is defined to be Mw divided by Mn. Unless otherwise noted, all molecular weight units (e.g., Mw, Mn, Mz) are g/mol. The following abbreviations may be used herein: Me is methyl, Et is ethyl, Pr is propyl, cPr is cyclopropyl, nPr is n-propyl, iPr is isopropyl, Bu is butyl, nBu is normal butyl, iBu is isobutyl, sBu is sec-butyl, tBu is tert-butyl, Oct is octyl, Ph is phenyl, Bn is benzyl, THF or thf is tetrahydrofuran, MAO is methylalumoxane.

[0054] The term "continuous" means a system that operates without interruption or cessation. For example a continuous process to produce a polymer would be one where the reactants are continually introduced into one or more reactors and polymer product is continually withdrawn.

[0055] For purposes of this invention and claims thereto, "alkoxides" include those where the alkyl group is a C_1 to C_{10} hydrocarbyl. The alkyl group may be straight chain, branched, or cyclic.

[0056] For purposes of this invention, an "alkyl" group is a linear, branched, or cyclic radical of carbon and hydrogen. In a preferred embodiment, "alkyl" refers to linear alkyls.

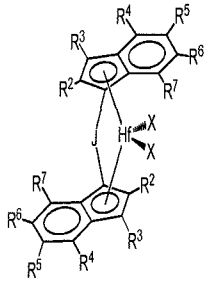
[0057] Room temperature is 22 °C, unless otherwise indicated.

DETAILED DESCRIPTION

Metallocene Catalyst Compounds

[0058] This invention relates to novel bridged ~~a~~-hafnium transition metal metallocene catalyst compounds having two indenyl ligands substituted at the 4 positions with a C_1 to C_{10} alkyl, where the 3 positions are hydrogen (assuming the bridge position is counted as the one position) and the bridge is carbon or silicon which is incorporated into a cyclic group comprising 3, 4, 5 or 6 silicon and/or carbon atoms that make up the cyclic ring, preferably the 2, 4 positions, 4, 7 positions, 2, 4, 5 positions, 2, 4, 6 positions, 2, 4, 7 positions, or 2, 4, 5, 6, 7 positions are substituted, preferably by a C_1 to C_{10} alkyl group, and optionally, if alkyl substituted, the 4 and 5, 5 and 6, and/or 6 and 7 positions may be bonded together to form a ring structure.

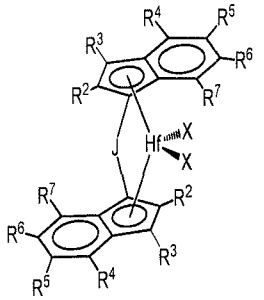
[0059] In a preferred embodiment this invention is related to metallocene catalyst compounds, and catalyst systems comprising such compounds, represented by the formula:



where each R^3 is hydrogen; each R^4 is independently a C_1-C_{10} alkyl (preferably methyl, ethyl, propyl, butyl, pentyl, heptyl, hexyl, octyl, nonyl, decyl or an isomer thereof); each R^2, and R^7 are independently hydrogen, or C_1-C_{10} alkyl (preferably hydrogen, methyl, ethyl, propyl, butyl, pentyl, heptyl, hexyl, octyl, nonyl, decyl or an isomer thereof); each R^5 and R^6 are independently hydrogen, or C_1-C_{50} substituted or unsubstituted hydrocarbyl (preferably

CLAIMS:

1. A metallocene catalyst compound represented by the formula:



where each R^3 is hydrogen; each R^4 is independently a C_1-C_{10} alkyl; each R^2 and R^7 is independently hydrogen, or C_1-C_{10} alkyl, each R^5 and R^6 is independently hydrogen, C_1-C_{50} substituted or unsubstituted hydrocarbyl, or C_1-C_{50} substituted or unsubstituted halocarbyl; and R^4 and R^5, R^5 and R^6 and/or R^6 and R^7 ~~may~~ are optionally ~~be~~ bonded together to form a ring structure; J is a bridging group represented by the formula $R^a{}_2J'$, where J' is C or Si, and each R^a is, independently, C_1 to C_{20} substituted or unsubstituted hydrocarbyl, and the two R^a form a cyclic structure incorporating J' and the cyclic structure ~~may be~~ is optionally a saturated or partially saturated cyclic or fused ring system; and each X is a univalent anionic ligand, or two Xs are joined and bound to the metal atom to form a metallocycle ring, or two Xs are joined to form a chelating ligand, a diene ligand, or an alkylidene ligand.

2. The metallocene catalyst compound of claim 1 wherein R^2, R^4 and R^7 are, independently, a C_1 to C_{10} alkyl, and R^3, R^5 and R^6 are hydrogen.

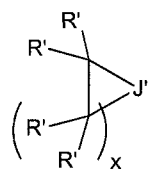
3. The metallocene catalyst compound of claim 1 wherein R^2, R^4 and R^7 are, independently, selected from the group consisting of methyl, ethyl, propyl, butyl, pentyl, heptyl, hexyl, octyl, nonyl, decyl and an isomers thereof.

4. The metallocene catalyst compound of claim 1 wherein R^2 and R^4 are, independently, a C_1 to C_{10} alkyl.

5. The metallocene catalyst compound of claim 1 wherein R^4 and R^7 are, independently, a C_1 to C_{10} alkyl.

6. The metallocene catalyst compound of claim 1 wherein each X is, independently, selected from the group consisting of hydrocarbyl radicals having from 1 to 20 carbon atoms, hydrides, amides, alkoxides, sulfides, phosphides, halides, dienes, amines, phosphines, ethers, and a combination thereof, ~~(~~ and two X's ~~may~~ optionally form ~~a~~ part of a fused ring or a ring system~~)~~.

7. The metallocene catalyst compound of claim 1 wherein J is represented by the formula:



wherein J' is a carbon or silicon atom, x is 1, 2, 3, or 4, and each R' is, independently, hydrogen

or C_1-C_{10} hydrocarbyl.

8. The metallocene catalyst compound of claim 1 wherein J is cyclopentamethylenesilylene, cyclotetramethylenesilylene, cyclotrimethylenesilylene.

9. A metallocene catalyst compound selected from the group consisting of:
cyclotetramethylenesilylene-bis(2,4,7-trimethylinden-1-yl)hafnium dimethyl,
cyclopentamethylenesilylene-bis(2,4,7-trimethylinden-1-yl)hafnium dimethyl,
cyclotrimethylenesilylene-bis(2,4,7-trimethylinden-1-yl)hafnium dimethyl,
cyclotetramethylenesilylene-bis(2,4,7-trimethylinden-1-yl)hafnium dichloride,
cyclopentamethylenesilylene-bis(2,4,7-trimethylinden-1-yl)hafnium dichloride,
cyclotrimethylenesilylene-bis(2,4,7-trimethylinden-1-yl)hafnium dichloride,
~~cyclotetramethylenesilylene-bis(2,4-dimethylinden-1-yl)hafnium dimethyl,~~
cyclopentamethylenesilylene-bis(2,4-dimethylinden-1-yl)hafnium dimethyl,
cyclotrimethylenesilylene-bis(2,4-dimethylinden-1-yl)hafnium dimethyl,
~~cyclotetramethylenesilylene-bis(2,4-dimethylinden-1-yl)hafnium dichloride,~~
cyclopentamethylenesilylene-bis(2,4-dimethylinden-1-yl)hafnium dichloride,
cyclotrimethylenesilylene-bis(2,4-dimethylinden-1-yl)hafnium dichloride,
cyclotetramethylenesilylene-bis(4,7-dimethylinden-1-yl)hafnium dimethyl,
cyclopentamethylenesilylene-bis(4,7-dimethylinden-1-yl)hafnium dimethyl,
cyclotrimethylenesilylene-bis(4,7-dimethylinden-1-yl)hafnium dimethyl,
cyclotetramethylenesilylene-bis(4,7-dimethylinden-1-yl)hafnium dichloride,
cyclopentamethylenesilylene-bis(4,7-dimethylinden-1-yl)hafnium dichloride,
cyclotrimethylenesilylene-bis(4,7-dimethylinden-1-yl)hafnium dichloride,
cyclotetramethylenesilylene-bis(2-methyl-4-cyclopropylinden-1-yl)hafnium dimethyl,
cyclopentamethylenesilylene-bis(2-methyl-4-cyclopropylinden-1-yl)hafnium dimethyl,
cyclotrimethylenesilylene-bis(2-methyl-4-cyclopropylinden-1-yl)hafnium dimethyl,
cyclotetramethylenesilylene-bis(2-methyl-4-cyclopropylinden-1-yl)hafnium dichloride,
cyclopentamethylenesilylene-bis(2-methyl-4-cyclopropylindenyl)hafnium dichloride,
cyclotrimethylenesilylene-bis(2-methyl-4-cyclopropylinden-1-yl)hafnium dichloride,
cyclotetramethylenesilylene-bis(2-ethyl-4-cyclopropylinden-1-yl)hafnium dimethyl,
cyclopentamethylenesilylene-bis(2-ethyl-4-cyclopropylinden-1-yl)hafnium dimethyl,
cyclotrimethylenesilylene-bis(2-ethyl-4-cyclopropylinden-1-yl)hafnium dimethyl,
cyclotetramethylenesilylene-bis(2-ethyl-4-cyclopropylinden-1-yl)hafnium dichloride,
cyclopentamethylenesilylene-bis(2-ethyl-4-cyclopropylinden-1-yl)hafnium dichloride,
cyclotrimethylenesilylene-bis(2-ethyl-4-cyclopropylinden-1-yl)hafnium dichloride,
cyclotetramethylenesilylene-bis(2-methyl-4-t-butylinden-1-yl)hafnium dimethyl,
cyclopentamethylenesilylene-bis(2-methyl-4-t-butylinden-1-yl)hafnium dimethyl,
cyclotrimethylenesilylene-bis(2-methyl-4-t-butylinden-1-yl)hafnium dimethyl,
cyclotetramethylenesilylene-bis(2-methyl-4-t-butylinden-1-yl)hafnium dichloride,
cyclopentamethylenesilylene-bis(2-methyl-4-t-butylinden-1-yl)hafnium dichloride,

cyclotrimethylenesilylene-bis(2-methyl-4-t-butylinden-1-yl)hafnium dichloride,
cyclotetramethylenesilylene-bis(4,7-diethylinden-1-yl)hafnium dimethyl,
cyclopentamethylenesilylene-bis(4,7-diethylinden-1-yl)hafnium dimethyl,
cyclotrimethylenesilylene-bis(4,7-diethylinden-1-yl)hafnium dimethyl,
cyclotetramethylenesilylene-bis(4,7-diethylinden-1-yl)hafnium dichloride,
cyclopentamethylenesilylene-bis(4,7-diethylinden-1-yl)hafnium dichloride,
cyclotrimethylenesilylene-bis(4,7-diethylinden-1-yl)hafnium dichloride,
cyclotetramethylenesilylene-bis(2,4-diethylinden-1-yl)hafnium dimethyl,
cyclopentamethylenesilylene-bis(2,4-diethylinden-1-yl)hafnium dimethyl,
cyclotrimethylenesilylene-bis(2,4-diethylinden-1-yl)hafnium dimethyl,
cyclotetramethylenesilylene-bis(2,4-diethylinden-1-yl)hafnium dichloride,
cyclopentamethylenesilylene-bis(2,4-diethylinden-1-yl)hafnium dichloride,
cyclotrimethylenesilylene-bis(2,4-diethylinden-1-yl)hafnium dichloride,
cyclotetramethylenesilylene-bis(2-methyl-4,7-diethylinden-1-yl)hafnium dimethyl,
cyclopentamethylenesilylene-bis(2-methyl-4,7-diethylinden-1-yl)hafnium dimethyl,
cyclotrimethylenesilylene-bis(2-methyl-4,7-diethylinden-1-yl)hafnium dimethyl,
cyclotetramethylenesilylene-bis(2-methyl-4,7-diethylinden-1-yl)hafnium dichloride,
cyclopentamethylenesilylene-bis(2-methyl-4,7-diethylinden-1-yl)hafnium dichloride,
cyclotrimethylenesilylene-bis(2-methyl-4,7-diethylinden-1-yl)hafnium dichloride,
cyclotetramethylenesilylene-bis(2-ethyl-4-methylinden-1-yl)hafnium dimethyl,
cyclopentamethylenesilylene-bis(2-ethyl-4-methylinden-1-yl)hafnium dimethyl,
cyclotrimethylenesilylene-bis(2-ethyl-4-methylinden-1-yl)hafnium dimethyl,
cyclotetramethylenesilylene-bis(2-ethyl-4-methylinden-1-yl)hafnium dichloride,
cyclopentamethylenesilylene-bis(2-ethyl-4-methylinden-1-yl)hafnium dichloride,
cyclotrimethylenesilylene-bis(2-ethyl-4-methylinden-1-yl)hafnium dichloride,
~~cyclotetramethylenesilylene-bis(2-methyl-4-isopropylinden-1-yl)hafnium dimethyl,~~
cyclopentamethylenesilylene-bis(2-methyl-4-isopropylinden-1-yl)hafnium dimethyl,
cyclotrimethylenesilylene-bis(2-methyl-4-isopropylinden-1-yl)hafnium dimethyl,
~~cyclotetramethylenesilylene-bis(2-methyl-4-isopropylinden-1-yl)hafnium dichloride,~~
cyclopentamethylenesilylene-bis(2-methyl-4-isopropylinden-1-yl)hafnium dichloride,
cyclotrimethylenesilylene-bis(2-methyl-4-isopropylinden-1-yl)hafnium dichloride,
cyclotetramethylenesilylene-bis(4,6,8-trimethyl-1,2,3-trihydro-*s*-indacen-5-yl)hafnium dimethyl,
cyclopentamethylenesilylene-bis(4,6,8-trimethyl-1,2,3-trihydro-*s*-indacen-5-yl)hafnium dimethyl,
cyclotrimethylenesilylene-bis(4,6,8-trimethyl-1,2,3-trihydro-*s*-indacen-5-yl)hafnium dimethyl,
cyclotetramethylenesilylene-bis(4,6,8-trimethyl-1,2,3-trihydro-*s*-indacen-5-yl)hafnium dichloride,

cyclopentamethylenesilylene-bis(4,6,8-trimethyl-1,2,3-trihydro-*s*-indacen-5-yl)hafnium dichloride,

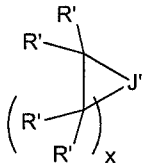
cyclotrimethylenesilylene-bis(4,6,8-trimethyl-1,2,3-trihydro-*s*-indacen-5-yl)hafnium dichloride; and any compound where the dimethyl in any of the compounds listed above is replaced with diethyl, dipropyl, diphenyl, dibenzyl, difloride, dibromide, or diiodide.

10. A catalyst system comprising activator and the metallocene catalyst compound of claim 1.

11. A catalyst system comprising activator and the metallocene catalyst compound of claim 6, wherein R^2, R^4 and R^7 are, independently, a C_1 to C_{10} alkyl, and R^3, R^5 and R^6 are hydrogen.

12. The catalyst system of claim 10 wherein R^2, R^4 and R^7 are, independently, selected from the group consisting of methyl, ethyl, propyl, butyl, pentyl, heptyl, hexyl, octyl, nonyl, decyl and an isomers thereof.

13. The catalyst system of claim 10 wherein J is represented by the formula:



wherein J′ is a carbon or silicon atom, x is 1, 2, 3, or 4, and each R′ is, independently, hydrogen or C_1-C_{10} hydrocarbyl.

14. The catalyst system of claim 10 wherein J is cyclopentamethylenesilylene, cyclotetramethylenesilylene, cyclotrimethylenesilylene.

15. A catalyst system comprising activator and the metallocene catalyst compound of claim 9.

16. The catalyst system of claim 10 wherein the activator comprises alumoxane.

17. The catalyst system of claim 10 wherein alumoxane is present at a molar ratio of aluminum to catalyst compound transition metal of 100:1 or more.

18. The catalyst system of claim 10 wherein the activator comprises a non-coordinating anion activator.

19. The catalyst system of claim 10 wherein 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.

20. The catalyst system of claim 10 wherein activator is represented by the formula:

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

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: (Ar_3C^+), where Ar is aryl or aryl substituted with a heteroatom, a C_1 to C_{40} hydrocarbyl, or a substituted C_1 to C_{40} hydrocarbyl.

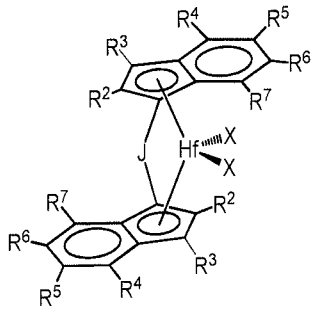
21. The catalyst system of claim 10 wherein the activator is one or more of: N,N-dimethylanilinium tetrakis(pentafluorophenyl)borate, triphenylcarbenium tetrakis(pentafluorophenyl)borate, trimethylammonium tetrakis(perfluoronaphthyl)borate, triethylammonium tetrakis(perfluoronaphthyl)borate, tripropylammonium tetrakis(perfluoronaphthyl)borate, tri(n-butyl)ammonium tetrakis(perfluoronaphthyl)borate, tri(t-butyl)ammonium tetrakis(perfluoronaphthyl)borate, N,N-dimethylanilinium tetrakis(perfluoronaphthyl)borate, N,N-diethylanilinium tetrakis(perfluoronaphthyl)borate, N,N-dimethyl-(2,4,6-trimethylanilinium) tetrakis(perfluoronaphthyl)borate, tropillium tetrakis(perfluoronaphthyl)borate, triphenylcarbenium tetrakis(perfluoronaphthyl)borate, triphenylphosphonium tetrakis(perfluoronaphthyl)borate, triethylsilylium tetrakis(perfluoronaphthyl)borate, benzene(diazonium) tetrakis(perfluoronaphthyl)borate, trimethylammonium tetrakis(perfluorobiphenyl)borate, triethylammonium tetrakis(perfluorobiphenyl)borate, tripropylammonium tetrakis(perfluorobiphenyl)borate, tri(n-butyl)ammonium tetrakis(perfluorobiphenyl)borate, tri(t-butyl)ammonium tetrakis(perfluorobiphenyl)borate, N,N-dimethylanilinium tetrakis(perfluorobiphenyl)borate, N,N-diethylanilinium tetrakis(perfluorobiphenyl)borate, N,N-dimethyl-(2,4,6-trimethylanilinium) tetrakis(perfluorobiphenyl)borate, tropillium tetrakis(perfluorobiphenyl)borate, triphenylcarbenium tetrakis(perfluorobiphenyl)borate, triphenylphosphonium tetrakis(perfluorobiphenyl)borate, triethylsilylium tetrakis(perfluorobiphenyl)borate, benzene(diazonium) tetrakis(perfluorobiphenyl)borate, [4-t-butyl-$PhNMe_2H$][$(C_6F_3(C_6F_5)_2)_4B$], trimethylammonium tetraphenylborate, triethylammonium tetraphenylborate, tripropylammonium tetraphenylborate, tri(n-butyl)ammonium tetraphenylborate, tri(t-butyl)ammonium tetraphenylborate, N,N-dimethylanilinium tetraphenylborate, N,N-diethylanilinium tetraphenylborate, N,N-dimethyl-(2,4,6-trimethylanilinium) tetraphenylborate, tropillium tetraphenylborate, triphenylcarbenium tetraphenylborate, triphenylphosphonium tetraphenylborate, triethylsilylium tetraphenylborate, benzene(diazonium)tetraphenylborate, trimethylammonium tetrakis(pentafluorophenyl)borate, triethylammonium tetrakis(pentafluorophenyl)borate, tripropylammonium tetrakis(pentafluorophenyl)borate, tri(n-butyl)ammonium tetrakis(pentafluorophenyl)borate, tri(sec-butyl)ammonium tetrakis(pentafluorophenyl)borate, N,N-dimethylanilinium tetrakis(pentafluorophenyl)borate, N,N-diethylanilinium tetrakis(pentafluorophenyl)borate, N,N-dimethyl-(2,4,6-trimethylanilinium) tetrakis(pentafluorophenyl)borate, tropillium tetrakis(pentafluorophenyl)borate, triphenylcarbenium tetrakis(pentafluorophenyl)borate, triphenylphosphonium tetrakis(pentafluorophenyl)borate, triethylsilylium tetrakis(pentafluorophenyl)borate, benzene(diazonium) tetrakis(pentafluorophenyl)borate, trimethylammonium tetrakis-(2,3,4,6-tetrafluorophenyl) borate, triethylammonium tetrakis-(2,3,4,6-tetrafluorophenyl)borate, tripropylammonium tetrakis-(2,3,4,6-tetrafluorophenyl)borate, tri(n-butyl)ammonium tetrakis-

(2,3,4,6-tetrafluoro-phenyl)borate, dimethyl(t-butyl)ammonium tetrakis-(2,3,4,6-tetrafluorophenyl)borate, N,N-dimethylanilinium tetrakis-(2,3,4,6-tetrafluorophenyl)borate, N,N-diethylanilinium tetrakis-(2,3,4,6-tetrafluorophenyl)borate, N,N-dimethyl-(2,4,6-trimethylanilinium) tetrakis- (2,3,4,6-tetrafluorophenyl)borate, tropillium tetrakis-(2,3,4,6-tetrafluorophenyl)borate, triphenylcarbenium tetrakis-(2,3,4,6-tetrafluorophenyl)borate, triphenylphosphonium tetrakis-(2,3,4,6-tetrafluorophenyl)borate, triethylsilylium tetrakis-(2,3,4,6-tetrafluorophenyl)borate, benzene(diazonium) tetrakis-(2,3,4,6-tetrafluorophenyl)borate, trimethylammonium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, triethylammonium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, tripropylammonium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, tri(n-butyl)ammonium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, tri(t-butyl)ammonium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, N,N-dimethylanilinium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, N,N-diethylanilinium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, N,N-dimethyl-(2,4,6-trimethylanilinium) tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, tropillium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, triphenylcarbenium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, triphenylphosphonium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, triethylsilylium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, benzene(diazonium) tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, di-(i-propyl)ammonium tetrakis(pentafluorophenyl)borate, dicyclohexylammonium tetrakis(pentafluorophenyl)borate, tri(o-tolyl)phosphonium tetrakis(pentafluorophenyl)borate, tri(2,6-dimethylphenyl)phosphonium tetrakis(pentafluorophenyl)borate, triphenylcarbenium tetrakis(perfluorophenyl)borate, 1-(4-(tris(pentafluorophenyl)borate)-2,3,5,6-tetrafluorophenyl)pyrrolidinium, tetrakis(pentafluorophenyl)borate, 4-(tris(pentafluorophenyl)borate)-2,3,5,6-tetrafluoropyridine, and triphenylcarbenium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate).

22. The catalyst system of claim 10 wherein the catalyst system is supported.

23. The catalyst system of claim 10 wherein the catalyst system is supported on silica.

24. The catalyst system of claim 10 wherein the catalyst system comprises two catalyst compounds at least one of which is represented by the formula:



where each R^3 is hydrogen; each R^4 is independently a C_1-C_{10} alkyl; each R^2 and R^7 is independently hydrogen, or C_1-C_{10} alkyl, each R^5 and R^6 is independently hydrogen, C_1-C_{50} substituted or unsubstituted hydrocarbyl, or C_1-C_{50} substituted or unsubstituted halocarbyl; and

R^4 and R^5, R^5 and R^6 and/or R^6 and R^7 ~~may~~ are optionally ~~be~~ bonded together to form a ring structure; J is a bridging group represented by the formula $R^a{}_2J'$, where J' is C or Si, and each R^a is, independently, C_1 to C_{20} substituted or unsubstituted hydrocarbyl, and the two R^a form a cyclic structure incorporating J and the cyclic structure ~~may be~~ is optionally a saturated or partially saturated cyclic or fused ring system; and each X is a univalent anionic ligand, or two Xs are joined and bound to the metal atom to form a metallocycle ring, or two Xs are joined to form a chelating ligand, a diene ligand, or an alkylidene ligand.

25. A process to polymerize olefins comprising contacting one or more olefins with the catalyst system of claim 10.

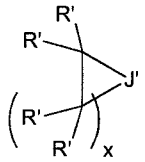
26. The process of claim 25 wherein each X is, independently, selected from the group consisting of hydrocarbyl radicals having from 1 to 20 carbon atoms, hydrides, amides, alkoxides, sulfides, phosphides, halides, dienes, amines, phosphines, ethers, and a combination thereof, ~~(~~ and two X's ~~may~~ optionally form ~~a~~ part of a fused ring or a ring system~~)~~.

27. The process of claim 25 wherein R^4 and at least one of R^2 and R^7 are, independently, a C_1 to C_{10} alkyl.

28. The process of claim 25 wherein R^2, R^4 and R^7 are, independently, a C_1 to C_{10} alkyl, and R^3, R^5 and R^6 are hydrogen.

29. The process of claim 25 wherein R^2, R^4 and R^7 are, independently, selected from the group consisting of methyl, ethyl, propyl, butyl, pentyl, heptyl, hexyl, octyl, nonyl, decyl and an isomers thereof.

30. The process of claim 25 wherein J is represented by the formula:



wherein J' is a carbon or silicon atom, x is 1, 2, 3, or 4, and each R' is, independently, hydrogen or C_1-C_{10} hydrocarbyl.

31. A process to polymerize olefins comprising contacting one or more olefins with the catalyst system of claim 15.

32. The process of claim 25 wherein the activator comprises alumoxane.

33. The process of claim 25 wherein alumoxane is present at a molar ratio of aluminum to catalyst compound transition metal of 100:1 or more.

34. The process of claim 25 wherein the activator comprises a non-coordinating anion activator.

35. The process of claim 25 wherein 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.

36. The process of claim 25 wherein activator is represented by the formula:

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

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: (Ar_3C^+), where Ar is aryl or aryl substituted with a heteroatom, a C_1 to C_{40} hydrocarbyl, or a substituted C_1 to C_{40} hydrocarbyl.

37. The process of claim 25 wherein the activator is one or more of:

N,N-dimethylanilinium tetrakis(pentafluorophenyl)borate, triphenylcarbenium tetrakis(pentafluorophenyl)borate, trimethylammonium tetrakis(perfluoronaphthyl)borate, triethylammonium tetrakis(perfluoronaphthyl)borate, tripropylammonium tetrakis(perfluoronaphthyl)borate, tri(n-butyl)ammonium tetrakis(perfluoronaphthyl)borate, tri(t-butyl)ammonium tetrakis(perfluoronaphthyl)borate, N,N-dimethylanilinium tetrakis(perfluoronaphthyl)borate, N,N-diethylanilinium tetrakis(perfluoronaphthyl)borate, N,N-dimethyl-(2,4,6-trimethylanilinium) tetrakis(perfluoronaphthyl)borate, tropillium tetrakis(perfluoronaphthyl)borate, triphenylcarbenium tetrakis(perfluoronaphthyl)borate, triphenylphosphonium tetrakis(perfluoronaphthyl)borate, triethylsilylium tetrakis(perfluoronaphthyl)borate, benzene(diazonium) tetrakis(perfluoronaphthyl)borate, trimethylammonium tetrakis(perfluorobiphenyl)borate, triethylammonium tetrakis(perfluorobiphenyl)borate, tripropylammonium tetrakis(perfluorobiphenyl)borate, tri(n-butyl)ammonium tetrakis(perfluorobiphenyl)borate, tri(t-butyl)ammonium tetrakis(perfluorobiphenyl)borate, N,N-dimethylanilinium tetrakis(perfluorobiphenyl)borate, N,N-diethylanilinium tetrakis(perfluorobiphenyl)borate, N,N-dimethyl-(2,4,6-trimethylanilinium) tetrakis(perfluorobiphenyl)borate, tropillium tetrakis(perfluorobiphenyl)borate, triphenylcarbenium tetrakis(perfluorobiphenyl)borate, triphenylphosphonium tetrakis(perfluorobiphenyl)borate, triethylsilylium tetrakis(perfluorobiphenyl)borate, benzene(diazonium) tetrakis(perfluorobiphenyl)borate, [4-t-butyl-$PhNMe_2H$][$(C_6F_3(C_6F_5)_2)_4B$], trimethylammonium tetraphenylborate, triethylammonium tetraphenylborate, tripropylammonium tetraphenylborate, tri(n-butyl)ammonium tetraphenylborate, tri(t-butyl)ammonium tetraphenylborate, N,N-dimethylanilinium tetraphenylborate, N,N-diethylanilinium tetraphenylborate, N,N-dimethyl-(2,4,6-trimethylanilinium) tetraphenylborate, tropillium tetraphenylborate, triphenylcarbenium tetraphenylborate, triphenylphosphonium tetraphenylborate, triethylsilylium tetraphenylborate, benzene(diazonium)tetraphenylborate, trimethylammonium tetrakis(pentafluorophenyl)borate, triethylammonium tetrakis(pentafluorophenyl)borate, tripropylammonium tetrakis(pentafluorophenyl)borate, tri(n-butyl)ammonium tetrakis(pentafluorophenyl)borate, tri(sec-butyl)ammonium tetrakis(pentafluorophenyl)borate, N,N-dimethylanilinium tetrakis(pentafluorophenyl)borate, N,N-diethylanilinium tetrakis(pentafluorophenyl)borate, N,N-dimethyl-(2,4,6-trimethylanilinium) tetrakis(pentafluorophenyl)borate, tropillium tetrakis(pentafluorophenyl)borate,

triphenylcarbenium tetrakis(pentafluorophenyl)borate, triphenylphosphonium tetrakis(pentafluorophenyl)borate, triethylsilylium tetrakis(pentafluorophenyl)borate, benzene(diazonium) tetrakis(pentafluorophenyl)borate, trimethylammonium tetrakis-(2,3,4,6-tetrafluorophenyl) borate, triethylammonium tetrakis-(2,3,4,6-tetrafluorophenyl)borate, tripropylammonium tetrakis-(2,3,4,6-tetrafluorophenyl)borate, tri(n-butyl)ammonium tetrakis-(2,3,4,6-tetrafluoro-phenyl)borate, dimethyl(t-butyl)ammonium tetrakis-(2,3,4,6-tetrafluorophenyl)borate, N,N-dimethylanilinium tetrakis-(2,3,4,6-tetrafluorophenyl)borate, N,N-diethylanilinium tetrakis-(2,3,4,6-tetrafluorophenyl)borate, N,N-dimethyl-(2,4,6-trimethylanilinium) tetrakis-(2,3,4,6-tetrafluorophenyl)borate, tropillium tetrakis-(2,3,4,6-tetrafluorophenyl)borate, triphenylcarbenium tetrakis-(2,3,4,6-tetrafluorophenyl)borate, triphenylphosphonium tetrakis-(2,3,4,6-tetrafluorophenyl)borate, triethylsilylium tetrakis-(2,3,4,6-tetrafluorophenyl)borate, benzene(diazonium) tetrakis-(2,3,4,6-tetrafluorophenyl)borate, trimethylammonium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, triethylammonium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, tripropylammonium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, tri(n-butyl)ammonium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, tri(t-butyl)ammonium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, N,N-dimethylanilinium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, N,N-diethylanilinium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, N,N-dimethyl-(2,4,6-trimethylanilinium) tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, tropillium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, triphenylcarbenium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, triphenylphosphonium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, triethylsilylium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, benzene(diazonium) tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, di-(i-propyl)ammonium tetrakis(pentafluorophenyl)borate, dicyclohexylammonium tetrakis(pentafluorophenyl)borate, tri(o-tolyl)phosphonium tetrakis(pentafluorophenyl)borate, tri(2,6-dimethylphenyl)phosphonium tetrakis(pentafluorophenyl)borate, triphenylcarbenium tetrakis(perfluorophenyl)borate, 1-(4-(tris(pentafluorophenyl)borate)-2,3,5,6-tetrafluorophenyl)pyrrolidinium, tetrakis(pentafluorophenyl)borate, 4-(tris(pentafluorophenyl)borate)-2,3,5,6-tetrafluoropyridine, and triphenylcarbenium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate).

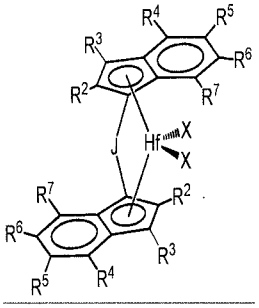
38. The process of claim 25 wherein the process occurs at a temperature of from about 0°C to about 300°C, at a pressure in the range of from about 0.35 MPa to about 10 MPa, and at a time up to 300 minutes.

39. The process of claim 25 further comprising obtaining polymer having at least 50% allyl chain ends.

40. The process of claim 25 wherein the olefins comprise ethylene and or propylene.

41. The metallocene catalyst compound of claim 1, wherein R^2 and R^4 are, independently, a C_1 to C_{10} alkyl.

42. A metallocene catalyst compound represented by the formula:



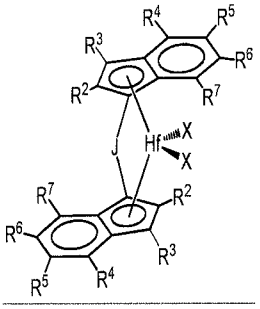
where each R^3 is hydrogen; each R^4 is independently a C_1-C_{10} alkyl; each R^2 and R^7 is independently a C_1-C_{10} alkyl; each R^5 and R^6 is independently hydrogen, C_1-C_{50} substituted or unsubstituted hydrocarbyl, or C_1-C_{50} substituted or unsubstituted halocarbyl; and R^4 and R^5, R^5 and R^6 and/or R^6 and R^7 are optionally bonded together to form a ring structure; J is a bridging group represented by the formula $R^a{}_2J$, where J is C or Si, and each R^a is, independently, C_1 to C_{20} substituted or unsubstituted hydrocarbyl, and the two R^a form a cyclic structure incorporating J and the cyclic structure is optionally a saturated or partially saturated cyclic or fused ring system; and each X is a univalent anionic ligand, or two Xs are joined and bound to the metal atom to form a metallocycle ring, or two Xs are joined to form a chelating ligand, a diene ligand, or an alkylidene ligand.

43. The metallocene catalyst compound of claim 1, wherein R^7 is a C_1 to C_{10} alkyl.

44. The metallocene catalyst compound of claim 1, wherein R^5 and R^6 are bonded together to form a ring structure.

45. The metallocene catalyst compound of claim 1, wherein when R^2 is Me, then R^4 is not methyl, isopropyl, or cyclohexyl.

46. A metallocene catalyst compound that obtains polymer having at least 50% allyl chain ends, said catalyst compound represented by the formula:



where each R^3 is hydrogen; each R^4 is independently a C_1-C_{10} alkyl; each R^2 and R^7 is independently hydrogen or C_1-C_{10} alkyl; each R^5 and R^6 is independently hydrogen, C_1-C_{50} substituted or unsubstituted hydrocarbyl, or C_1-C_{50} substituted or unsubstituted halocarbyl; and R^4 and R^5, R^5 and R^6 and/or R^6 and R^7 are optionally bonded together to form a ring structure; J is a bridging group represented by the formula $R^a{}_2J$, where J is C or Si, and each R^a is, independently, C_1 to C_{20} substituted or unsubstituted hydrocarbyl, and the two R^a form a cyclic structure incorporating J and the cyclic structure is optionally a saturated or partially

saturated cyclic or fused ring system; and each X is a univalent anionic ligand, or two Xs are joined and bound to the metal atom to form a metallocycle ring, or two Xs are joined to form a chelating ligand, a diene ligand, or an alkylidene ligand.

47. The metallocene catalyst compound of claim 1, wherein each R^4 is independently methyl, ethyl, n-propyl, cyclopropyl, or n-butyl.

48. The metallocene catalyst compound of claim 1, wherein each R^4 and R^7 are, independently, a C_1 to C_4 alkyl group.

49. The metallocene catalyst compound of claim 1, wherein each R^4 and R^7 are, independently, methyl, ethyl, propyl, butyl and isomers thereof.