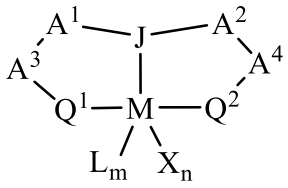
CLAIMS

What is claimed is:

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



(**I**)

wherein:

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

each A^1, A^2, A^3, and A^4 is independently an aromatic group;

J is a heterocyclic Lewis base;

each Q^1 and Q^2 are independently selected from O, S, $N(R^{30})$, or $P(R^{30})$, wherein R^{30} is C_1-C_{40} hydrocarbyl, substituted C_1-C_{40} hydrocarbyl, or a heteroatom, or a heteroatom-containing group;

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;

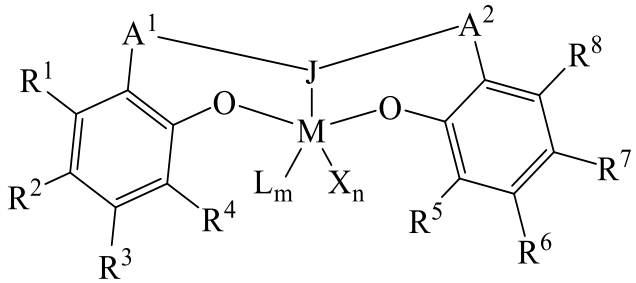
any two L groups may be joined together to form a bidentate Lewis base;

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,

wherein the ring formed by M, Q^1, A^3, A^1, and J is an eight-membered ring and the ring formed by M, Q^2, A^4, A^2 and, J is an eight-membered ring.

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

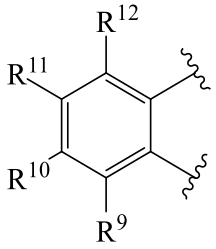


(**II**)

wherein:

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

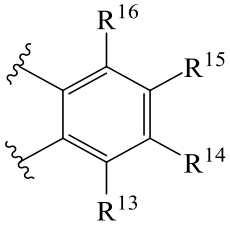
A^1 and A^2 are independently an aromatic group, preferably A^1 being represented by the formula



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, and

preferably A^2 being 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;

J is a heterocyclic ring having 5 ring atoms;

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;

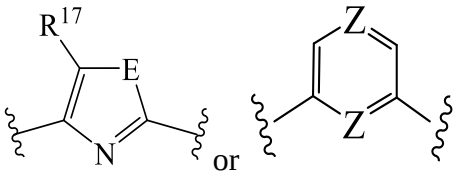
any two L groups may be joined together to form a bidentate Lewis base;

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,

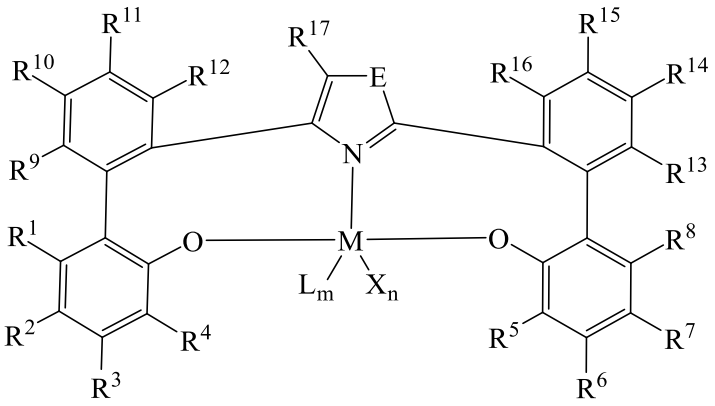
wherein the ring formed by M, O, A^1, and J is an eight-membered ring and the ring formed by M, O, A^2, and J is an eight-membered ring.

3. The catalyst compound of claim 1, wherein J is a group 15-containing heterocycle, a group 16-containing heterocycle, nitrogen-containing heterocycle, an oxygen-containing heterocycle, a phosphorus-containing heterocycle, a sulfur-containing heterocycle, a thiazole, an oxazole, an oxazoline, an imidazole, a furan, a thiofuran, or J is represented by the formula



wherein ≀ indicates a connection to the catalyst compound; R^{17} is hydrogen, C_1-C_{40} hydrocarbyl, C_1-C_{40} substituted hydrocarbyl, a heteroatom or a heteroatom-containing group; E is unsubstituted heteroatom, or substituted heteroatom; and each Z is independently an unsubstituted heteroatom or a substituted heteroatom.

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



(**III**)

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;

R^{17} is hydrogen, C_1-C_{40} hydrocarbyl, C_1-C_{40} substituted hydrocarbyl, a heteroatom or a heteroatom-containing group, preferably hydrogen;

E is sulfur or oxygen;

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.

5. The catalyst compound of any of claim 4, 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.

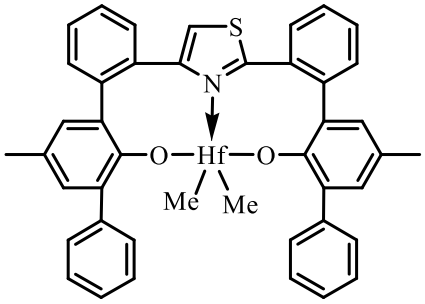
6. The catalyst compound of claim 5, wherein R^4 and R^5 are independently C_1-C_{10} alkyl, preferably tert-butyl.

7. The catalyst compound of claim 5, wherein R^2 and R^7 are independently C_1-C_{10} alkyl, preferably methyl.

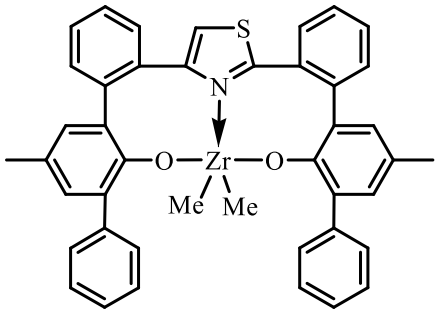
8. The catalyst compound of claim 5 or 7, wherein each of R^1, R^3, R^6, R^8, R^9, R^{10}, R^{11}, R^{12}, R^{13}, R^{14}, R^{15}, R^{16}, and R^{17} is independently hydrogen, C_1-C_{10} alkyl, methyl, ethyl, propyl, isopropyl, phenyl, cyclohexyl, fluoro, chloro, methoxy, ethoxy, phenoxy, or trimethylsilyl, preferably hydrogen.

9. The catalyst compound of claim 1, wherein n is 2 and each X is independently chloro, benzyl, or methyl.

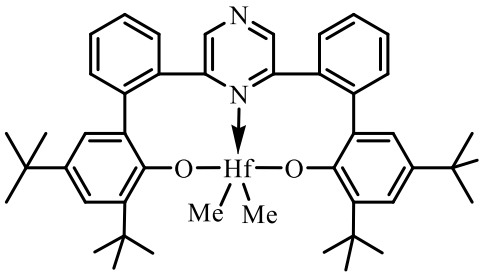
10. The catalyst compound of claim 1, wherein the catalyst compound is selected from:



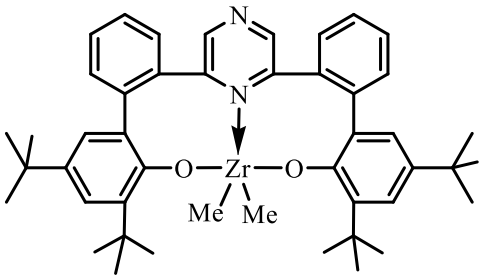
Catalyst 2



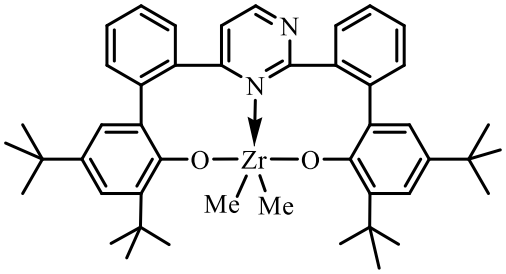
Catalyst 3



Catalyst 4



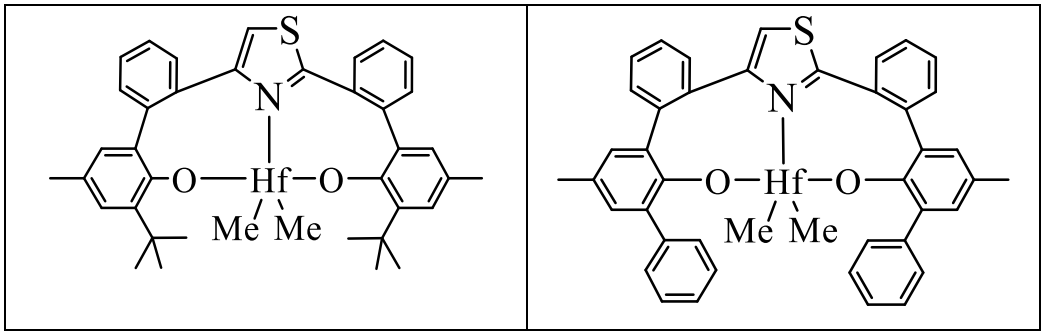
Catalyst 5

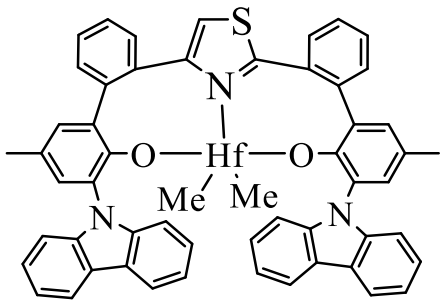
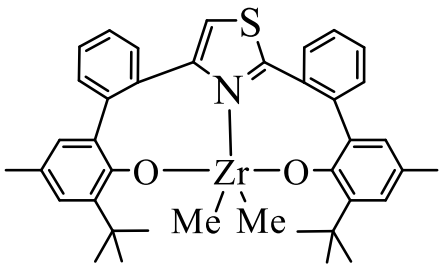
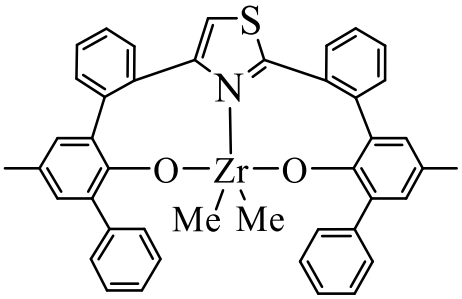
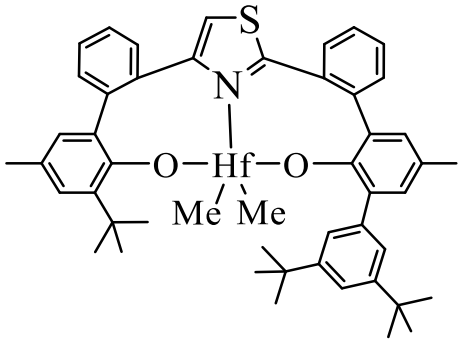
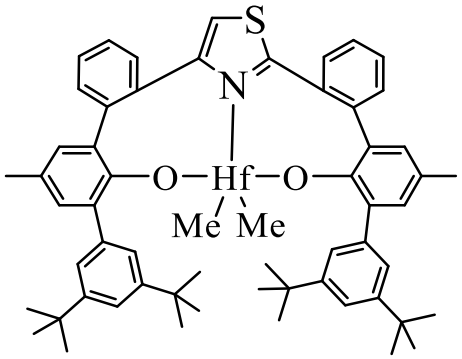
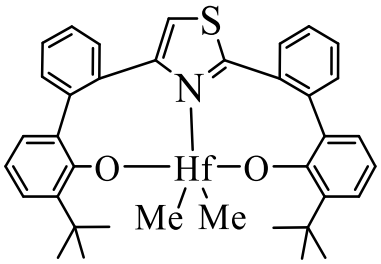
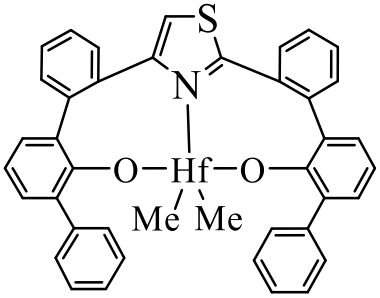
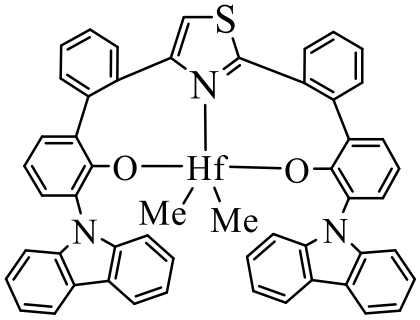
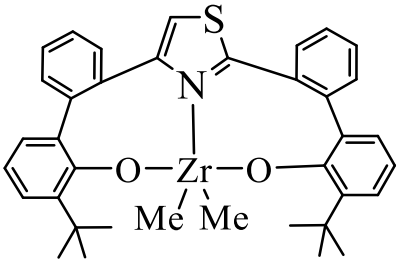
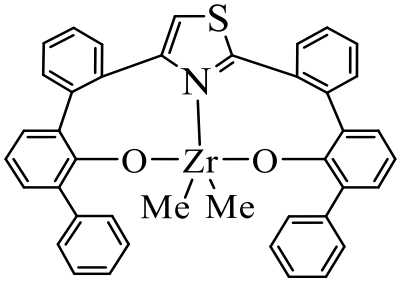


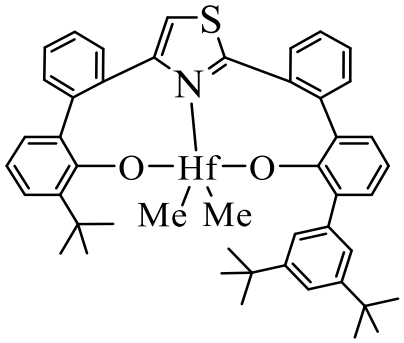
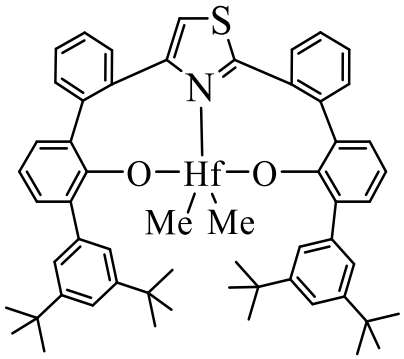
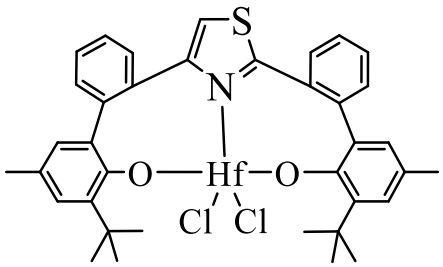
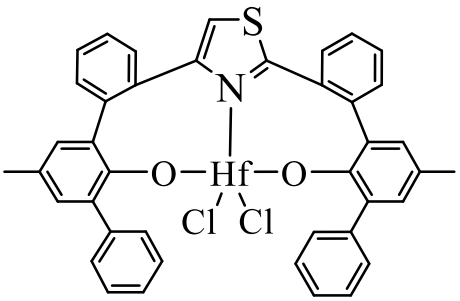
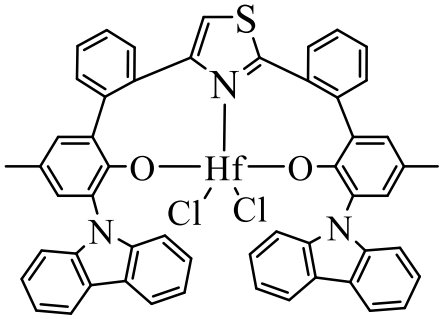
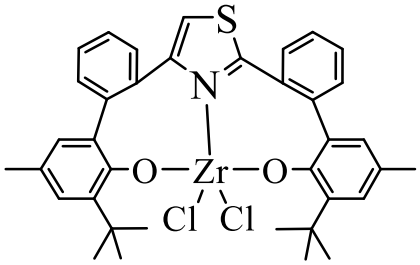
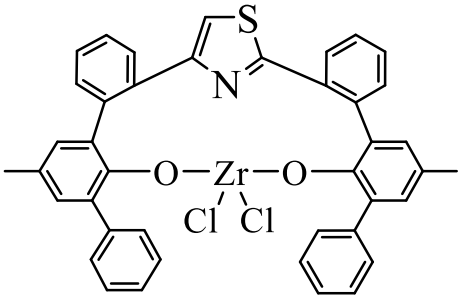
Catalyst 6

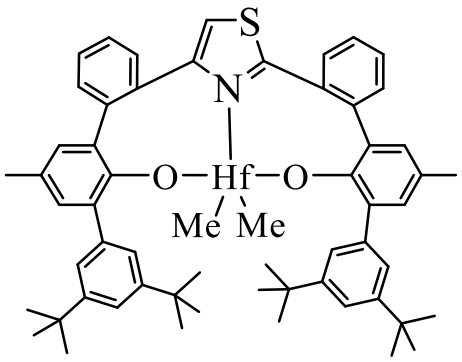
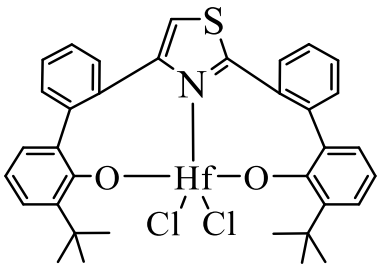
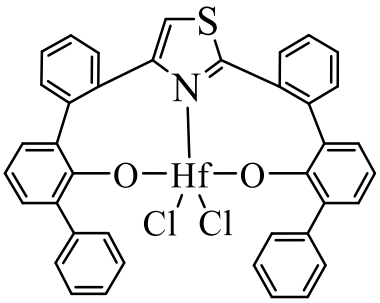
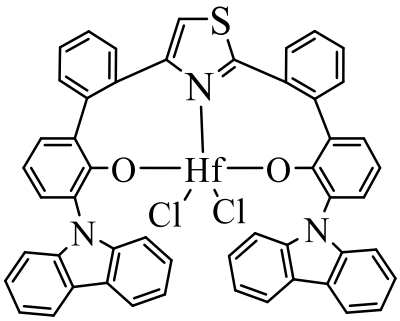
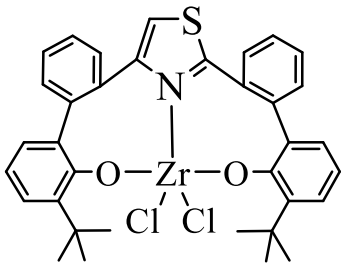
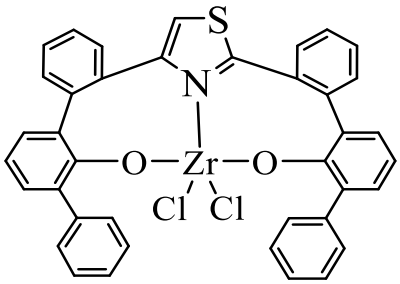
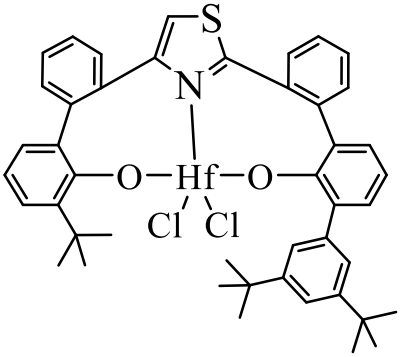
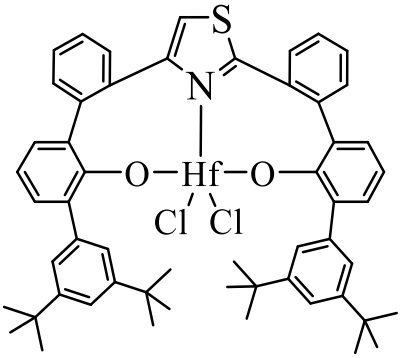
.

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

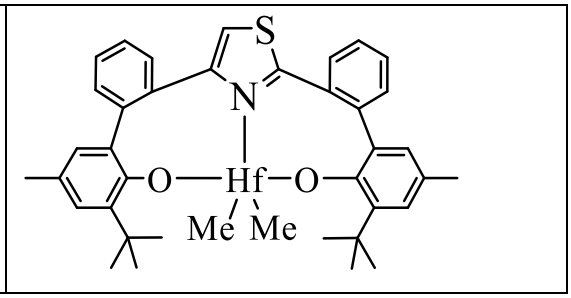


preferably the catalyst compound is:

1	

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 system of claim1, 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 2,000 to 3,000,000, Mn value of from 1,000 to 2,000,000, Mz value of from 10,000 to 10,000,000, and a PDI of from 1 to 5 or the propylene based polymer has an Mw value of from 500 to 15,000, Mn value of from 500 to 15,000, Mz value of from 500 to 20,000, and a PDI of from 1 to 5.

14. The process of claim 13, wherein the ethylene based polymer has a melting point of from 110°C to 150°C or the propylene based polymer has a melting point of from 50°C to 150°C or the ethylene alpha-olefin copolymer has a melting point of from 100°C to 140°C.

15. The process of claim 12, wherein the ethylene alpha-olefin copolymer has a comonomer content of 0.1 to 50 wt%, an Mw value of from 1,000 to 3,000,000, and Mz value of from 1,000 to 10,000,000, an Mn value of from 1,000 to 1,000,000, and a PDI of from 1 to 5.

16. The process of claims 12-15, wherein the at least one C_3-C_{20} alpha-olefin includes at least one C_4-C_{20} alpha-olefin.