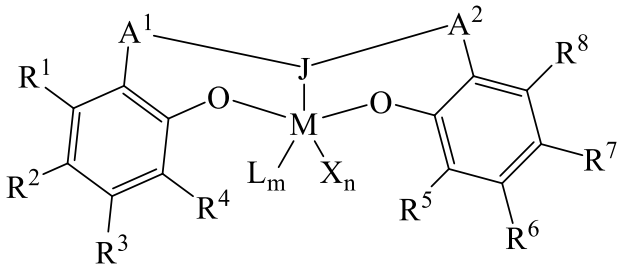
CLAIMS

What is claimed is:

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



(**I**)

wherein:

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

A^1 and A^2 are independently an aromatic group;

J is a heterocyclic Lewis base;

L is a Lewis base;

X is an anionic ligand;

n is 1, 2 or 3;

m is 0, 1, or 2;

n+m is not greater than 4;

each of R^1, R^2, R^3, R^4, R^5, R^6, R^7, and R^8 is independently hydrogen, C_1-C_{40} hydrocarbyl, C_1-C_{40} substituted hydrocarbyl, a heteroatom or a heteroatom-containing group, or one or more of R^1 and R^2, R^2 and R^3, R^3 and R^4, R^5 and R^6, R^6 and R^7, or R^7 and R^8 may be joined to form one or more substituted hydrocarbyl rings, unsubstituted hydrocarbyl rings, substituted heterocyclic rings, or unsubstituted heterocyclic rings each having 5, 6, 7, or 8 ring atoms, and where substitutions on the ring can join to form additional rings;

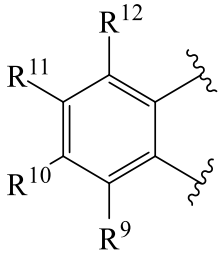
any two L groups may be joined together to form a bidentate Lewis base;

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,

wherein n is preferably 2 and each X is preferably independently chloro, benzyl, or methyl.

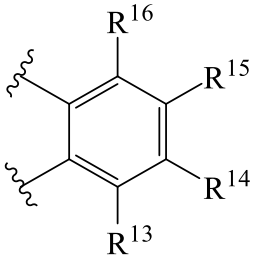
2. The catalyst compound of claim 1, wherein A^1 is represented by the formula:



wherein ≀ indicates a connection to the catalyst compound, and

each of R^9, R^{10}, R^{11}, and R^{12} is independently hydrogen, C_1-C_{40} hydrocarbyl, C_1-C_{40} substituted hydrocarbyl, a heteroatom or a heteroatom-containing group, or one or more of R^9 and R^{10}, R^{10} and R^{11}, or R^{11} and R^{12} may be joined to form one or more substituted hydrocarbyl rings, unsubstituted hydrocarbyl rings, substituted heterocyclic rings, or unsubstituted heterocyclic rings each having 5, 6, 7, or 8 ring atoms.

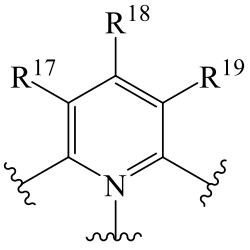
3. The catalyst compound of claim 1, wherein A^2 is represented by the formula:



wherein ≀ indicates a connection to the catalyst compound, and

each of R^{13}, R^{14}, R^{15}, and R^{16} is independently hydrogen, C_1-C_{40} hydrocarbyl, C_1-C_{40} substituted hydrocarbyl, a heteroatom or a heteroatom-containing group, or one or more of R^{13} and R^{14}, R^{14} and R^{15}, or R^{15} and R^{16} may be joined to form one or more substituted hydrocarbyl rings, unsubstituted hydrocarbyl rings, substituted heterocyclic rings, or unsubstituted heterocyclic rings each having 5, 6, 7, or 8 ring atoms.

4. The catalyst compound of claim 1, wherein J is selected from a pyridine, a thiazole, an oxazole, an oxazoline, an imidazole, a furan, or a thiofuran, wherein J is preferably represented by the formula:

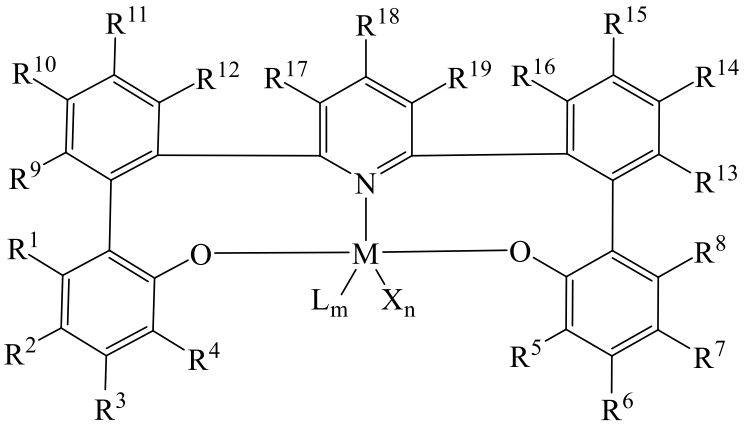


wherein ≀ indicates a connection to the catalyst compound, and

each of R^{17}, R^{18}, and R^{19} is independently hydrogen, C_1-C_{40} hydrocarbyl, C_1-C_{40} substituted hydrocarbyl, a heteroatom or a heteroatom-containing group, or one or more of R^{17} and R^{18}, R^{18} and R^{19}, or R^{17} and R^{19} may be joined to form one or more substituted hydrocarbyl rings, unsubstituted hydrocarbyl rings, substituted heterocyclic rings, or unsubstituted heterocyclic rings each having 5, 6, 7, or 8 ring atoms.

5. The catalyst compound of claim 4, wherein R^{17}, R^{18}, and R^{19} are hydrogen.

6. The catalyst compound of claim 1, wherein the complex is represented by Formula (**II**):



(**II**)

wherein:

each of R^1, R^2, R^3, R^4, R^5, R^6, R^7, and R^8 is independently hydrogen, C_1-C_{40} hydrocarbyl, C_1-C_{40} substituted hydrocarbyl, a heteroatom or a heteroatom-containing group, or one or more of R^1 and R^2, R^2 and R^3, R^3 and R^4, R^5 and R^6, R^6 and R^7, or R^7 and R^8 may be joined to form one or more substituted hydrocarbyl rings, unsubstituted hydrocarbyl rings, substituted heterocyclic rings, or unsubstituted heterocyclic rings each having 5, 6, 7, or 8 ring atoms;

each of R^9, R^{10}, R^{11}, and R^{12} is independently hydrogen, C_1-C_{40} hydrocarbyl, C_1-C_{40} substituted hydrocarbyl, a heteroatom or a heteroatom-containing group, or one or more of R^9 and R^{10}, R^{10} and R^{11}, or R^{11} and R^{12} may be joined to form one or more substituted hydrocarbyl rings, unsubstituted hydrocarbyl rings, substituted heterocyclic rings, or unsubstituted heterocyclic rings each having 5, 6, 7, or 8 ring atoms;

each of R^{13}, R^{14}, R^{15}, and R^{16} is independently hydrogen, C_1-C_{40} hydrocarbyl, C_1-C_{40} substituted hydrocarbyl, a heteroatom or a heteroatom-containing group, or one or more of R^{13} and R^{14}, R^{14} and R^{15}, or R^{15} and R^{16} may be joined to form one or more substituted hydrocarbyl

rings, unsubstituted hydrocarbyl rings, substituted heterocyclic rings, or unsubstituted heterocyclic rings each having 5, 6, 7, or 8 ring atoms;

each of R^{17}, R^{18}, and R^{19} is independently hydrogen, C_1-C_{40} hydrocarbyl, C_1-C_{40} substituted hydrocarbyl, a heteroatom or a heteroatom-containing group, or one or more of R^{17} and R^{18}, R^{18} and R^{19}, or R^{17} and R^{19} may be joined to form one or more substituted hydrocarbyl rings, unsubstituted hydrocarbyl rings, substituted heterocyclic rings, or unsubstituted heterocyclic rings each having 5, 6, 7, or 8 ring atoms;

M is a group 3, 4, or 5 metal, preferably zirconium or hafnium;

L is a Lewis base;

X is an anionic ligand, preferably halogens or hydrocarbyl groups containing 1 to 8 carbons;

n is 1, 2 or 3;

m is 0, 1, or 2;

n+m is not greater than 4;

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

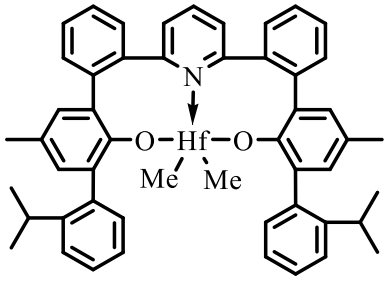
any two X groups may be joined together to form a dianionic ligand group.

7. The catalyst compound of claim 6, wherein each of R^1, R^2, R^3, R^4, R^5, R^6, R^7, and R^8 is independently selected from hydrogen, C_1-C_{40} hydrocarbyl, C_1-C_{40} substituted hydrocarbyl, alkoxy, silyl, amino, aryloxy, halogen, or phosphino, or one or more of R^1 and R^2, R^2 and R^3, R^3 and R^4, R^5 and R^6, R^6 and R^7, or R^7 and R^8 may be joined to form one or more substituted hydrocarbyl rings, unsubstituted hydrocarbyl rings, substituted heterocyclic rings, or unsubstituted heterocyclic rings each having 5, 6, 7, or 8 ring atoms, wherein preferably R^2 and R^7 are independently C_1-C_{10} alkyl or are methyl.

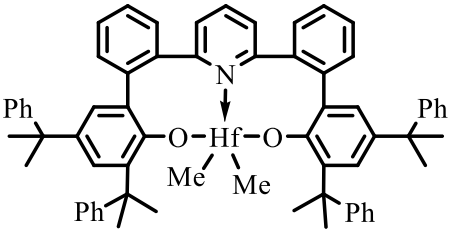
8. The catalyst compound of claim 7, wherein R^4 and R^5 are independently C_1-C_{10} alkyl, and preferably *tert*-butyl, aryl, phenyl, carbazole, Et_3Si, or 3,5-di-*tert*-butylbenzyl.

9. The catalyst compound of claim 7, wherein each of R^1, R^3, R^6, R^8, R^9, R^{10}, R^{11}, R^{12}, R^{13}, R^{14}, R^{15}, R^{16}, R^{17}, R^{18}, and R^{19} is independently hydrogen, C_1-C_{10} alkyl, methyl, ethyl, propyl, isopropyl, phenyl, cyclohexyl, fluoro, chloro, methoxy, ethoxy, phenoxy, or trimethylsilyl, preferably hydrogen.

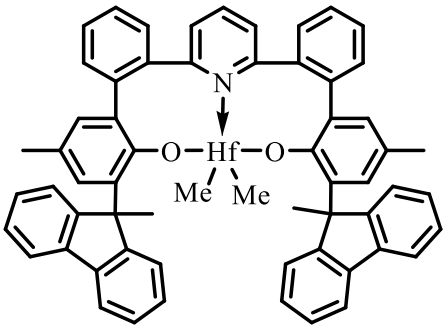
10. The catalyst compound of claim 1, wherein the catalyst compound is selected from:



Catalyst 8



Catalyst 9



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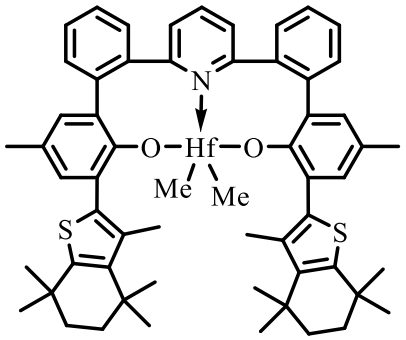
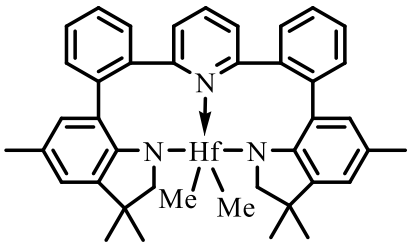


Catalyst 11



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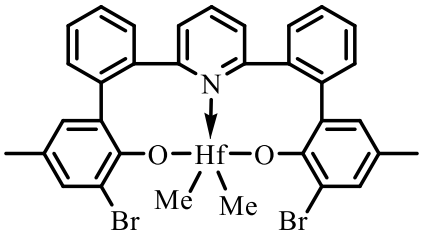

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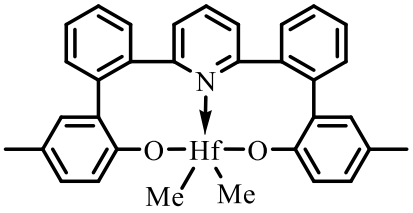

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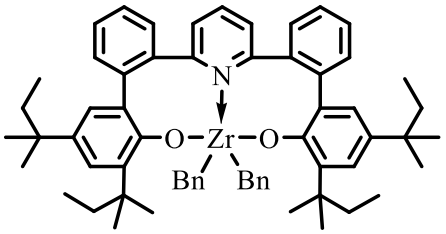

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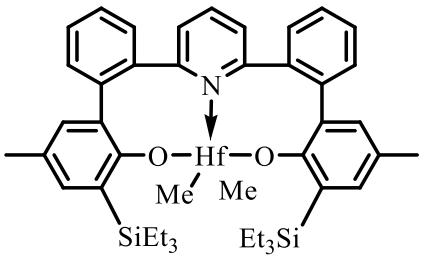
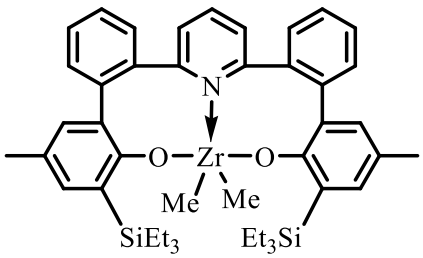
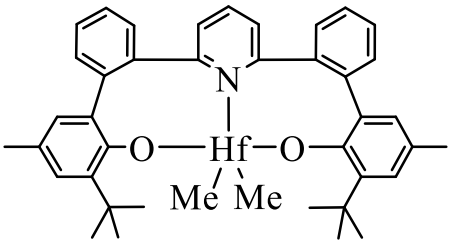
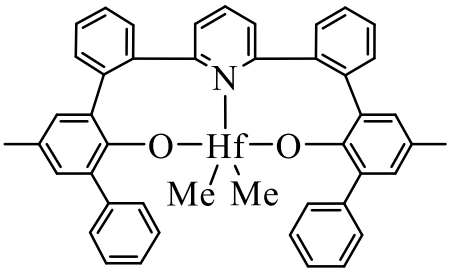
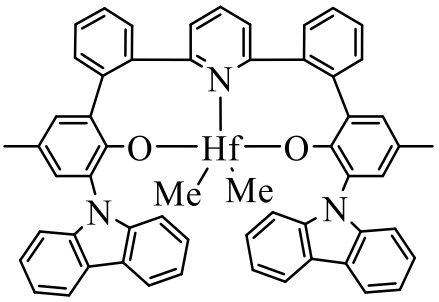
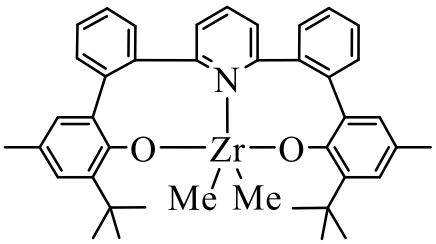
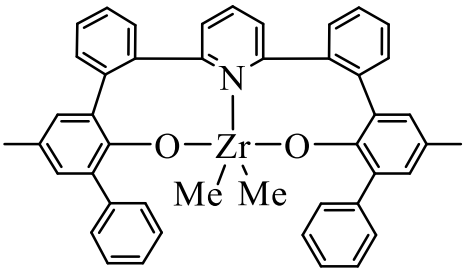
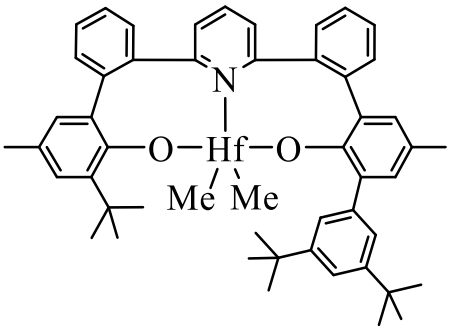
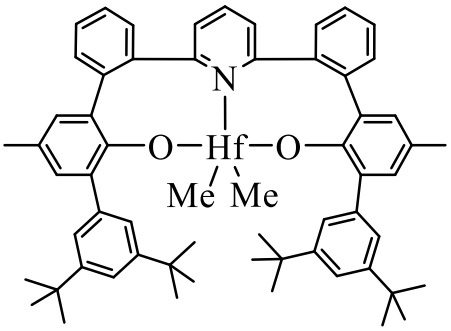
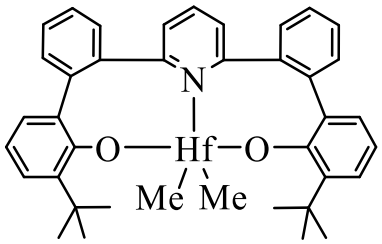
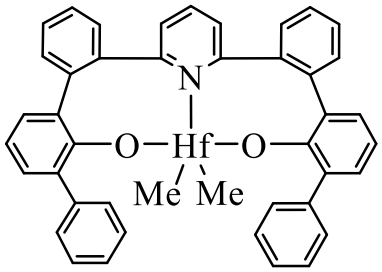
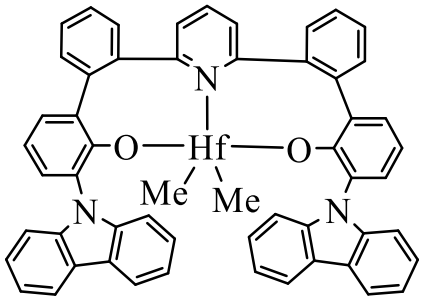


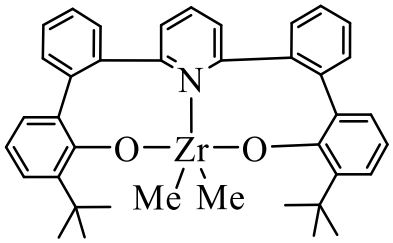
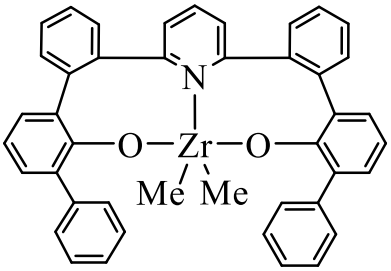
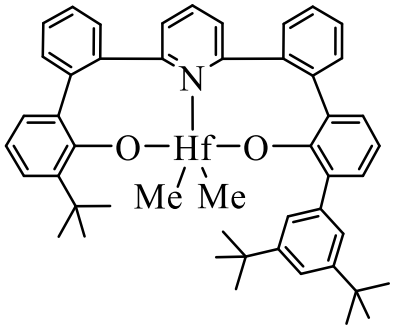
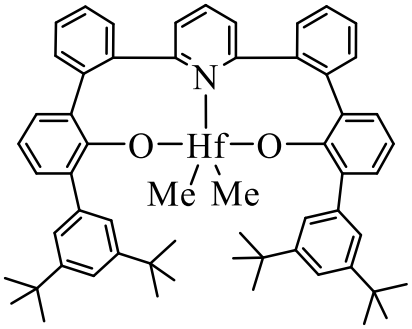
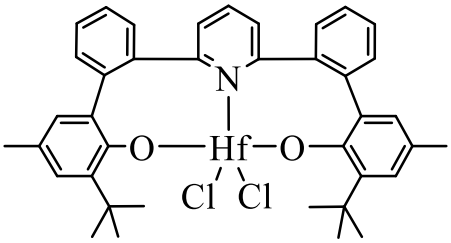
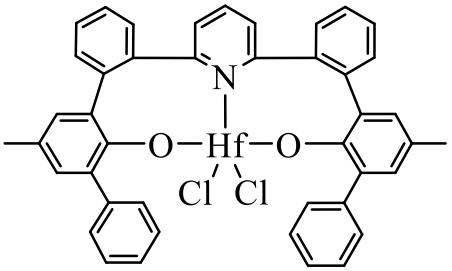
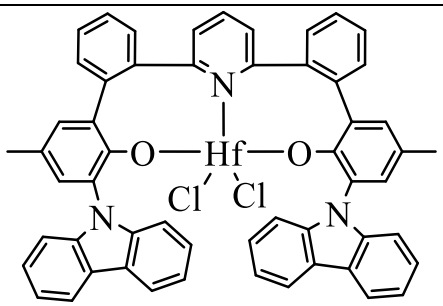
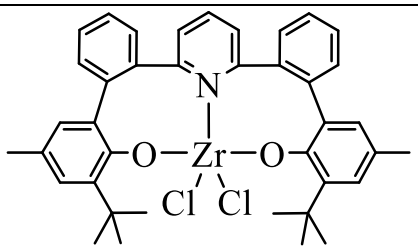
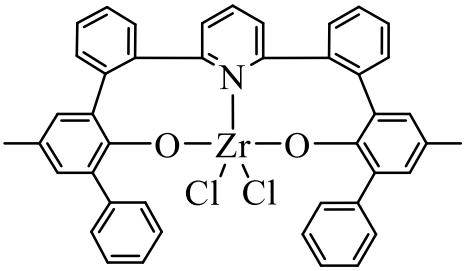
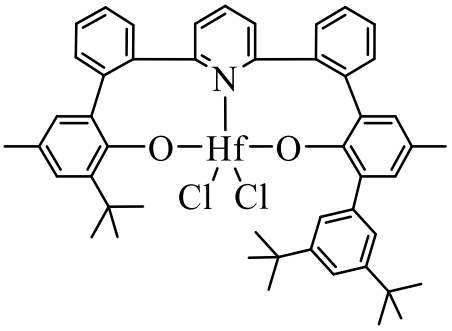
Catalyst 16

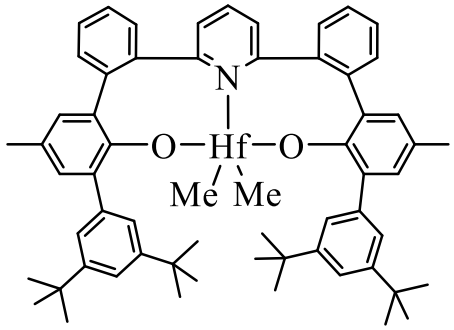
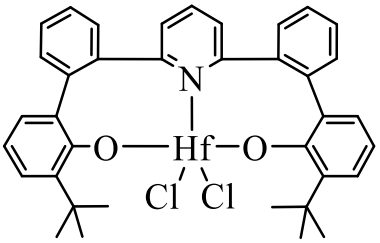
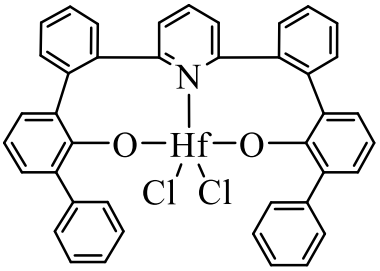
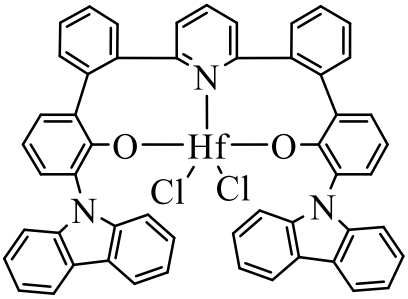
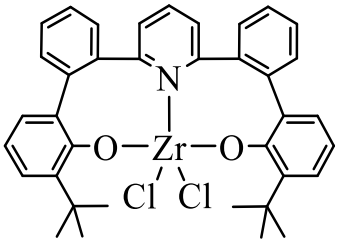
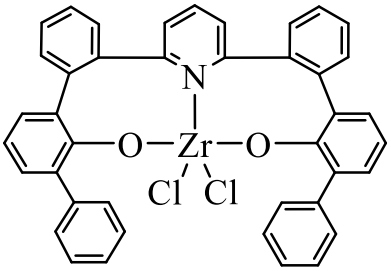
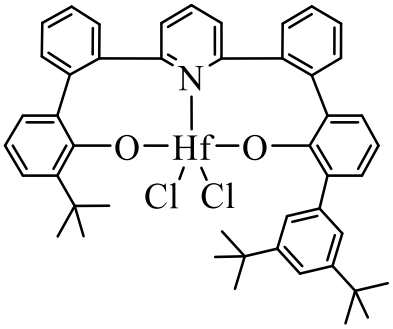
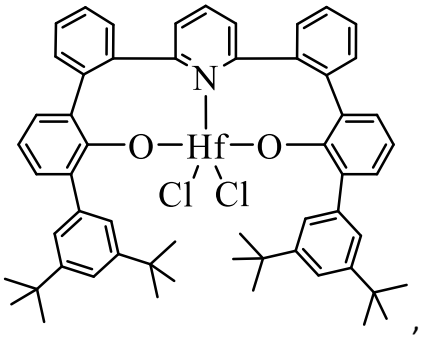


Catalyst 17

11. The catalyst compound of claim 1, wherein the catalyst compound is selected from:

1		2	
3		4	
5		6	
7		8	
9		10	

11		12	
13		14	
15		16	
17		18	
19		20	

21		22	
23		24	
25		26	
27		28	

preferably catalysts 1 or 4.

12. A process for the production of an ethylene or propylene based polymer comprising: polymerizing ethylene or propylene by contacting the ethylene, optionally with at least one C_3-C_{20} alpha-olefin, or propylene with a catalyst of claim 1 to 11, 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.

13. The process of claim 12, wherein the ethylene based polymer has an Mw value of from 1,000 to 3,000,000 g/mol, Mn value of from 1,000 to 2,000,000 g/mol, Mz value of from 1,000 to 10,000,000 g/mol, and a PDI of from 1 to 20, or the propylene based polymer has an Mw value of from 500 to 150,000 g/mol, Mn value of from 500 to 100,000 g/mol, Mz value of from 2,000 to 400,000 g/mol, a PDI of from 1 to 3, 1 to 5, or 10 to 20, wherein the ethylene based polymer has a melting point of from 100°C to 140°C or the propylene based polymer has a melting point of from 50°C to 170°C.

14. The process of claim 12, wherein the ethylene alpha-olefin copolymer has an Mw value of from 5,000 to 1,500,000 g/mol, and Mz value of from 5,000 to 10,000,000 g/mol, an Mn value of from 2,000 to 400,000 g/mol, a PDI of from 1 to 40, preferably 1 to 5, or preferably 20 to 40, and a melting point of from 40°C to 140°C.

15. A transition metal compound comprising a tridentate dianionic ligand chelated to a group 4 transition metal, wherein the tridentate ligand coordinates to the metal with two anionic oxygen donors and one neutral heterocyclic nitrogen donor to form a pair of eight-membered metallocycle rings.