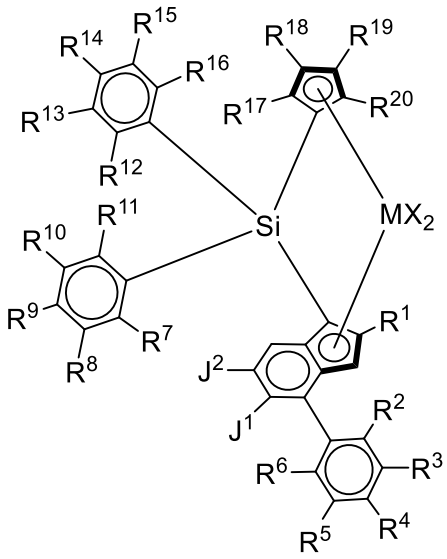
CLAIMS

What is claimed is:

1. A catalyst system comprising a metallocene compound described in the Formula (I):



(I)

where:

M is a Group 4 metal;

each of X1 and X2 is a univalent anionic ligand, or X1 and X2 are joined to form a metallocycle ring; R^1 is hydrogen, an unsubstituted C_1-C_{40} hydrocarbyl, a C_1-C_{40} substituted hydrocarbyl, an unsubstituted C_4-C_{62} aryl, a substituted C_4-C_{62} aryl, an unsubstituted C_4-C_{62} heteroaryl, a substituted C_4-C_{62} heteroaryl, -NR'$_2$, -SR', -OR, -SiR'$_3$, -OSiR'$_3$, -PR'$_2$, or -R''-SiR'$_3$, where R'' is C_1-C_{10} alkyl and each R' is hydrogen, halogen, C_1-C_{10} alkyl, or C_6-C_{10} aryl;

J^1 and J^2 are independently hydrogen, an unsubstituted C_1-C_{40} hydrocarbyl, a C_1-C_{40} substituted hydrocarbyl, an unsubstituted C_4-C_{62} aryl, a substituted C_4-C_{62} aryl, an unsubstituted C_4-C_{62} heteroaryl, a substituted C_4-C_{62} heteroaryl, -NR'$_2$, -SR', -OR, -SiR'$_3$, -OSiR'$_3$, -PR'$_2$, or -R''-SiR'$_3$, where R'' is C_1-C_{10} alkyl and each R' is hydrogen, halogen, C_1-C_{10} alkyl, or C_6-C_{10} aryl. Optionally J^1 and J^2 can be joined to form a 4, 5 or 6 membered ring;

each R^2-R^6 is hydrogen, an unsubstituted C_1-C_{40} hydrocarbyl, a C_1-C_{40} substituted hydrocarbyl, an unsubstituted C_4-C_{62} aryl, a substituted C_4-C_{62} aryl, an unsubstituted C_4-C_{62} heteroaryl, a substituted C_4-C_{62} heteroaryl, -NR'$_2$, -SR', -OR, -SiR'$_3$, -OSiR'$_3$, -PR'$_2$, or -R''-SiR'$_3$, where R'' is C_1-C_{10} alkyl and each R' is hydrogen, halogen, C_1-C_{10} alkyl, or C_6-C_{10} aryl;

each R^7-R^{16} is hydrogen, an unsubstituted C_1-C_{40} hydrocarbyl, a C_1-C_{40} substituted hydrocarbyl, an unsubstituted C_4-C_{62} aryl, a substituted C_4-C_{62} aryl, an unsubstituted C_4-C_{62} heteroaryl, a substituted C_4-C_{62} heteroaryl, -NR'_2, -SR', -OR, -SiR'_3, -$OSiR'_3$, -PR'_2, or -R''-SiR'_3, where R'' is C_1-C_{10} alkyl and each R' is hydrogen, halogen, C_1-C_{10} alkyl, or C_6-C_{10} aryl; optionally, R^{11} and R^{12} can be joined to form a silafluorene moiety; and

each R^{17}, R^{18}, R^{19}, and R^{20} is independently hydrogen, a halogen, an unsubstituted C_1-C_{40} hydrocarbyl, a C_1-C_{40} substituted hydrocarbyl, an unsubstituted C_4-C_{62} aryl, a substituted C_4-C_{62} aryl, an unsubstituted C_4-C_{62} heteroaryl, a substituted C_4-C_{62} heteroaryl, -NR'_2, -SR', -OR, -SiR'_3, -$OSiR'_3$, -PR'_2, or -R''-SiR'_3, wherein R'' is C_1-C_{10} alkyl and each R' is hydrogen, halogen, C_1-C_{10} alkyl, or C_6-C_{10} aryl.

2. The catalyst system of claim 1, further comprising an activator.

3. The catalyst system of claim 2, wherein the activator is either aluminoxane or salts of non-coordinating (NCA) anions.

4. The catalyst system of claim 3, wherein the activator is a NCA represented by the formula: $(Z)d^+$ (Ad^-)

wherein Z is (L-H) or a reducible Lewis Acid,

L is a Lewis base;

H is hydrogen;

(L-H)+ is a Bronsted acid;

Ad- is a non-coordinating anion having the charge d-; and

d is an integer from 1 to 3.

5. The catalyst system of claim 3, wherein the activator is a NCA represented by the formula: (Z)d+ (Ad-) wherein Ad- 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 C_1 to C_{40} hydrocarbyl, or a substituted C_1 to C_{40} hydrocarbyl.

6. The catalyst system of claim 2, wherein the activator is aluminoxane and a ratio of the aluminoxane to metal is at least 1:100, or at least 1:250, or at least 1:500.

7. The catalyst system of claim 1, further comprising a support material.

8. The catalyst system of claim 7, wherein the support material is selected from Al_2O_3, ZrO_2, SiO_2, SiO_2/Al_2O_3, SiO_2/TiO_2, silica clay, silicon oxide/clay, and mixtures thereof.

9. A process for preparing a propylene homopolymer or copolymer, comprising:

introducing propylene, one or more C_2 or C_4 to C_{40} olefin comonomers, and a catalyst system of claim 1, and optionally hydrogen into a reactor at a reactor pressure of from 0.7 bar to 70 bar and a reactor temperature of from 20°C to 150°C; and

obtaining a propylene homopolymer or copolymer.

10. The process of claim 9, wherein the C_4 to C_{40} olefin comonomers are selected from the group consisting of 1-butene, 1-pentene, 1-hexene, 2-methyl-1-pentene, vinylcyclobutane, 1-heptene, 1-octene, 1-decene, 1,5-hexadiene, 1,7-octadiene and 1,9-decadiene.

11. The process of claim 9, wherein the propylene homopolymer or copolymer has a Mw value of 5,000 to 500,000 g/mol, or from 5,000 to 350,000 or from 10,000 to 250,000 as measured by gel permeation chromatography.

12. The process of claim 9, wherein the propylene homopolymer or copolymer has a Mw value of 10,000 to 250,000 as measured by gel permeation chromatography.

13. The process of claim 9, wherein the propylene homopolymer or copolymer has a melt-flow rate (MFR) according to ASTM D1238 (230°C, 2.16 kg) of 0.1 dg/minute to 3000 dg/minute, or from 1 dg/minute to 1000 dg/minute, or from 10 dg/minute to 100 dg/minute, or from 20 dg/minute to 70 dg/minute.

14. The process of claim 11, wherein the propylene homopolymer or copolymer has a molecular weight distribution (Mw/Mn) of about 2 to about 30, or about 3 to about 20, or about 4 to about 10.

15. The process of claim 9, wherein the propylene homopolymer or copolymer has a melting temperature (Tm) of greater than 80°C, or greater than 130°C, or greater than 150°C.

16. The process of claim 11, wherein the propylene co-polymer has a comonomer content of 0.1 – 50 wt%.

17. The process of claim 1, wherein the propylene co-polymer has a comonomer content of 1 to 35 wt%, or from 2 to 20 wt%, or from 3 to 10 wt%.