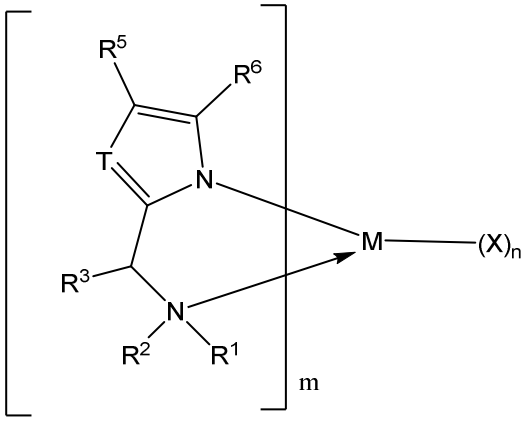
CLAIMS

1. A catalyst system comprising a metal–ligand complex according to formula (I):



(I)

where

M is a metal chosen from titanium, zirconium, or hafnium, the metal having a formal oxidation state of +2, +3, or +4;

each X is a monodentate or bidentate ligand independently chosen from unsaturated (C_2–C_{50})hydrocarbon, unsaturated (C_2–C_{50})heterohydrocarbon, (C_1–C_{50})hydrocarbyl, (C_1–C_{50})heterohydrocarbyl, (C_6–C_{50})aryl, (C_6–C_{50})heteroaryl, cyclopentadienyl, substituted cyclopentadienyl, (C_4–C_{12})diene, halogen, –$N(R^N)_2$, and –$NCOR^C$;

n is 1, 2, or 3;

m is 1 or 2;

the metal–ligand complex has 6 or fewer metal–ligand bonds;

each T is nitrogen or CR^4, wherein each R^4 is independently chosen from (C_1–C_{50})hydrocarbyl, (C_1–C_{50})heterohydrocarbyl, (C_6–C_{50})aryl, (C_4–C_{50})heteroaryl, –$Si(R^C)_3$, –$Ge(R^C)_3$, –$P(R^P)_2$, –$N(R^N)_2$, –OR^C, –SR^C, –NO_2, –CN, –CF_3, halogen, or –H;

each R^1 is independently selected from the group consisting of an aliphatic (C_1–C_{50})hydrocarbyl, an aliphatic (C_1–C_{50})heterohydrocarbyl, – halogen, and –H, and, when m is 2, two R^1 are optionally covalently connected to each other;

each R^2 is independently chosen from (C_1–C_{50})hydrocarbyl, (C_1–C_{50})heterohydrocarbyl, (C_6–C_{50})aryl, (C_4–C_{50})heteroaryl, –$Si(R^C)_3$, and –$Ge(R^C)_3$;

R^1 and R^2 are optionally covalently connected to form a ring structure;

each R^3 and each R^5 is independently chosen from $(C_1–C_{50})$hydrocarbyl, $(C_1–C_{50})$heterohydrocarbyl, $(C_6–C_{50})$aryl, $(C_4–C_{50})$heteroaryl, $–Si(R^C)_3$, $–Ge(R^C)_3$, $–P(R^P)_2$, $–N(R^N)_2$, $–OR^C$, $–SR^C$, $–NO_2$, –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, or –H;

each R^6 is independently chosen from $(C_1–C_{50})$hydrocarbyl, $(C_1–C_{50})$heterohydrocarbyl, $(C_6–C_{50})$aryl, $(C_4–C_{50})$heteroaryl, $–Si(R^C)_3$, $–Ge(R^C)_3$, $–P(R^P)_2$, $–N(R^N)_2$, $–OR^C$, $–SR^C$, $–NO_2$, –CN, $–CF_3$, $R^CS(O)–$, $R^CS(O)_2–$, $(R^C)_2C=N–$, $R^CC(O)O–$, $R^COC(O)–$, $R^CC(O)N(R)–$, $(R^C)_2NC(O)–$, or halogen;

R^5 and R^6 are optionally covalently connected to form a ring structure; and

each R^C and R^N in formula (I) is independently a $(C_1–C_{50})$hydrocarbyl.

2. The catalyst system according to claim 1, wherein:

M is zirconium or hafnium;

each X is independently chosen from $(C_6–C_{20})$aryl, $(C_4–C_{20})$heteroaryl, $(C_4–C_{12})$diene, or a halogen; and

each R^6 is independently chosen from $(C_1–C_{50})$aryl or $(C_4–C_{50})$heteroaryl.

3. The catalyst system according to claim 1, wherein R^5 and R^6 are covalently connected to form a six-member aromatic ring.

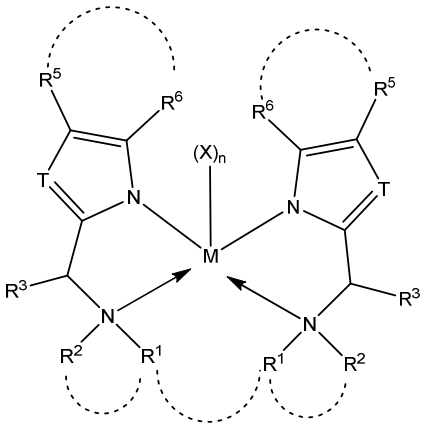
4. The catalyst system according to claim 1, wherein R^5 and R^6 are covalently connected to form a six-member aromatic ring; R^3 is –H; and R^2 is methyl.

5. The catalyst system according to claim 1, wherein each R^6 is anthracenyl, di-substituted anthracenyl, or tri-substituted anthracenyl.

6. The catalyst system according to claim 1, wherein each R^6 is phenyl or a substituted phenyl.

7. The catalyst system according to claim 1, wherein each R^6 is a substituted phenyl chosen from 2,4,6-trimethylphenyl; 2,6-di(*iso*-propyl)phenyl; 3,5-di-*tert*-butylphenyl, or 3,5-diphenylphenyl.

8. The catalyst system according to claim 1, wherein m is 2 and the metal–ligand complex has a structure according to formula (II):



(II)

where M, T, R^1, R^2, R^3, R^4, R^5, R^6, and X are as defined in formula (I); n is 1 or 2; and the dotted lines indicate optional covalent connections.

9. The catalyst system according to claim 8, wherein:

M is zirconium or hafnium;

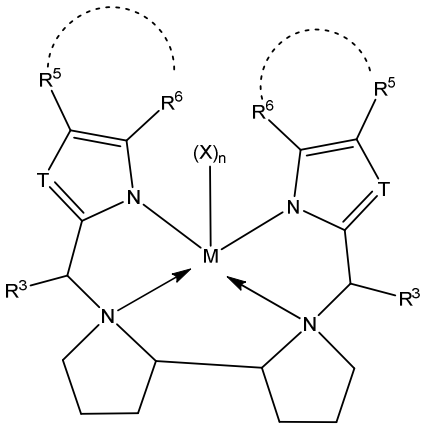
each X is independently chosen from (C_6–C_{50})aryl, (C_6–C_{50})heteroaryl, (C_4–C_{12})diene, or halogen;

each R^1 and R^2 is independently chosen from (C_1–C_{50})hydrocarbyl, (C_1–C_{50})heterohydrocarbyl, (C_6–C_{50})aryl, (C_4–C_{50})heteroaryl, or halogen.

10. The catalyst system according to claim 8, wherein the two R^1 are covalently connected to each other; and each R^2 is independently (C_1–C_{10})alkyl.

11. The catalyst system according to claim 1, wherein the two R^1 are covalently connected as an alkylene chosen from –CH_2CH_2–, –$CH_2CH_2CH_2$–, or –$CH_2CH_2CH_2CH_2$–.

12. The catalyst system according to claim 1, wherein m is 2 and the metal–ligand complex has a structure according to formula (III):



(III)

where M, T, R^3, R^4, R^5, R^6, and X are as defined in formula (I); n is 1 or 2; and the dotted lines indicate optional covalent connections.

13. The catalyst system according to claim 12, wherein each R^6 is independently chosen from carbazolyl, 3,5-di-*tert*-butylphenyl; 2,4,6-trimethylphenyl; 2,6-di-*iso*-propylphenyl; or 3,5-di-*iso*-propylphenyl.

14. The catalyst system according to claim 12, wherein each R^6 is 2,6-di-*iso*-propylphenyl.

15. The catalyst system according to claim 12, wherein each R^6 is 2,4,6-trimethylphenyl.

16. The catalyst system according to claim 1, wherein T is N.

17. The catalyst system according to claim 1, wherein T is CR^4, and R^4 is –H.

18. A polymerization process for producing an ethylene-based polymer, the polymerization process comprising:

polymerizing ethylene and at least one additional α-olefin in the presence of a catalyst system according to claim 1 and at least one activator to form a polymer.

19. The polymerization process according claim 18, wherein the activator comprises MMAO, bis(hydrogenated tallow alkyl)methylammonium tetrakis(pentafluorophenyl)borate, or tris(pentafluorophenyl)borane.