CLAIMS:

1. A process comprising:

introducing a C_4-C_{30} internal-olefin feed with a catalyst system comprising a nickel diimine catalyst ~~optionally in the presence of a solvent~~; and

obtaining a C_6-C_{100} polyolefin product having one or more of:

a carbon fraction of epsilon-carbons of from about 0.08 to about 0.3,

a carbon fraction of CH_3 from (methyl + ethyl) of from about 0.02 to about 0.15,

a carbon fraction of CH_3 from (propyl + butyl + longer carbon chains) of from about 0.06 to about 0.2, and

a carbon fraction of total CH_3 of from about 0.1 to about 0.3, as determined by ^{13}C NMR spectroscopy, based ~~on~~ a the total carbon content of the polyolefin product.

2. The process of claim 1, wherein the catalyst system further comprises a palladium diimine catalyst.

3. The process of ~~claims 1 or 2~~ claim 1, wherein the polyolefin product is a C_{10}-C_{25} polyolefin product.

4. The process of ~~any of claims 1 to 3~~ claim 1, wherein the catalyst system further comprises an alkyl alumoxane.

5. The process of ~~any of claims 1 to 4~~ claim 1, wherein introducing is performed in the presence of a solvent and the solvent is selected from n-hexane, n-heptane, cyclohexane, benzene, toluene, xylenes, or a mixture thereof.

6. The process of ~~any of claims 1 to 4~~ claim 1, wherein introducing is performed free of a solvent.

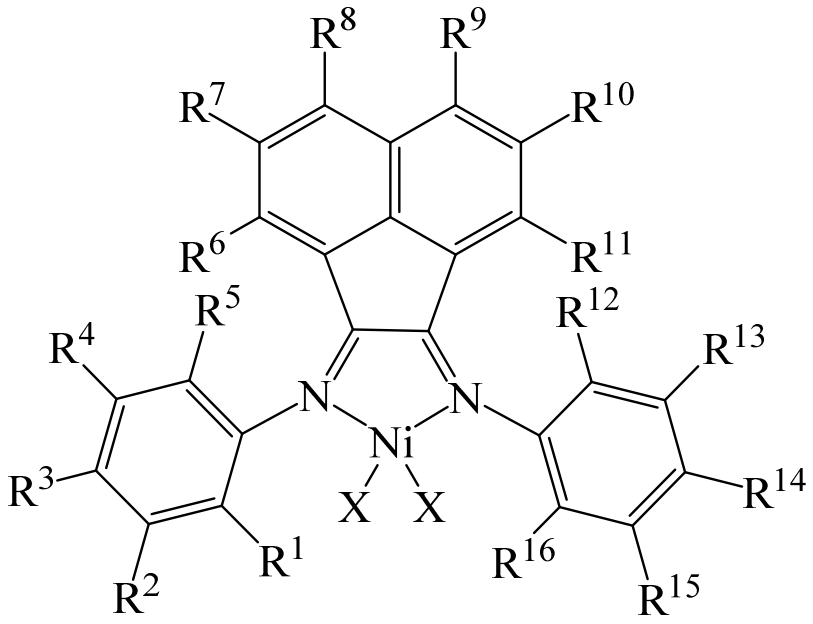
7. The process of ~~any of claims 1 to 6~~ claim 1, wherein a molar ratio of nickel diimine catalyst to palladium diimine catalyst is from about 0.5:1 to about 1:0.5.

8. The process of claim 7, wherein the molar ratio is about 1:1.

9. The process of ~~any of claims 1 to 8~~ claim 1, wherein introducing is performed at a temperature of from about -25ºC to about 25ºC.

10. The process of claim 9, wherein the reaction time is from about 1 minute to about 30 minutes.

11. The process of ~~any of claims 1 to 10~~ claim 1, wherein the nickel diimine catalyst is represented by Formula (**I**):



(**I**)

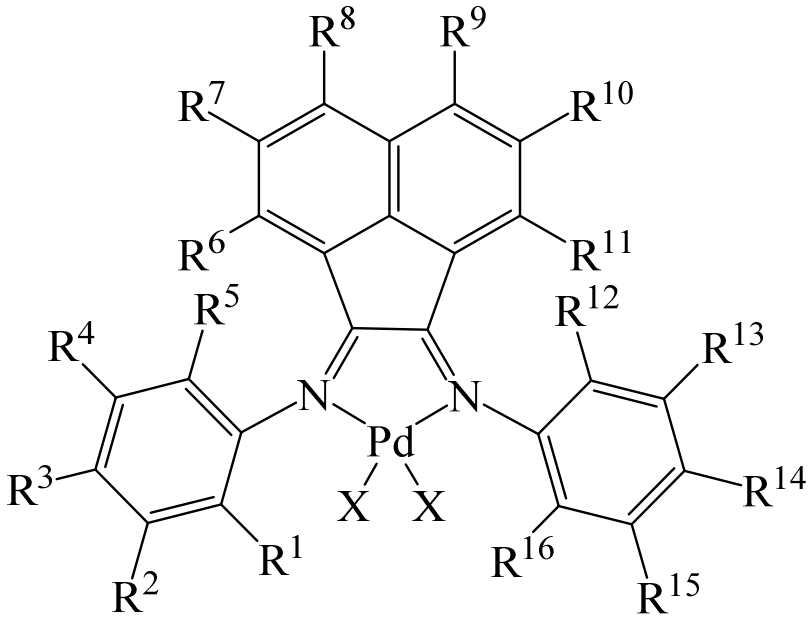
wherein:

each of R^1, R^2, R^3, R^4, R^5, R^6, R^7, R^8, R^9, R^{10}, R^{11}, R^{12}, R^{13}, R^{14}, R^{15}, and R^{16} is independently selected from hydrogen, C_1-C_{40} hydrocarbyl, C_1-C_{40} substituted hydrocarbyl, or a halogen, and each X is independently selected from C_1-C_{20} hydrocarbyl, C_1-C_{20} substituted hydrocarbyl, or a halogen.

12. The process of claim 11, wherein R^1 and R^{16} are hydrogen and each of R^5 and R^{12} is independently selected from C_1-C_{40} hydrocarbyl, C_1-C_{40} substituted hydrocarbyl, or a halogen.

13. The process of ~~claims 11 or 12~~ claim 11, wherein each of R^2, R^3, R^4, R^6, R^7, R^8, R^9, R^{10}, R^{11}, R^{13}, R^{14}, and R^{15} is hydrogen and each of R^1, R^5, R^{12}, and R^{16} is independently selected from hydrogen, methyl, isopropyl, or fluorine.

14. The process of ~~any of claims 2 to 13~~ claim 2, wherein the palladium diimine catalyst is represented by Formula (**II**):



(**II**)

wherein:

each of R^1, R^2, R^3, R^4, R^5, R^6, R^7, R^8, R^9, R^{10}, R^{11}, R^{12}, R^{13}, R^{14}, R^{15}, and R^{16} is independently selected from hydrogen, C_1-C_{40} hydrocarbyl, C_1-C_{40} substituted hydrocarbyl, or a halogen, and each X is independently selected from C_1-C_{20} hydrocarbyl, C_1-C_{20} substituted hydrocarbyl, or a halogen.

15. The process of claim 14, wherein R^1 and R^{16} of the palladium catalyst are hydrogen and each of R^5 and R^{12} of the palladium catalyst is independently selected from C_1-C_{40} hydrocarbyl, C_1-C_{40} substituted hydrocarbyl, or a halogen.

16. The process of ~~claims 14 or 15~~ claim 14, wherein each of R^2, R^3, R^4, R^6, R^7, R^8, R^9, R^{10}, R^{11}, R^{13}, R^{14}, and R^{15} of the palladium diimine catalyst is hydrogen and each of R^1, R^5, R^{12}, and R^{16} of the palladium diimine catalyst is independently selected from hydrogen, methyl, isopropyl, or fluorine.

17. The process of ~~any of claims 1 to 16~~ claim 1, wherein the polyolefin product has:

a carbon fraction of epsilon-carbons of from about 0.13 to about 0.24,

a carbon fraction of CH_3 from (methyl + ethyl) of from about 0.05 to about 0.12,

a carbon fraction of CH_3 from (propyl + butyl + longer carbon chains) of from about 0.08

to about 0.13, and

a carbon fraction of total CH_3 of from about 0.13 to about 0.21, as determined by ^{13}C NMR spectroscopy, based on the total carbon content of the polyolefin product.

18. The process of ~~any of claims 1 to 17~~ clam 1, wherein the polyolefin product has a viscosity index of about 120 or greater, as determined according to ASTM D2270.

19. The process of claim 18, wherein the polyolefin product has a viscosity index of about 150 or greater, as determined according to ASTM D2270.

20. The process of ~~any of claims 1 to 19~~ claim 1, wherein the polyolefin product has a kinematic viscosity at 100°C of from about 50 cSt to about 100 cSt, as determined by ASTM D445.

21. The process of ~~any of claims 1 to 20~~ claim 1, wherein the polyolefin product has a kinematic viscosity at 40°C of from about 470 cSt to about 1,100 cSt, as determined by ASTM D445.

22. The process of ~~any of claims 1 to 20~~ claim 1, wherein the polyolefin product has a glass transition temperature of from about -110°C to about -50°C, as determined by Differential Scanning Calorimetry (DSC).

23. The process of claim 22, wherein the polyolefin product has a glass transition temperature of from about -95°C to about -85°C, as determined by Differential Scanning Calorimetry (DSC).

24. The process of ~~any of claims 1 to 23~~ claim 1, wherein the polyolefin product has one or more of:

a di-substituted olefin content of from about 30% to about 80%,

a tri-substituted olefin content of from about 1% to about 50%,

a vinyl content of from about 0.5% to about 10%, and

a vinylidene content of from about 0.1% to about 10%, based on total unsaturations of the polyolefin product, as determined by ^{1}H NMR spectroscopy.

25. The process of claim 24, wherein the polyolefin product has:

a di-substituted olefin content of from about 60% to about 70%,

a tri-substituted olefin content of from about 20% to about 40%,

a vinyl content of from about 1% to about 4%, and

a vinylidene content of from about 0.5% to about 3%, based on total unsaturations of the polyolefin product, as determined by ^{1}H NMR spectroscopy.

26. The process of ~~any of claims 1 to 25~~ claim 1, further comprising hydrogenating the polyolefin product to form a hydrogenated polyolefin product.

27. The process of claim 26, wherein the hydrogenated polyolefin product has a methylene content of from about 1 wt% to about 30 wt%, as determined by ^{1}H NMR spectroscopy.

28. The process of claim 27, wherein the hydrogenated polyolefin product has a methylene content of from about 10 wt% to about 15 wt%, as determined by ^{1}H NMR spectroscopy.

29. The process of ~~any of claims 26 to 28~~ claim 26, wherein the hydrogenated polyolefin product has a cetane number of about 45 or greater.

30. The process of claim 29, wherein the hydrogenated polyolefin product has a cetane number of about 70 or greater.

31. The process of ~~claims 1 30~~ claim 1, wherein the feed is from a refinery stream.

32. The process of claim ~~1 30~~ 1, wherein the feed comprises a dilute olefin stream.

33. A C_6-C_{100} polyolefin product having one or more of:

a carbon fraction of epsilon-carbons of from about 0.08 to about 0.3,

a carbon fraction of CH_3 from (methyl + ethyl) of from about 0.02 to about 0.15,

a carbon fraction of CH_3 from (propyl + butyl + longer carbon chains) of from about 0.06 to about 0.2, and

a carbon fraction of total CH_3 of from about 0.1 to about 0.3, as determined by ^{13}C NMR spectroscopy, based on ~~the~~ a total carbon content of the polyolefin product.

34. The polyolefin product of claim 33, wherein the polyolefin product is a C_{10}-C_{25} polyolefin product.

35. The polyolefin product of ~~claims 33 or 34~~ claim 33, wherein the polyolefin product has:

a carbon fraction of epsilon-carbons of from about 0.13 to about 0.24,

a carbon fraction of CH_3 from (methyl + ethyl) of from about 0.05 to about 0.12,

a carbon fraction of CH_3 from (propyl + butyl + longer carbon chains) of from about 0.08 to about 0.13, and

a carbon fraction of total CH_3 of from about 0.13 to about 0.21, as determined by ^{13}C NMR spectroscopy, based on the total carbon content of the polyolefin product.

36. The polyolefin product of ~~any of claims 33 to 34~~ claim 33, wherein the polyolefin product has a viscosity index of about 120 or greater, as determined according to ASTM D2270.

37. The polyolefin product of claim 35, wherein the polyolefin product has a viscosity index of about 150 or greater, as determined according to ASTM D2270.

38. The polyolefin product of ~~any of claims 33 to 36~~ claim 33, wherein the polyolefin product has a kinematic viscosity at 100°C of from about 50 cSt to about 100 cSt, as determined by ASTM D445.

39. The polyolefin product of ~~any of claims 33 to 37~~ claim 33, wherein the polyolefin product has a kinematic viscosity at 40°C of from about 470 cSt to about 1,100 cSt, as determined by ASTM D445.

40. The polyolefin product of ~~any of claims 33 to 38~~ claim 33, wherein the polyolefin product has a glass transition temperature of from about -110°C to about -50°C, as determined by Differential Scanning Calorimetry (DSC).

41. The polyolefin product of claim 39, wherein the polyolefin product has a glass transition temperature of from about -95°C to about -85°C, as determined by Differential Scanning Calorimetry (DSC).

42. The polyolefin product of ~~any of claims 33 to 40~~ claim 33, wherein the polyolefin product has one or more of:

a di-substituted olefin content of from about 30% to about 80%,

a tri-substituted olefin content of from about 1% to about 50%,

a vinyl content of from about 0.5% to about 10%, and

a vinylidene content of from about 0.1% to about 10%, based on total unsaturations of the polyolefin product, as determined by ^{1}H NMR spectroscopy.

43. The polyolefin product of ~~any of claims 33 to 40~~ claim 33, wherein the polyolefin product has:

a di-substituted olefin content of from about 60% to about 70%,

a tri-substituted olefin content of from about 20% to about 40%,

a vinyl content of from about 1% to about 4%, and

a vinylidene content of from about 0.5% to about 3%, based on total unsaturations of the polyolefin product, as determined by ^{1}H NMR spectroscopy.

44. A hydrogenated C_6-C_{100} polyolefin product having:

a methylene content of from about 1 wt% to about 30 wt%, as determined by ^{1}H NMR spectroscopy, and

a cetane number of about 45 or greater.

45. The hydrogenated polyolefin product of claim 44, wherein the polyolefin product is a hydrogenated C_{10}-C_{25} polyolefin product.

46. The hydrogenated polyolefin product of ~~claims 44 or 45~~ claim 44, wherein the hydrogenated polyolefin product has:

a methylene content of from about 10 wt% to about 15 wt%, as determined by ^{1}H NMR spectroscopy, and

a cetane number of about 70 or greater.

47. A lubricating base oil comprising:

a polyolefin product of any of claims ~~32~~ 33 to 46; and

one or more additives,

wherein the lubricating base oil has one or more of:

a viscosity index of about 120 or greater, as determined according to ASTM D2270,

a KV100 of from about 2 cSt to about 25 cSt, as determined by ASTM D445, and

a KV40 of from about 10 cSt to about 125 cSt, as determined by ASTM D445.

48. The lubricating base oil of claim 47, wherein the lubricating base oil comprises from about 1 wt% to about 25 wt% of the polyolefin product, based on ~~the~~ a weight of the lubricating oil, and the lubricating oil has:

a viscosity index is about 150 or greater, as determined according to ASTM D2270,

a KV100 of from about 4 cSt to about 10 cSt, as determined by ASTM D445, and

a KV40 of from about 20 cSt to about 50 cSt, as determined by ASTM D445.