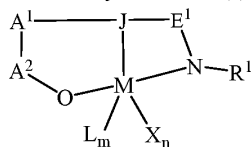


Claims:

1. A catalyst compound represented by Formula (I):



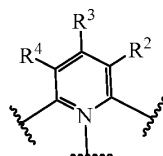
(I)

wherein:

- M is a group 3, 4, 5, or 6 metal;
 - each of A¹ and A² are independently selected from the group consisting of aryl, substituted aryl, heteroaryl group, and substituted heteroaryl group;
 - J comprises a heterocyclic Lewis base;
 - E¹ is selected from the group consisting of hydrocarbyl, substituted hydrocarbyl, silyl, and substituted silyl, wherein J and E¹ are optionally joined to form one or more hydrocarbyl rings, substituted hydrocarbyl rings, heterocyclic rings, or substituted heterocyclic rings;
 - each L is independently a Lewis base;
 - each X is independently an anionic ligand;
 - n is 1, 2 or 3;
 - m is 0, 1, or 2;
 - n+m is not greater than 4;
 - R¹ is selected from the group consisting of C₁-C₄₀ hydrocarbyl, substituted C₁-C₄₀ hydrocarbyl, a heteroatom-containing group, and substituted heteroatom-containing group;
 - any two L groups may be joined together to form a bidentate Lewis base;
 - an X group may be joined to an L group to form a monoanionic bidentate group; and
 - any two X groups may be joined together to form a dianionic ligand group.
2. The catalyst compound of claim 1, wherein the catalyst compound comprises an eight-membered metallocycle ring and a five-membered metallocycle ring.

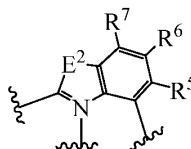
3. The catalyst compound of claim 1 or 2, wherein E¹ is selected from the group consisting of C(R⁸)(R⁹) and Si(R⁸)(R⁹), wherein each of R⁸, and R⁹ is independently selected from the group consisting of hydrogen, C₁-C₄₀ hydrocarbyl, substituted C₁-C₄₀ hydrocarbyl, a heteroatom, heteroatom containing group, and substituted heteroatom-containing group, or R⁸ and R⁹ may be joined to form one or more C₃-C₂₀ alkyl groups, hydrocarbyl rings, substituted hydrocarbyl rings, heterocyclic rings, or substituted heterocyclic rings each having 5, 6, 7, or 8 ring atoms, and wherein substitutions on the ring can join to form additional rings.

4. The catalyst compound of any preceding claim, wherein J is represented by the formula:



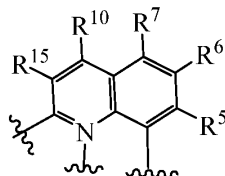
wherein each of R², R³, and R⁴ is independently selected from the group consisting of hydrogen, C₁-C₄₀ hydrocarbyl, substituted C₁-C₄₀ hydrocarbyl, a heteroatom, and heteroatom-containing group, or one or more of R² and R³ or R³ and R⁴ may be joined to form one or more hydrocarbyl rings, substituted hydrocarbyl rings, heterocyclic rings, or substituted heterocyclic rings each having 5, 6, 7, or 8 ring atoms, and where substitutions on the ring can join to form additional rings, or

wherein J and E¹ are joined to form a ring represented by the formula:



wherein E² is selected from O, S, N(R¹⁰), wherein each of R⁵, R⁶, R⁷, and R¹⁰ is independently selected from the group consisting of hydrogen, C₁-C₄₀ hydrocarbyl, substituted C₁-C₄₀ hydrocarbyl, a heteroatom, heteroatom-containing group, and substituted heteroatom-containing group, or one or more of R⁵ and R⁶ or R⁶ and R⁷ may be joined to form one or more hydrocarbyl rings, substituted hydrocarbyl rings, heterocyclic rings, or substituted heterocyclic rings each having 5, 6, 7, or 8 ring atoms, and where substitutions on the ring can join to form additional rings, or

wherein J and E¹ are joined to form a ring represented by the formula:

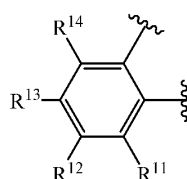


wherein each of R⁵, R⁶, R⁷, R¹⁰ and R¹⁵ is independently selected from the group consisting of hydrogen, C₁-C₄₀ hydrocarbyl, substituted C₁-C₄₀ hydrocarbyl, a heteroatom, heteroatom-containing group, and substituted heteroatom-containing group, or one or more of R⁵ and R⁶ or R⁶ and R⁷ or R⁷ and R¹⁰ or R¹⁰ and R¹⁵ may be joined to form one or more

hydrocarbyl rings, substituted hydrocarbyl rings, heterocyclic rings, or substituted heterocyclic rings each having 5, 6, 7, or 8 ring atoms, and where substitutions on the ring can join to form additional rings.

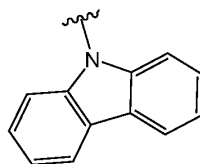
5. The catalyst compound of any preceding claim, wherein M is a group 4 transition metal and A¹ is aryl or substituted aryl.

6. The catalyst compound of any preceding claim, wherein A² is represented by the formula:



wherein each of R¹¹, R¹², R¹³, and R¹⁴ is independently selected from the group consisting of hydrogen, C₁-C₄₀ hydrocarbyl, substituted C₁-C₄₀ hydrocarbyl, a heteroatom, heteroatom-containing group, and a substituted heteroatom-containing group.

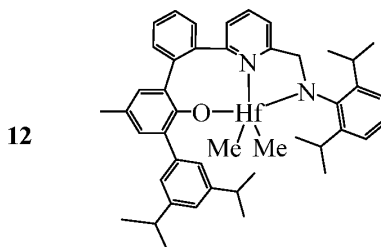
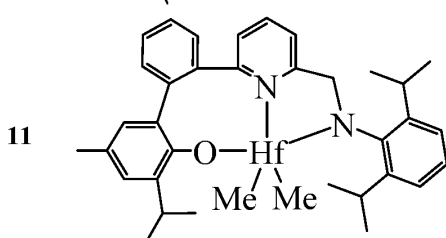
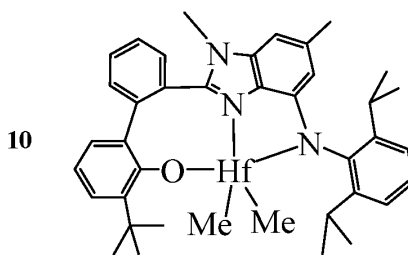
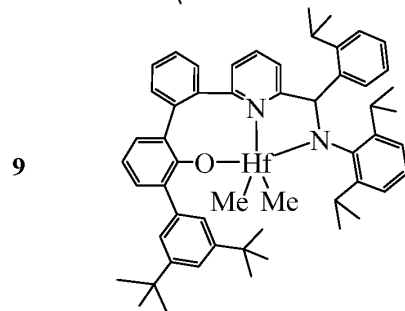
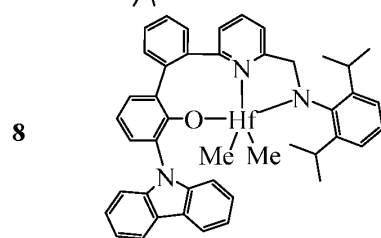
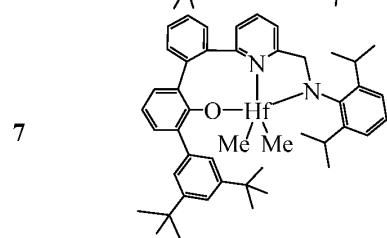
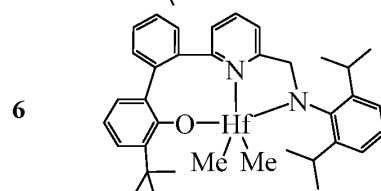
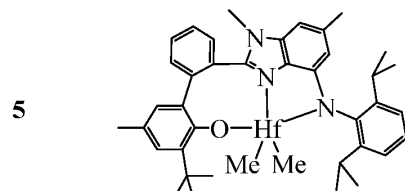
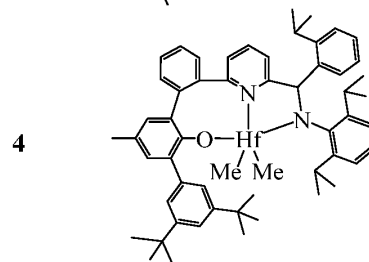
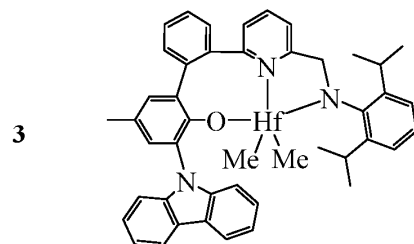
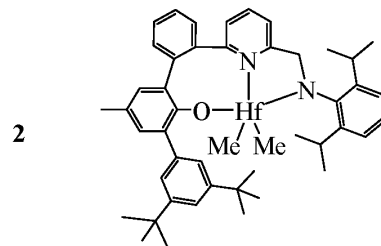
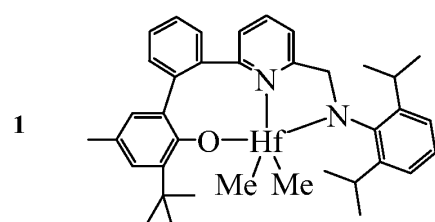
7. The catalyst compound of claim 6, wherein R¹¹ is a C₁-C₂₀ hydrocarbyl or substituted hydrocarbyl, is *tert*-butyl, is a di-*tert*-butylphenyl group, or R¹¹ is represented by the formula:

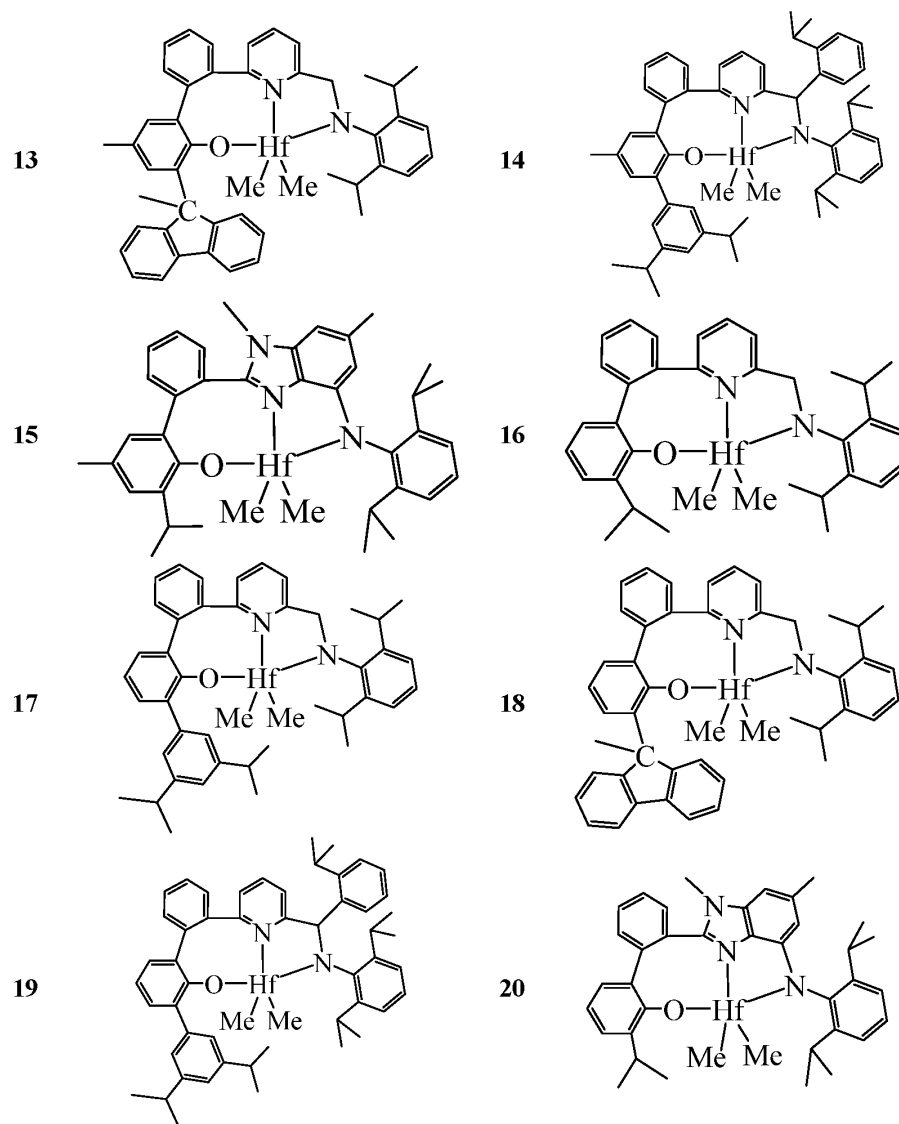


8. The catalyst compound of claim 4, wherein E² selected from the group consisting of NH, C₁-C₂₀ alkyl-N, and C₄-C₂₀ aryl-N.

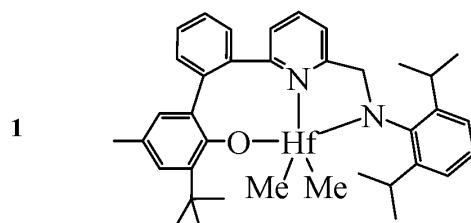
9. The catalyst compound of claim 4, wherein each of R², R³, and R⁴ are independently selected from the group consisting of hydrogen and C₁-C₁₀ alkyl, R¹ is a di-*tert*-butylphenyl group, and E¹ is C(R⁸)(R⁹) with R⁸ being hydrogen and R⁹ being a *tert*-butylphenyl group, or E¹ is CH₂.

10. The catalyst compound of any preceding claim, wherein the catalyst compound is selected from the group consisting of:



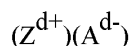


11. The catalyst compound of any preceding claim, wherein the catalyst compound is:



12. A catalyst system comprising an activator and the catalyst compound of any one of claims 1-11.

13. The catalyst system of claim 12, wherein the activator is represented by the formula:



wherein Z is (L-H) or a reducible Lewis Acid, L is a Lewis base; H is hydrogen; (L-H)⁺ is a Bronsted acid; A^{d-} is a non-coordinating anion having the charge d-; and d is an integer from 1 to 3, or

wherein A^{d-} is a non-coordinating anion having the charge d-; d is an integer from 1 to 3, and Z is a reducible Lewis acid represented by the formula: (Ar₃C⁺), where Ar is aryl or aryl substituted with a heteroatom, a C₁ to C₄₀ hydrocarbyl, or a substituted C₁ to C₄₀ hydrocarbyl; or

the activator is represented by the Formula (AI):



wherein:

E is nitrogen or phosphorous;

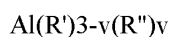
d is 1, 2 or 3; k is 1, 2, or 3; n is 1, 2, 3, 4, 5, or 6; n - k = d;

each of R¹, R², and R³ is independently hydrogen, a C₁-C₄₀ alkyl, or a C₅-C₅₀-aryl, wherein each of R¹, R², and R³ is independently unsubstituted or substituted; wherein R¹, R², and R³ together comprise 15 or more carbon atoms;

M is an element selected from group 13 of the Periodic Table of the Elements; and

each Q is independently selected from the group consisting of a hydrogen, bridged or unbridged dialkylamido, halide, alkoxy, substituted alkoxy, aryloxy, substituted aryloxy, hydrocarbyl, substituted hydrocarbyl, halocarbyl, substituted halocarbyl, and halosubstituted-hydrocarbyl radical.

14. The catalyst system of claims 12 or 13, further comprising a metal hydrocarbenyl chain transfer agent represented by the formula:

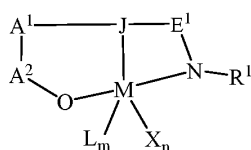


wherein each R' independently is a C₁-C₃₀ hydrocarbyl group; each R'', independently, is a C₄-C₂₀ hydrocarbenyl group having an end-vinyl group; and v is from 0.1 to 3.

15. A process for the production of a polymer comprising:

polymerizing an alkene by contacting the alkene with a catalyst system that includes an activator and catalyst compound, wherein the catalyst compound is represented by

Formula (I):



(I)

wherein:

M is a group 3, 4, 5, or 6 metal;

each of A¹ and A² are independently selected from the group consisting of aryl, substituted aryl, heteroaryl group, and substituted heteroaryl group;

J comprises a heterocyclic Lewis base;

E¹ is selected from the group consisting of hydrocarbyl, substituted hydrocarbyl, silyl, and substituted silyl, wherein J and E¹ are optionally joined to form one or more hydrocarbyl rings, substituted hydrocarbyl rings, heterocyclic rings, or substituted heterocyclic rings;

each L is independently a Lewis base;

each X is independently an anionic ligand;

n is 1, 2 or 3;

m is 0, 1, or 2;

n+m is not greater than 4;

R¹ is selected from the group consisting of C₁-C₄₀ hydrocarbyl, substituted C₁-C₄₀ hydrocarbyl, a heteroatom-containing group, and substituted heteroatom-containing group;

any two L groups may be joined together to form a bidentate Lewis base;

an X group may be joined to an L group to form a monoanionic bidentate group; and

any two X groups may be joined together to form a dianionic ligand group; and

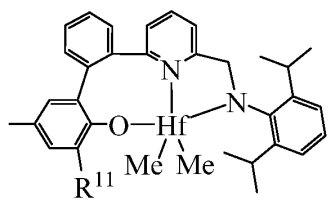
wherein the polymerizing is performed in one or more continuous stirred tank reactors or loop reactors, in series or in parallel, at a reactor pressure of from 0.05 MPa to 1,500 MPa and a reactor temperature of from 30°C to 230°C.

16. The process of claim 15, wherein the polymer is homopolyethylene and the alkene is ethylene, wherein the homopolyethylene has an Mw value of from 155,000 g/mol to 1,200,000 g/mol, Mn value of from 90,000 to 550,000, Mz value of from 350,000 to 4,000,000, and a PDI of from 1.5 to 3.

17. The process of claim 16, wherein:

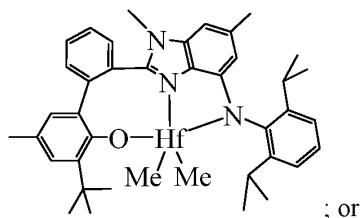
the melting temperature of the polymer is between about 135°C and 138°C, and

the catalyst compound is represented by the formula:

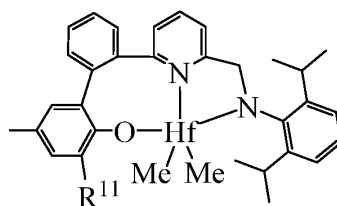


wherein R^{11} is selected from the group consisting of hydrogen, C_1 - C_{40} hydrocarbyl, substituted C_1 - C_{40} hydrocarbyl, a heteroatom, and a heteroatom-containing group; or wherein:

the melting temperature of the polymer is between about 135°C and 138°C, and the catalyst compound is:



wherein the polymer is an ethylene-octene copolymer, the copolymer has an M_w value of from 100,000 to 3,600,000, M_n value of from 50,000 to 2,250,000, M_z value of from 225,000 to 6,200,000, and a PDI of from 1.5 to 3, the melting temperature of the polymer is from 104°C to 126°C, preferably the melting temperature of the polymer being from 121°C to 126°C, and the catalyst compound is represented by the formula:



wherein R^{11} is selected from the group consisting of hydrogen, C_1 - C_{40} hydrocarbyl, substituted C_1 - C_{40} hydrocarbyl, a heteroatom, and a heteroatom-containing group, preferably R^{11} being *tert*-butyl; or wherein:

the alkene is propylene,
the polymer is homopolypropylene, and
the homopolypropylene has:

an M_w value of from 85,000 g/mol to 750,000 g/mol,
an M_n value of from 55,000 g/mol to 400,000 g/mol,
an M_z value of from 165,000 g/mol to 1,600,000 g/mol, and
a PDI of from 1.6 to 2.1,
the reactor temperature is between about 60°C and 80°C,
the melting temperature of the polymer is from 146°C to 147°C, and
the catalyst compound is:

