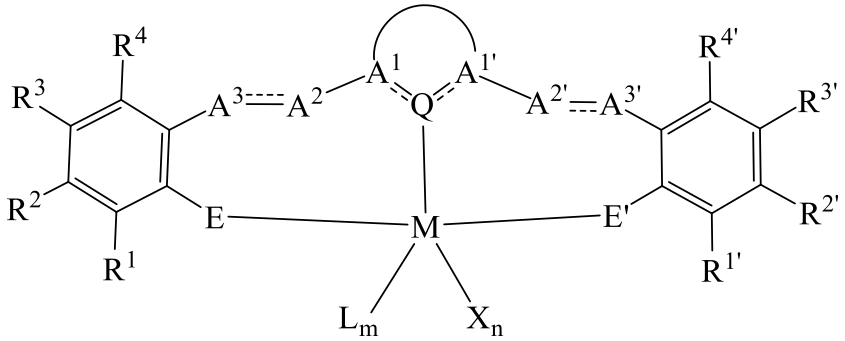
CLAIMS

What is claimed is

1. A polymerization process comprising contacting, in a homogeneous phase, at least one C_3-C_{40} alpha olefin and ethylene with a catalyst system comprising activator and catalyst compound represented by the Formula (**I**):



(**I**)

wherein:

M is a group 3, 4, 5, or 6 transition metal or a Lanthanide, preferably Hf, Zr, or Ti;

E and E' are each independently O, S, or NR^9 where R^9 is independently hydrogen, a C_1-C_{40} hydrocarbyl, a C_1-C_{40} substituted hydrocarbyl or a heteroatom-containing group;

Q is group 14, 15, or 16 atom that forms a dative bond to metal M;

$A^1QA^{1'}$ are part of a heterocyclic Lewis base containing 4 to 40 non-hydrogen atoms that links A^2 to $A^{2'}$ via a 3-atom bridge with Q being the central atom of the 3-atom bridge, A^1 and $A^{1'}$ are independently C, N, or C(R^{22}), where R^{22} is selected from hydrogen, C_1-C_{20} hydrocarbyl, C_1-C_{20} substituted hydrocarbyl;

A^3=A^2 is a divalent group containing 2 to 40 non-hydrogen atoms that links A^1 to the E-bonded aryl group via a 2-atom bridge;

$A^{2'}$=$A^{3'}$ is a divalent group containing 2 to 40 non-hydrogen atoms that links $A^{1'}$ to the E'-bonded aryl group via a 2-atom bridge;

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, $R^{1'}$, $R^{2'}$, $R^{3'}$, and $R^{4'}$ is independently hydrogen, a C_1-C_{40} hydrocarbyl, a C_1-C_{40} substituted hydrocarbyl, a heteroatom or a heteroatom-containing group, and one or more of R^1 and R^2, R^2 and R^3, R^3 and R^4, $R^{1'}$ and $R^{2'}$, $R^{2'}$ and $R^{3'}$, $R^{3'}$ and $R^{4'}$

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;

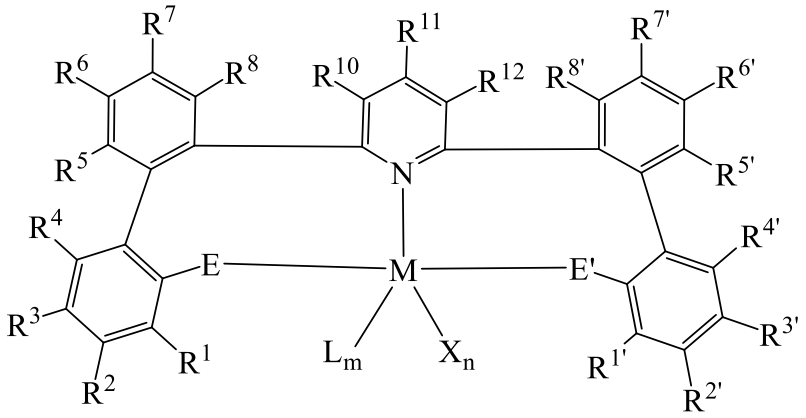
an X group may be joined to an L group to form a monoanionic bidentate group;

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

obtaining a polymer comprising up to 35 mole% ethylene.

2. The polymerization process of claim 1, wherein the C_3-C_{40} alpha olefin is propylene and the polymer comprises 0.1 to 35 mol% ethylene and 99.9 to 65 mol% propylene.

3. The process of claim 1 where the catalyst compound represented by the Formula (**II**):



(**II**)

wherein:

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

E and E' are each independently O, S, or NR^9, where R^9 is independently hydrogen, a C_1-C_{40} hydrocarbyl, a C_1-C_{40} substituted hydrocarbyl, or a heteroatom-containing group;

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;

each of R^1, R^2, R^3, R^4, $R^{1'}$, $R^{2'}$, $R^{3'}$, and $R^{4'}$ 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, $R^{1'}$ and $R^{2'}$, $R^{2'}$ and $R^{3'}$, $R^{3'}$ and $R^{4'}$ 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;

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

each of R^5, R^6, R^7, R^8, $R^{5'}$, $R^{6'}$, $R^{7'}$, $R^{8'}$, R^{10}, R^{11}, and R^{12} is independently hydrogen, a C_1-C_{40} hydrocarbyl, a C_1-C_{40} substituted hydrocarbyl, a heteroatom or a heteroatom-containing group, or one or more of R^5 and R^6, R^6 and R^7, R^7 and R^8, $R^{5'}$ and $R^{6'}$, $R^{6'}$ and $R^{7'}$, $R^{7'}$ and $R^{8'}$, 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 where substitutions on the ring can join to form additional rings.

4. The process of claim 1, 2, or 3wherein R^1 and $R^{1'}$ are independently selected from the group consisting of a C_4-C_{40} tertiary hydrocarbyl group, a C_4-C_{40} cyclic tertiary hydrocarbyl group, and a C_4-C_{40} polycyclic tertiary hydrocarbyl group.

5. The process any of claims 1 to 4 wherein each X is, independently, selected from the group consisting of substituted or unsubstituted hydrocarbyl radicals having from 1 to 20 carbon atoms, hydrides, amides, alkoxides, sulfides, phosphides, halides, and a combination thereof, (two X's may form a part of a fused ring or a ring system).

6. The process any of claims 1 to 5 wherein each L is, independently, selected from the group consisting of: ethers, thioethers, amines, phosphines, ethyl ether, tetrahydrofuran, dimethylsulfide, triethylamine, pyridine, alkenes, alkynes, allenes, and carbenes and a combinations thereof, optionally two or more L's may form a part of a fused ring or a ring system).

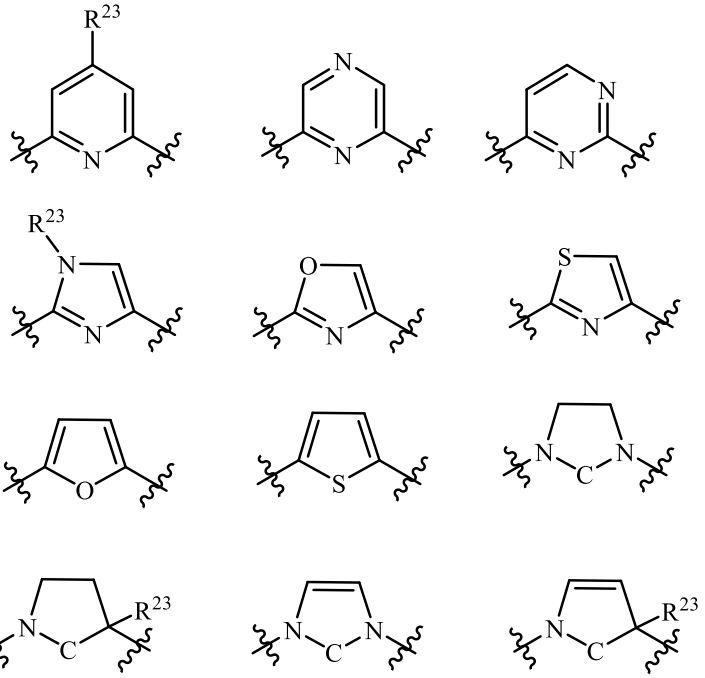
7. The process of claim 1, wherein M is Zr or Hf, Q is nitrogen, both A^1 and $A^{1'}$ are carbon, both E and E' are oxygen, and both R^1 and $R^{1'}$ are C_4-C_{20} cyclic tertiary alkyls.

8. The process of claim 1, wherein M is Zr or Hf, Q is nitrogen, both A^1 and $A^{1'}$ are carbon, both E and E' are oxygen, and both R^1 and $R^{1'}$ are C_6-C_{20} aryls.

9. The process of claim 1, wherein Q is nitrogen, A^1 and $A^{1'}$ are both carbon, both R^1 and $R^{1'}$ are hydrogen, both E and E' are NR^9, where R^9 is selected from a C_1-C_{40} hydrocarbyl, a C_1-C_{40} substituted hydrocarbyl, or a heteroatom-containing group.

10. The process of claim 1, wherein Q is carbon, A^1 is nitrogen, $A^{1'}$ is $C(R^{22})$, and both E and E' are oxygen, where R^{22} is selected from hydrogen, C_1-C_{20} hydrocarbyl, C_1-C_{20} substituted hydrocarbyl.

11. The process of claim 1, wherein the heterocyclic Lewis base is selected from the groups represented by the following formulas:



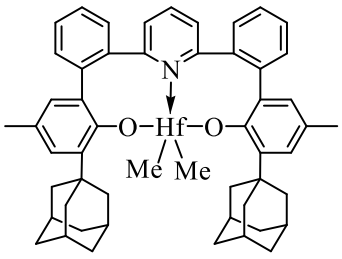
where each R^{23} is independently selected from hydrogen, C_1-C_{20} alkyls, and C_1-C_{20} substituted alkyls.

12. The process of claim 2, wherein M is Zr or Hf, both E and E' are oxygen, and both R^1 and $R^{1'}$ are C_4-C_{20} cyclic tertiary alkyls.

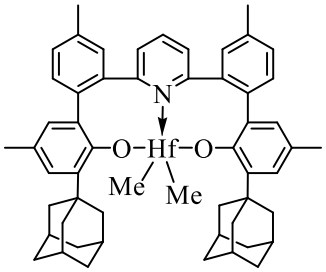
13. The process of claim 2, wherein M is Zr or Hf, both E and E' are oxygen, and each of R^1, $R^{1'}$, R^3 and $R^{3'}$ are adamantan-1-yl or substituted adamantan-1-yl.

14. The process of claim 2, wherein M is Zr or Hf, both E and E' are oxygen, both R^1 and $R^{1'}$ are C_4-C_{20} cyclic tertiary alkyls, and both R^7 and $R^{7'}$ are C_1-C_{20} alkyls.

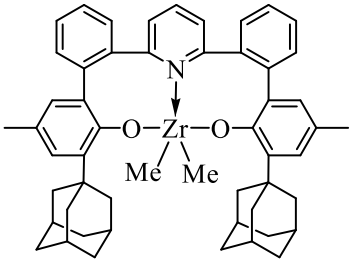
15. The process of claim 1 wherein the catalyst compound is represented by one or more of the following formulas:



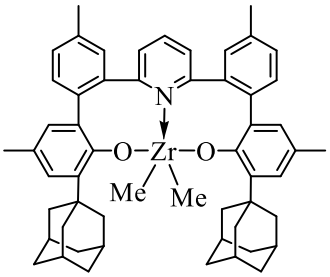
Complex 1



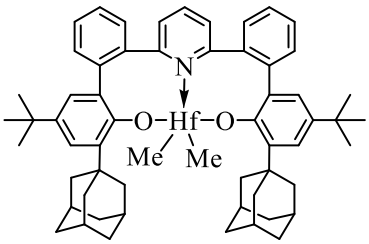
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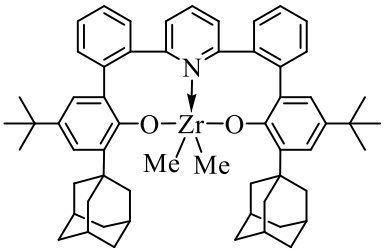
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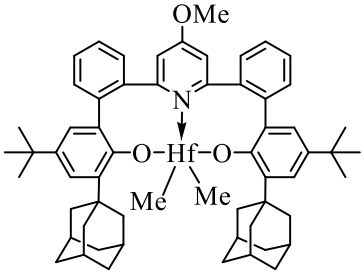
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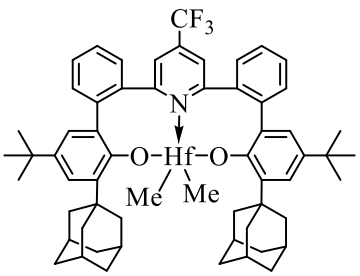
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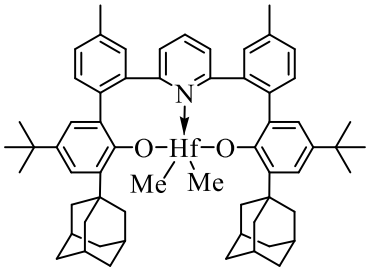
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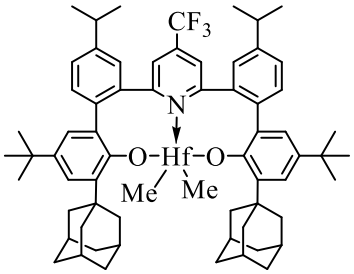
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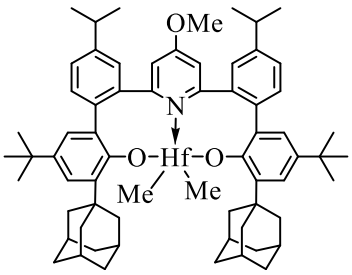
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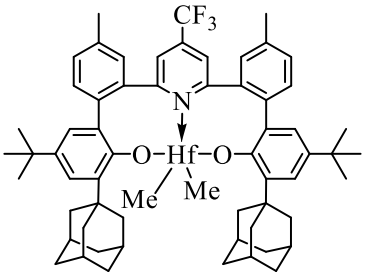
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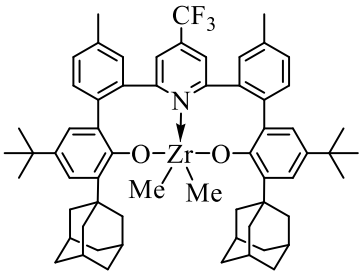
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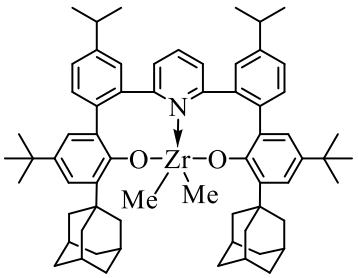
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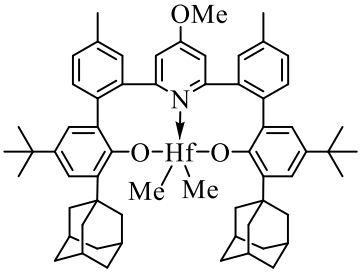
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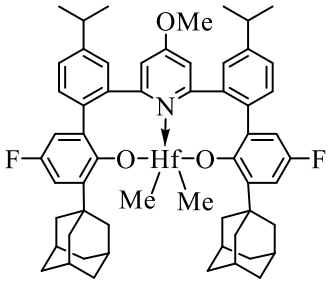
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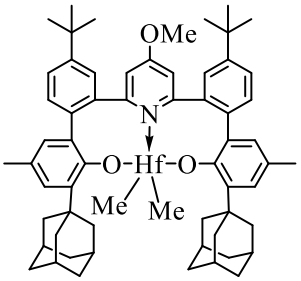
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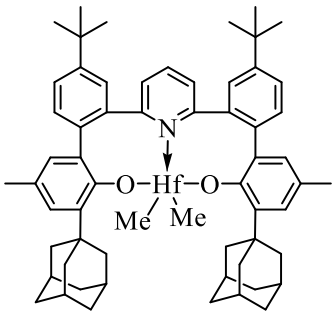
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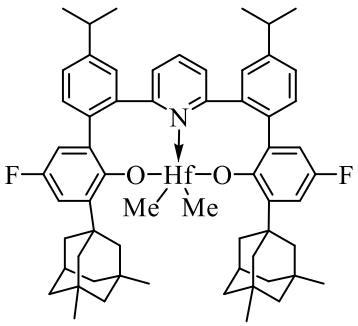
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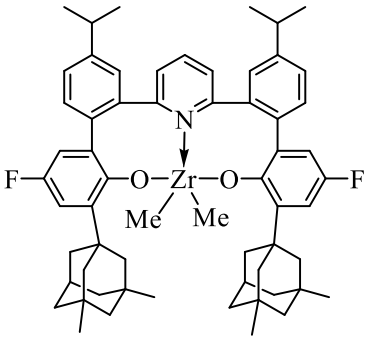
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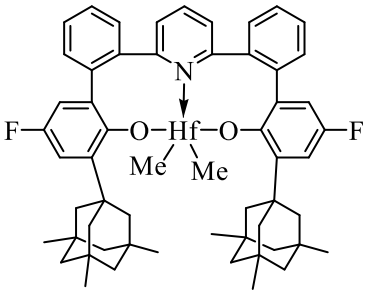
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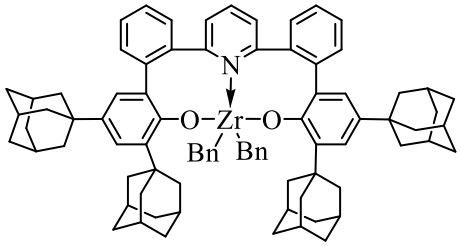
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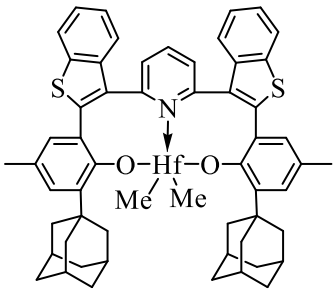
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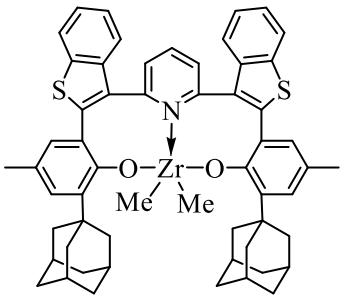
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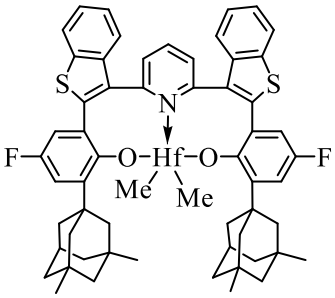
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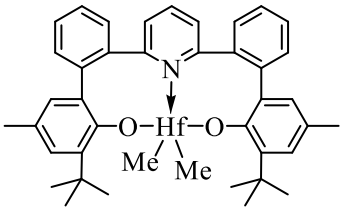
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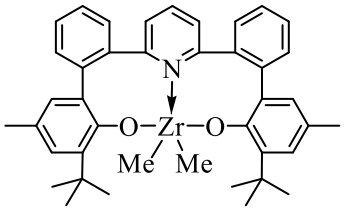
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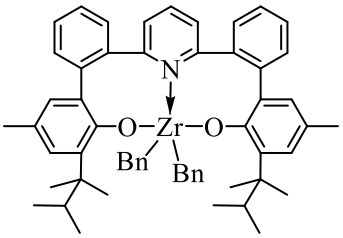
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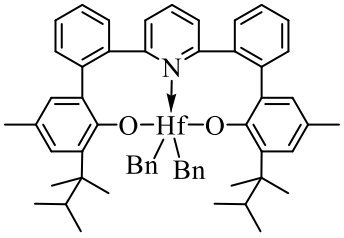
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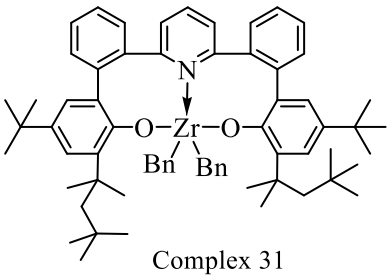
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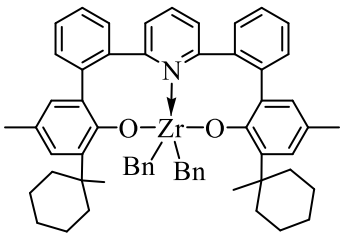
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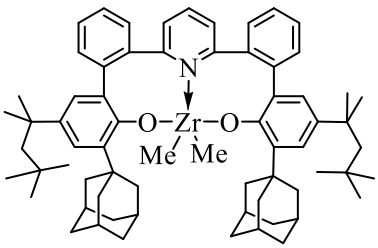
Complex 30



Complex 31



Complex 32



Complex 33

16. The process of claim 1, wherein the catalyst system is free of aromatic solvent.

17. The process of claim 24, wherein the activator is represented by the formula:

$$(Z)_d^+ (A^{d-})$$

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

18. The process of claim 1 wherein the process occurs at a temperature of from about 0°C to about 300°C, at a pressure in the range of from about 0.35 MPa to about 10 MPa, and at a residence time up to 300 minutes.

19. The process of claim 1 wherein the catalyst activity is 200,000 kg polymer per kg of catalyst or more.

20. The process of claim 1 or 2, wherein the copolymer has three or more of the following properties:

a) an Mw of 50,000 g/mol or more, alternatively 100,000 g/mol or more;

b) an Mn of 25,000 g/mol or more, alternatively 50,000 g/mol or more;

c) an Mw/Mn of 1.5 to 15, alternatively 2.0 to 10;

d) a melt flow rate of 1500g/10 minutes or less, alternatively 800 g/10 minutes or less;

e) a Brookfield viscosity of 500 mPa.sec or more, alternatively 1,000 mPa.sec or more;

f) an ethylene content of 5 to 26 mol%;

g) a Tm of 155°C or less, alternatively 140°C or less;

h) a Tc of 120°C or less, alternatively 100°C or less;

i) a heat of fusion of 100 J/g or less, alternatively 80 J/g or less;

j) an r_1r_2 of the copolymer in range of 0.8 to 3.0, alternatively from 0.9 to 2.6;

k) an r_1r_2 is greater than 1.12-(0.0157x) where x is the wt% of ethylene as measured by ^{13}C NMR;

l) regio defects of from 0.01 to 1.2 mol%, alternatively from 0.05 to 1.0 mol%;

m) an mm triad tacticity of 75% or greater, alternatively 80% or greater mm triad tacticity; and

n) an EEE triad sequence distribution greater than $(3x10^{-5})x^2 + 0.0005x - 0.0039$ where x is the wt% of ethylene as measured by ^{13}C NMR.