, wherein MWD is defined as M_w/M_n with M_w being a weight average molecular weight and M_n being a number average molecular weight.

[0011c] In another aspect, the prestn disclosure refers to a polymerization process as described herein, wherein the density is from 0.880 to 0.930 g/cc.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] FIG. 1 is a graph of Gel Permeation Chromatography (GPC) results of a molecular weight distribution overlay from five polymers synthesized from five catalyst systems.

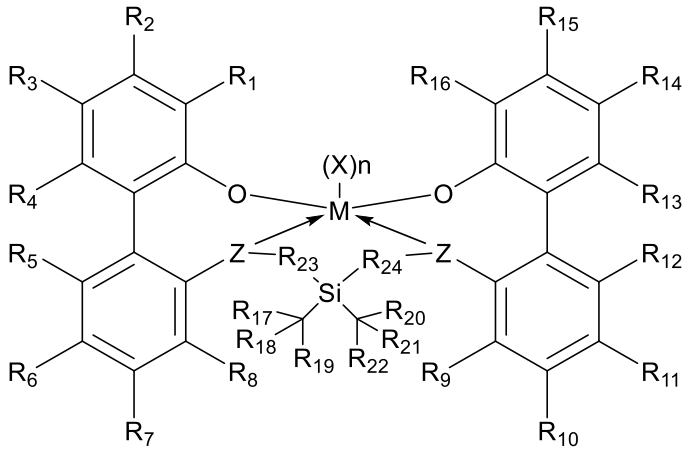
[0013] FIG. 2 is a graph of the Crystallization Elution Fractionation (CEF) overlay results from five polymers synthesized from five catalyst systems.

DETAILED DESCRIPTION OF THE INVENTION

[0014] Specific embodiments of the present application will now be described. The disclosure may, however, be embodied in different forms and should not be construed as limited

CLAIMS

1. A metal ligand complex comprising a structure defined by formula (I):



(I)

wherein:

M is titanium, zirconium, or hafnium, each independently being in a formal oxidation state of +2, +3, or +4; and n is an integer of from 0 to 3, and wherein when n is 0, X is absent; and each X independently is a monodentate ligand that is neutral, monoanionic, or dianionic; or two Xs are taken together to form a bidentate ligand that is neutral, monoanionic, or dianionic; and X and n are chosen in such a way that the metal ligand complex of formula (I) is, overall, neutral; and each Z independently is O, S, N(C_1-C_{40})hydrocarbyl, or P(C_1-C_{40})hydrocarbyl;

R^{1-7} and R^{10-16} are selected from the group consisting of a (C_1-C_{40})hydrocarbyl, (C_1-C_{40})heterohydrocarbyl, $Si(R^C)_3$, $P(R^P)_2$, $N(R^N)_2$, OR^C, SR^C, NO_2, CN, CF_3, $R^CS(O)$—, $R^CS(O)_2$—, $(R^C)_2C$═N—, $R^CC(O)O$—, $R^COC(O)$—, $R^CC(O)N(R)$—, $(R^C)_2NC(O)$—, halogen atom, hydrogen atom, and combinations thereof;

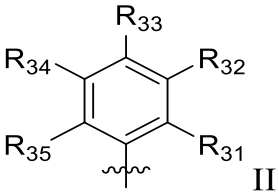
R^8 and R^9 consist of hydrogen atoms;

R^{23} and R^{24} are –CH_2–;

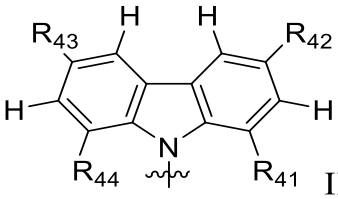
R^{17-22} are independently selected from a hydrogen atom, a (C_1-C_{40})hydrocarbyl, or two or more groups selected from R^{17-22} can combine together into a ring structure, with such ring

structures having from 3 to 50 atoms in the ring, excluding any hydrogen atoms and the sum of the non-hydrogen atoms for R^{17-19} is larger than 1, and/or the sum of the non-hydrogen atoms for R^{20-22} is larger than 1;

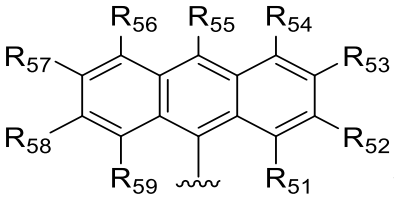
at least R^1, R^{16}, or both comprise formula (II), formula (III), or formula (IV):



II



III



IV

R^{31-35}, R^{41-44}, and R^{51-59} are independently chosen from a (C_1-C_{40})hydrocarbyl, (C_1-C_{40})heterohydrocarbyl, $Si(R^C)_3$, $P(R^P)_2$, $N(R^N)_2$, OR^C, SR^C, NO_2, CN, CF_3, $R^CS(O)$—, $R^CS(O)_2$—, $(R^C)_2C$═N—, $R^CC(O)O$—, $R^COC(O)$—, $R^CC(O)N(R)$—, $(R^C)_2NC(O)$—, halogen atom, hydrogen atom, and combinations thereof; and

wherein independently selected each R^C is (C_1-C_{30})hydrocarbyl, each R^P is (C_1-C_{30})hydrocarbyl; and each R^N is (C_1-C_{30})hydrocarbyl or absent.

2. The metal ligand complex according to claim 1, wherein R^1 and R^{16} are the same.

3. The metal ligand complex according to any of the preceding claims, wherein two of R^{17-19} and/or two of R^{20-22} are members in a C_5-C_6 cycloalkyl ring structure.

4. The metal ligand complex according to any of the preceding claims, wherein at least one of R^1 and R^{16} is formula (III) and at least one R^{42} and R^{43} is *tert*-butyl.

5. The metal ligand complex according to any of claims 1 to 3, wherein at least one of R^1 and R^{16} is formula (III) and R^{41} and R^{44} are hydrogen atoms.

6. The metal ligand complex according to any of claims 1 to 3, wherein at least one of R^1 and R^{16} is formula (IV).

7. A polymerization process for producing an ethylene-based polymer comprising:

polymerizing ethylene and at least one additional α-olefin in the presence of a catalyst system, wherein the catalyst system comprises a pro-catalyst defined by the metal ligand complex of any of claims 1-5, wherein the polymer comprises:

a density from 0.850 to 0.950 g/cc according to ASTM D792;

a melt flow ratio (I_{10}/I_2) from 5 to 15, wherein melt index I_2 is measured according to ASTM D1238 at 190 °C and 2.16 kg load, and melt index I_{10} is measured according to ASTM D1238 at 190 °C and 10 kg load;

a molecular weight distribution (MWD) from 1 to 10, wherein MWD is defined as M_w/M_n with M_w being a weight average molecular weight and M_n being a number average molecular weight.

8. The polymerization process according claim 7, wherein the catalyst system comprises at least one additional cocatalyst.

9. The polymerization process according to any of claims 7 and 8, wherein the MWD is from 1 to 3.

10. A polymerization process according to any of claims 7-9, wherein the density is from 0.880 to 0.930 g/cc.