CLAIMS

1. A process comprising contacting a bridged metallocene compound, an activator selected from among Lewis acid activators and ionic activators, optionally a co-activator, and a feed having an average carbon number of at least 4.1 and comprising at least two different alpha-olefin monomers selected from C_3 to C_{30} alpha-olefins under conditions suitable to obtain an essentially random liquid polymer comprising said at least two feed alpha-olefins, with the proviso that any one of ethylene and propylene, if present in said feed, is present in the amount of less than 50 wt% individually, and in the amount of less than 50 wt% combined, based on the combined weight of alpha-olefins in said feed.

2. The process of claim 1, wherein said at least two different alpha-olefin monomers are selected from the group consisting of linear alpha-olefins, alpha-olefins characterized by alkyl or aryl substitution at least two carbons away from the double bond, and mixtures thereof.

3. The process of claim 1, wherein said at least two different alpha-olefins are selected from the group consisting of C_4-C_8 linear alpha-olefins, C_{12}-C_{24} linear alpha-olefins, 4-methyl-1-pentene, 5-methyl-1-hexene, 4-ethyl-1-hexene, 4-phenyl-1-pentene, and 5-phenyl-1-pentene.

4. The process of claim 1, wherein said at least two different alpha-olefins are provided directly, without separation of individual alpha-olefins, from an alpha-olefin-producing process selected from an ethylene growth process, an olefin metathesis process, a wax-cracking process, a syn gas synthesis process, and mixtures thereof.

5. The process according to any one of claims 1 to 4, wherein said random liquid polymer is characterized by a χ value (degree of randomness) ranging from 0.7 to 1.4.

6. The process according to any one of claims 1 to 5, wherein said random liquid polymer is characterized by a χ value (degree of randomness) ranging from 0.75 to 1.3.

7. The process according to any one of claims 1 to 6, wherein said random liquid polymer is characterized by a χ value (degree of randomness) ranging from 0.8 to 1.2.

8. The process according to any one of claims 1 to 7, wherein said random liquid polymer is characterized by a χ value (degree of randomness) ranging from 0.9 to 1.1.

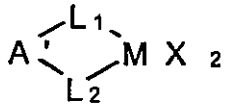
9. The process according to any one of claims 1-4, wherein the composition of said random liquid polymer is characterized by an incorporation of each alpha-olefin monomer within said product of within at least 20 wt % of the distribution of said alpha-olefin monomer within said feed.

10. The process according to any one of claims 1-4, wherein the composition of the random liquid polymer is characterized by the ratio of the incorporated monomer mole % to the feed monomer mole % ranging from 0.5 to 5.

11. The process according to any one of claims 1-4, wherein the composition of the random liquid polymer is characterized by the ratio of the incorporated monomer mole % to the feed monomer mole % ranging from 0.5 to 3.

12. The process according to any one of claims 1 to 11, wherein said random liquid polymer is characterized by a stereo-arrangement of each monomer that is isotactic, atactic, syndiotactic or a combination of these tacticities.

13. The process according to any one of claims 1 to 12, wherein said metallocene compound is characterized by the formula 1:



Formula 1

wherein M is selected from Zr, Hf, Ti; each X is independently selected from the group consisting of halide and hydrogen, branched or unbranched C_1 to C_{20} hydrocarbyls, L_1 and L_2 are independently selected from cyclopentadienyl, indenyl, tetrahydroindenyl, fluorenyl, and their alkyl substituted analogs, and A is selected from R_1R_2Si, R_1R_2C, $(R_1R_2C)_2$, $(R_1R_2Si)_2$; wherein R_1 and R_2 are independently selected from hydrogen, branched or unbranched C_1 to C_{20} hydrocarbyl radicals, phenyl, and substituted phenyl.

14. The process according to any one of claims 1 to 12, wherein said metallocene compound has either a racemic or meso form.

15. The process according to any one of the preceding claims, wherein said activator is an ionic activator selected from $[Me_2PhNH][B(C_6F_5)_4]$, $[R_3NH][B(C_6F_5)_4]$, $[R_2NH_2][B(C_6F_5)_4]$, $[RNH_3][B(C_6F_5)_4]$, $[R_4N][B(C_6F_5)_4]$, $[Ph_3C][B(C_6F_5)_4]$, $[Me_2PhNH][B((C_6H_3\text{-}3,5\text{-}(CF_3)_2))_4]$, $[Ph_3C][B((C_6H_3\text{-}3,5\text{-}(CF_3)_2))_4]$, $[NH_4][B(C_6H_5)_4]$ or a Lewis acidic activator selected from $B(C_6F_5)_3$, $B(C_6H_5)_3$, where Ph is phenyl, Me is methyl, and R represents a C_1 to C_{16} alkyl group.

16. The process according to any one of claims 1 to 15, wherein said contacting further comprises contacting a promoter or co-activator selected from the group consisting of alkylaluminum compounds having the formula R_3Al and alkylboron compounds having the formula R_3B, where each R is independently selected from C_1 to C_{20} alkyl group or H.

17. The process according to any one of claims 1 to 16, wherein said contacting further comprises contacting in the presence of H_2.

18. The process according to any one of claims 1 to 16, wherein said contacting is further characterized by contacting in the absence of H_2.

19. The according to any one of claims 1 to 18, wherein said random liquid polymer is characterized by a bromine number of greater than 2 and said process further comprises contacting said product with hydrogen to obtain a second polymer product characterized by a bromine number of less than 2.

20. The process according to any one of claims 1 to 19, wherein said feed comprises at least two alpha-olefins selected from C_3 to C_{24} alpha-olefins.

21. The process according to any one of claims 1 to 19, wherein said feed comprises at least two different alpha-olefins selected from C_4 to C_{24} alpha-olefins.

22. The process according to any one of claims 1 to 19, wherein said feed comprises at least two different alpha-olefins selected from C_6 to C_{18} alpha-olefins.

23. The process according to any one of claims 1 to 19, wherein said feed comprises at least two different alpha-olefins selected from C_4 to C_{18} alpha-olefins.

24. The process according to any one of claims 1 to 19, wherein said feed comprises at least three different alpha-olefins.

25. The process according to any one of claims 1 to 19, wherein said feed comprises at least four different alpha-olefins.

26. The process according to any one of claims 1 to 25, wherein said feed comprises less than 80 wt % of alpha-olefins selected from C_8 to C_{12} alpha-olefins, based on the combined weight of alpha-olefins in said feed.

27. The process according to any one of claims 1 to 25, wherein said feed comprises less than 70 wt % of alpha-olefins selected from C_8 to C_{12} alpha-olefins, based on the combined weight of alpha-olefins in said feed.

28. The process according to any one of claims 1 to 25, wherein said feed comprises less than 60 wt % of alpha-olefins selected from C_8 to C_{12} alpha-olefins, based on the combined weight of alpha-olefins in said feed.

29. The process according to any one of claims 1 to 25, wherein said feed comprises less than 50 wt % of alpha-olefins selected from C_8 to C_{12} alpha-olefins, based on the combined weight of alpha-olefins in said feed.

30. The process according to any one of claims 1 to 25, wherein said feed comprises less than 40 wt % of alpha-olefins selected from C_8 to C_{12} alpha-olefins, based on the combined weight of alpha-olefins in said feed.

31. The process according to any one of claims 1 to 30, wherein no alpha-olefin is present in said feed in an amount greater than 33 wt %, based on the combined weight of alpha-olefins in said feed.

32. The process according to any one of claims 1 to 31, wherein the feed is selected from at least one alpha-olefin selected from 1-butene and 1-hexene and at least one alpha-olefin selected from C_{12}-C_{18} alpha-olefins, and wherein the combined amount of 1-decene and 1-octene is less than 40 wt %.

33. The process according to any one of claims 1 to 32, wherein said feed is characterized by an average carbon number of between about 4 and about 14.

34. The process according to any one of claims 1 to 33, wherein said feed is characterized by an average carbon number of greater than about 5 to about less than 12.

35. The process according to any one of claims 1 to 34, wherein said feed is characterized by an average carbon number of greater than about 5.5 to about less than 11 and further characterized by the presence of C_8 to C_{12} alpha-olefins in the combined amount of less than 50 wt %, based on the combined weight of alpha-olefins in said feed.

36. The process according to any one of claims 1 to 35, wherein said feed is characterized by an average carbon number of greater than about 5.5 to about less than 11 and further characterized by the presence of C_8 to C_{12} alpha-olefins in the combined amount of less than 10 wt %, based on the combined weight of alpha-olefins in said feed.

37. The process of any one of claims 1 and 10 to 19, wherein said feed is obtained and used for said contacting without separation or isolation of alpha-olefins from an ethylene growth process.

38. The process according to any one of claims 1 to 37, wherein said product is further characterized by at least one of the parameters selected from: (a) M_n = 200-50,000; (b) M_w = 200-80,000; (c) MWD = 1 to 5; (d) Pour Point less than 10°C; (e) KV at 40°C of about 4 to about 80,000 cSt; (f) KV at 100°C of about 1.5 to 5,000 cSt; (g) a VI greater than or equal to 100.

39. The process according to any one of claims 1 to 38, wherein said product is further characterized by a VI of at least about 120.

40. The process according to any one of claims 1 to 39, wherein said product is further characterized by a VI of at least 130.

41. The process according to any one of claims 1 to 39, wherein said product is further characterized by a VI of at least 150.

42. The process according to any one claims 1 to 41, wherein said product is further characterized by a VI of at least 200.

43. The process according to any one of claims 1 to 42, wherein said feed comprises from about 1 wt% to about 95 wt% C_4 to C_8 alpha-olefins, based on the combined weight of alpha-olefins in said feed.

44. The process according to any one of claims 1 to 43, wherein said feed comprises from about 5 wt% to about 85 wt% C_4 to C_8 alpha-olefins, based on the combined weight of alpha-olefins in said feed.

45. The process according to any one of claims 1 to 44, wherein said feed comprises from about 5 wt% to about 85 wt% C_4 to C_8 alpha-olefins, 15 wt% to about 95 wt% C_{12}-C_{18} alpha-olefins, and less than 80 wt% C_8-C_{10} alpha-olefins, based on the combined weight of alpha-olefins in said feed.

46. The process according to any one of claims 1 to 45, wherein said feed comprises from about 5 wt% to about 85 wt% 1-hexene, based on the combined weight of alpha-olefins in said feed.

47. The process according to any one of claims 1 to 46, wherein said feed comprises from about 5 wt% to about 85 wt% 1-hexene, and less than 80 wt % of any one of 1-octene and 1-decene, based on the combined weight of alpha-olefins in said feed.

48. The process according to any one of claims 1 to 47, wherein said feed comprises from about 5 wt% to about 85 wt% 1-hexene, and less than 55 wt % of any one of 1-octene and 1-decene, based on the combined weight of alpha-olefins in said feed.

49. The process according to any one of claims 1 to 48, wherein said feed comprises from about 5 wt% to about 85 wt% 1-hexene, and less than 25 wt % of any one of 1-octene and 1-decene, based on the combined weight of alpha-olefins in said feed.

50. The process according to any one of claims 1 to 49, wherein said feed comprises from about 60 wt% to about 75 wt% of alpha-olefins selected from 1-hexene, 1-heptene and/or 1-octene and mixtures thereof and about 25 wt% to about 40 wt% of alpha-olefins selected from 1-dodecene, 1-tetradecene, and mixture thereof, based on the combined weight of alpha-olefins in said feed, and said product is characterized by a viscosity index of from about 140 to about 375, a KV at 100°C of from about 10 to about 1000 cSt, and a pour point of less than -10°C.

51. A random liquid polyalpha-olefin containing at least two types of branches with average branch length ranging from 2.1 to 12 and further characterized by

(a) randomness factor between 0.7 and 1.4 determined by mass spectrometry;

(b) a minimized Diff factor of less than 0.3 for the $S_{\alpha\alpha}$ methlene peak, determined by NMR;

(c) M_n = 200-50,000;

(d) M_w = 200-80,000;

(e) MWD = 1 to 5;

(f) a pour point less than 10°C;

(g) a KV at 100°C = 1.5 to 5,000; and

(h) a VI greater than or equal to 100.

52. The random liquid polyalpha-olefin of claim 51, wherein the randomness factor is between 0.8 to 1.2.

53. The random liquid polyalpha-olefin of claim 51, wherein the randomness factor is between 0.9 and 1.1.

54. The random liquid polyalpha-olefin of claim 51, characterized by an average branch length of from 3 to 10.

55. The random liquid polyalpha-olefin of claim 51, characterized by an average branch length of from 4 to 9.5.

56. The random liquid polyalpha-olefin of claim 51, characterized by an average branch length of from 5 to 9.

57. The random liquid polyalpha-olefin of claim 51, characterized by an average branch length of from 5.5 to 8.8.

58. The random liquid polyalpha-olefin of claim 51, characterized by an average branch length of from 6 to 8.5.

59. A lubricant comprising about 1 wt% to about 95 wt% of at least one random liquid polyalpha-olefin according to claim 44.

60. The lubricant of claim 59, further comprising a second basestock selected from the group consisting of API Groups I, II, III, IV or V, or a Fischer-Tropsch hydrocarbon derived lubricants.

61. The lubricant of claim 60, characterized by a pour point of less than -20°C.

62. The use of a random liquid polyalpha-olefin according to claim 51 in a fully formulated lubricant.

63. The use of a lubricant according to claim 60 in a gear or an apparatus comprising roller bearings.

64. A process comprising contacting a bridged metallocene compound, an activator selected from among Lewis acid activators and ionic activators, optionally a co-activator, and a feed having an average carbon number of at least 4.1 and comprising at least two different alpha-olefin monomers selected from C_3 to C_{30} alpha-olefins under conditions suitable to obtain a polymer comprising said at least two alpha-olefins;

said polymer characterized as having no distinct melting point above 20°C, and a kinematic viscosity at 100°C of 3000 cSt or less, and/or a kinematic viscosity at 40°C of 35,000 cSt or less;

said polymer further characterized as random by at least one of the following:

(a) said polymer having a degree of randomness (χ) between 0.7 to 1.4, as determined by Mass Spectrometry; and/or

(b) said polymer having a minimized Diff factor of less than 0.3 for the $S_{\alpha\alpha}$ methlene peak, determined by NMR; and/or

(c) wherein the ratio of the rate of disappearance of the fastest reacting monomer in said feed to the disappearance of the slowest reacting monomer in said feed is no more than 5; and/or

(d) wherein the ratio of the amount of any single alpha-olefin monomer incorporated in said polymer to the amount of said any single alpha-olefin in said feed is from about 0.5 to about 3;

with the proviso that any one of ethylene and propylene, if present in said feed, is present in the amount of less than 50 wt% individually, and in the amount of less than 50 wt% combined, based on the combined weight of alpha-olefins in said feed.

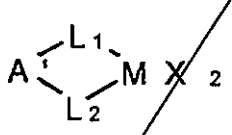
65. The process of claim 64, wherein said polymer is characterized as random by having a degree of randomness (χ) between 0.8 to 1.2, as determined by Mass Spectrometry.

66. The process of claim 64, wherein said polymer is characterized as random by a minimized Diff factor of less than 0.3 for the $S_{\alpha\alpha}$ methlene peak, determined by NMR.

67. The process of claim 64, wherein said polymer is characterized as random by the ratio of the rate of disappearance of the fastest reacting monomer in said feed to the disappearance of the slowest reacting monomer in said feed being no more than 5.

68. The process of claim 64, wherein said polymer is characterized as random by having the ratio of the amount of any alpha-olefin monomer incorporated in said polymer to the amount of said any alpha-olefin in said feed being from about 0.5 to about 3.

69. The process according to any one of claims 64 to 68, wherein said metallocene compound is characterized by the formula 1:



Formula 1

wherein M is selected from Zr, Hf, Ti; each X is independently selected from the group consisting of halide, hydrogen and branched or unbranched C_1 to C_{20} hydrocarbyls, L_1 and L_2 are independently selected from cyclopentadienyl, indenyl, tetrahydroindenyl, fluorenyl, and their alkyl substituted analogs, and A is selected from R_1R_2Si, R_1R_2C, $(R_1R_2C)_2$, $(R_1R_2Si)_2$; and wherein R_1 and R_2 are independently selected from hydrogen, branched or unbranched C_1 to C_{20} hydrocarbyl radicals, phenyl, and substituted phenyl.

70. The process of any one of claims 64 to 69, wherein said activator is an ionic activator selected from $[Me_2PhNH][B(C_6F_5)_4]$, $[R_3NH][B(C_6F_5)_4]$, $[R_2NH_2][B(C_6F_5)_4]$,

$[RNH_3][B(C_6F_5)_4]$, $[R_4N][B(C_6F_5)_4]$, $[Ph_3C][B(C_6F_5)_4]$, $[Me_2PhNH][B((C_6H_3\text{-}3,5\text{-}(CF_3)_2))_4]$, $[Ph_3C][B((C_6H_3\text{-}3,5\text{-}(CF_3)_2))_4]$, $[NH_4][B(C_6H_5)_4]$ or a Lewis acidic activator selected from $B(C_6F_5)_3$, $B(C_6H_5)_3$, where Ph is phenyl, Me is methyl, and R represents a C_1 to C_{16} alkyl group.

71. The process of any one of claims 64-70, wherein said at least two different alpha-olefins are selected from the group consisting of C_4-C_8 linear alpha-olefins, C_{12}-C_{24} linear alpha-olefins, 4-methyl-1-pentene, 5-methyl-1-hexene, 4-ethyl-1-hexene, 4-phenyl-1-pentene, and 5-phenyl-1-pentene.

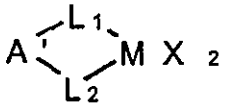
72. The process of any one of claims 64-71, wherein the average carbon number of said feed is between about 5.5 to less than about 11.

73. The process of any one of claims 64-72, further characterized by:
(a) M_n = 200-50,000;
(b) M_w = 200-80,000;
(c) MWD = 1 to 5;
(d) a pour point less than 10°C;
(e) a KV at 100°C = 1.5 to 3,000; and
(h) a VI greater than or equal to 120, preferably greater than or equal to 140.

74. The process according to any one of claims 64-73, wherein said feed is characterized as consisting essentially of at least two different alpha-olefins selected from 1-butene, 1-hexene, 1-dodecene, and C_{14} to C_{20} alpha-olefins, and wherein ethylene and/or propylene, if present, are present in the total combined amount of less than 40 wt%, based on the combined weight of alpha-olefins in said feed.

75. A process comprising contacting a bridged metallocene compound, an activator, and a feed having an average carbon number of between about 5.5 and 14, said feed comprising

at least two different alpha-olefin monomers selected from C_4 to C_{24} alpha-olefins, under conditions suitable to obtain a polymer comprising said at least two alpha-olefins, wherein said metallocene compound is characterized by the formula 1:



Formula 1

wherein M is selected from Zr, Hf, Ti; each X is independently selected from the group consisting of halide and branched or unbranched C_1 to C_{20} hydrocarbyls, L_1 and L_2 are independently selected from cyclopentadienyl, indenyl, tetrahydroindenyl, fluorenyl, and their alkyl substituted analogs, and A is selected from R_1R_2Si, R_1R_2C, $(R_1R_2C)_2$, $(R_1R_2Si)_2$; wherein R_1 and R_2 are independently selected from hydrogen, branched or unbranched C_1 to C_{20} hydrocarbyl radicals, phenyl, and substituted phenyl, and wherein said activator is selected from among Lewis acid activators and ionic activators, and obtaining thereby a polymer characterized by:

(a) M_n = 200-50,000;

(b) M_w = 200-80,000;

(c) MWD = 1 to 5;

(d) a pour point less than 10°C;

(e) a KV at 100°C = 1.5 to 5,000;

(h) a VI greater than or equal to;

(i) having no distinct melting point above 0°C; and

(j) by having the ratio of the amount of any alpha-olefin monomer incorporated in said polymer to the amount of said any alpha-olefin in said feed being from about 0.5 to about 3.

76. The process of claim 75, wherein ethylene and/or propylene, if present in said feed, are present in the combined amount of less than 50 wt%, based on the combined weight of alpha-olefins in said feed.

77. The process of claim 74 or 75, wherein 1-octene and/or 1-decene, if present in said feed, are present in the amount of 66 wt% or less individually, based on the combined weight of alpha-olefins in said feed.

78. The process of claim 74 or 75, wherein 1-octene and/or 1-decene and/or 1-dodecene, if present in said feed, are present in the amount of less than 70 wt% individually, based on the combined weight of alpha-olefins in said feed.

79. The process of claims 74 or 75, wherein 1-octene and/or 1-decene and/or 1-dodecene, if present in said feed, are present in the amount of less than 55 wt% individually, based on the combined weight of alpha-olefins in said feed.

80. The process of claims 74 or 75, wherein 1-octene and/or 1-decene and/or 1-dodecene, if present in said feed, are present in the amount of less than 25 wt% individually, based on the combined weight of alpha-olefins in said feed.

81. The process of claims 74 or 75, wherein the average carbon number of said feed is from about 5.7 to less than 12.

82. The polymer obtainable by a process according to any one of claims 1 to 50 and 64 to 81.

83. The polymer made by a process according to any one of claims 1 to 50 and 64 to 81.

84. A composition suitable for lubricating a gear or roller bearing element comprising the polymer of claim 82 or 83.

85. A composition suitable for lubricating all engine elements comprising the polymer of claim 82 or 83.

86. The process according to claim 1, wherein said activators are selected from methylaluminoxane, alkylanilinium tetrakis(perfluorophenyl)borate, tris(pentafluorophenyl)boron, their analogs and derivatives, and mixtures thereof.

87. The process according to claim 1, wherein said activator is N,N-dimethylanilinium tetrakis(perfluorophenyl)borate

88. The process according to claim 1, wherein said co-activators are present and at least one is a co-activator selected from trialkylaluminum compounds, preferably triethyl aluminum, tri-isobutylaluminum, tri-n-hexylaluminum, tri-n-octylaluminum, tri-n-decylaluminum, and tri-n-dodecylaluminum.

89. The process according to any one of claims 1 to 50, wherein said catalyst has a productivity of >1,000 gram of product per gram of metallocene component.

90. The process according to any one of claims 1 to 50, wherein said feed comprises from about 5 wt% to about 85 wt% 1-hexene, and less than 25 wt % of any one of 1-octene, 1-decene, and 1-dodecene, based on the combined weight of alpha-olefins in said feed.

91. The process of claim 48, wherein said feed further comprises at least about 20 wt% 1-hexene, based on the combined weight of alpha-olefins in said feed.

92. The use of a lubricant according to claim 60 in an engine lubricant in automobile, ship or gas turbine

93. The process according to any one of claims 1 to 50, wherein said feed comprises from about 20 wt% to about 75 wt% of alpha-olefins selected from 1-hexene, 1-heptene and 1-octene and mixtures thereof, and about 25 wt% to about 75 wt% of alpha-olefins selected from 1-dodecene, 1-tetradecene, and mixture thereof, based on the combined weight of

alpha-olefins in said feed and said product is characterized by a viscosity index of from about 140 to about 375, a KV at 100°C of from about 10 to about 1000 cSt, and a pour point of less than -10°C.

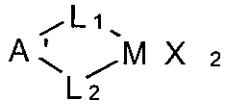
94. The process of claims 64 to 71, wherein said feed comprises from about 5 wt% to about 85 wt% 1-hexene, and less than 55 wt % of any one of 1-octene and 1-decene and less than 80% of any one of 1-tetradecene and 1-hexadecene, based on the combined weight of alpha-olefins in said feed.

95. Process according to claim 64, further comprising treating said polymer with hydrogen and hydrogenation catalyst to give fully saturated polymer with low bromine number of less than 2.

CLAIMS

1. A process comprising contacting:

(a) an activated bridged racemic metallocene compound of Formula 1:



Formula 1

wherein M is selected from Zr, Hf, Ti; each X is independently selected from the group consisting of halide and hydrogen, branched or unbranched C_1 to C_{20} hydrocarbyls, L_1 and L_2 are independently selected from cyclopentadienyl, indenyl, tetrahydroindenyl, and their alkyl substituted analogs, and A is selected from R_1R_2Si, R_1R_2C, $(R_1R_2C)_2$, $(R_1R_2Si)_2$; wherein R_1 and R_2 are independently selected from hydrogen, branched or unbranched C_1 to C_{20} hydrocarbyl radicals, phenyl, and substituted phenyl;

(b) a non-coordinating anion activator;

(c) co-activator; and

(d) a monomer feed comprising at least two different linear alpha-olefin monomers selected from C_4 to C_{24} linear alpha-olefins having an average carbon number of from 5 to less than 12 and under conditions suitable to produce an isotactic polyalpha-olefin comprising the at least two different linear alpha-olefin monomers,

with the *proviso* that any one of ethylene and propylene, if present in the at least two different linear alpha-olefin monomers, is present in the amount of less than 5 wt% individually or combined based on the total weight of alpha-olefin monomers;

wherein the isotactic polyalpha-olefin has:

(1) a randomness factor between 0.7 and 1.4 as determined by mass spectrometry;

(2) a molecular weight distribution Mw/Mn of 1 to 4 as measured by GPC using polystyrene as a calibration standard;

(3) a pour point less than 0°C as measured by ASTM D 97;

(4) a kinematic viscosity KV at 100°C of 3 to 1000 cSt as measured by ASTM D 445; and

(5) a VI from 100 to 300 as determined according to ASTM D2270-93 (1998).

2. The process of claim 1, wherein the isotactic polyalpha-olefin has an average branch length of 5 to 9.

3. The process of claim 1, wherein no single linear alpha-olefin is present in an amount of greater than 60 wt%.

4. The process of claim 1, wherein the at least two different linear alpha-olefin monomers comprise from 5 wt% to 85 wt% C_4 to C_8 alpha-olefins, based on the total weight of the at least two different linear alpha-olefin monomers.

5. The process of claim 1, wherein the at least two different linear alpha-olefin monomers comprise C_4-C_8 linear alpha-olefins and C_{12}-C_{24} linear alpha-olefins.

6. The process of claim 1, wherein the at least two different linear alpha-olefin monomers comprise at least two different alpha-olefins selected from C_6 to C_{18} alpha-olefins.

7. The process of claim 1, wherein the isotactic polyalpha-olefin incorporates each alpha-olefin monomer within at least 20 wt% of the distribution of the alpha-olefin monomer.

8. The process of claim 1, wherein the at least two different linear alpha-olefin monomers comprise from 5 wt% to 85 wt% C_4 to C_8 alpha-olefins, 15 wt% to 95 wt% C_{12}-C_{18} alpha-olefins, and less than 80 wt% C_8-C_{10} alpha-olefins, based on the total weight of the at least two different linear alpha-olefin monomers.

9. The process of claim 1, wherein the at least two different linear alpha-olefin monomers are selected from the group consisting of 1-butene, 1-hexene, and at least one alpha-

olefin selected from C_{12}-C_{18} alpha-olefins; wherein the combined amount of 1-decene and 1-octene is less than 40 wt%.

10. The process of claim 1, wherein the at least two different linear alpha-olefin monomers comprise less than 10 wt% 1-decene.

11. The process of claim 1, wherein the at least two different linear alpha-olefin monomers comprise from 60 wt% to 75 wt% of alpha-olefins selected from 1-hexene and 1-octene and mixtures thereof, and 25 wt% to 40 wt% of alpha-olefins selected from 1-dodecene, 1-tetradecene and mixture thereof, based on the total weight of the at least two different linear alpha-olefin monomers; wherein the polyalpha-olefin has a viscosity index from 140 to 375, a KV at 100°C from 10 to 1000 cSt, and a pour point of less than -10°C.

12. The process of claim 1, wherein the process is a continuous solution or bulk phase process.

13. The process of claim 1, wherein the contacting is in the absence of H_2 gas.

14. The process of claim 1 further comprising:
treating the isotactic polyalpha-olefin to reduce a heteroatom catalyst component to less than 600 ppm; and
contacting the isotactic polyalpha-olefin with hydrogen and a hydrogenation catalyst to produce a polyalpha-olefin having a bromine number less than 1.8.

15. The process of claim 1, wherein the isotactic polyalpha-olefin has at least two types of branches with an average branch length ranging from 4 to 10.

16. The process of claim 1, wherein the isotactic polyalpha-olefin has a KV at 100°C from 8 to 500 cSt.

17. The process of claim 1 further comprising: blending the isotactic polyalpha-olefin with a base stock selected from the group consisting of API Groups I, II, III, IV or V, a Fischer-Tropsch hydrocarbon derived base stock, a GTL base stock, or mixtures thereof, wherein blending the isotactic polyalpha-olefin to form a blend and the blend comprises from 20 to 80 wt% of the isotactic polyalpha-olefin.