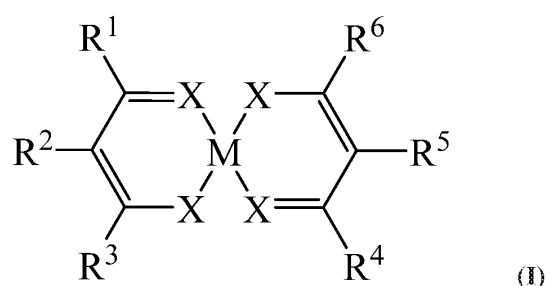


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CLAIMS:*What is claimed is:*

1. A process comprising:
introducing, neat or in the presence of a solvent, a feed comprising a branched C₅-C₃₀ internal olefin to a catalyst compound comprising a group 8, 9, 10, or 11 transition metal and at least one heteroatom; and
obtaining a C₆-C₁₀₀ polyolefin product having one or more of:
one olefin,
less than 3 sp² hybridized carbons,
a methylene content of from about 1 wt% to about 98 wt%, based on the total weight of the C₆-C₁₀₀ polyolefin product, and
a methyl content of from about 1 wt% to about 75 wt%, based on the total weight of the C₆-C₁₀₀ polyolefin product.
2. The process of claim 1, wherein the feed further comprises a linear C₄-C₃₀ internal olefin.
3. The process of claim 1, wherein the feed further comprises a C₂-C₃₀ alpha-olefin.
4. The process of claim 1, wherein the feed further comprises a linear C₄-C₃₀ internal olefin and a C₂-C₃₀ alpha-olefin.
5. The process of claim 1, wherein the heteroatom is fluorine.
6. The process of claim 1, wherein the feed comprises one or more C₅ olefins selected from 2-Me-2-butene, 2-Me-1-butene, 3-Me-1-butene, 1-pentene, cis-2-pentene, trans-2-pentene, or mixture thereof.
7. The process of claim 1, wherein the catalyst compound is represented by Formula (I):

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wherein:

M is a group 8, 9, 10, or 11 metal;

each X is a heteroatom; and

each of R¹, R², R³, R⁴, R⁵, and R⁶ is independently selected from hydrogen, C₁-C₄₀ hydrocarbyl, C₁-C₄₀ substituted hydrocarbyl, a heteroatom or a heteroatom-containing group, wherein at least one of R¹, R², R³, R⁴, R⁵, and R⁶ is a heteroatom or a heteroatom-containing group, or one or more of R¹ and R², R² and R³, R⁴ and R⁵, or R⁵ and R⁶ are 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, wherein at least one of the rings is substituted with a heteroatom or a heteroatom-containing group if the remainder of R groups of Formula (I) are not a heteroatom or a heteroatom-containing group.

8. The process of claim 7, wherein at least one of R¹, R², R³, R⁴, R⁵, and R⁶ are independently selected from a halogen or a halogen-containing group.

9. The process of claim 7, wherein each of R¹, R³, R⁴, or R⁶ is CF₃ and each of R² and R⁵ is independently selected from hydrogen, methyl, isopropyl, or fluorine.

10. The process of claim 9, wherein M is Ni.

11. The process of claim 1, wherein introducing comprises introducing the feed to a catalyst system comprising the catalyst of claim 1 and an activator.

12. The process of claim 11, wherein the catalyst system further comprises a support material.

13. The process of claim 11, wherein the activator comprises an alkylaluminoxane.

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14. The process of claim 1, wherein introducing is performed in the presence of a solvent selected from n-hexane, n-heptane, cyclohexane, benzene, toluene, xylenes, or a mixture thereof.
15. The process of claim 1, wherein introducing is performed in the presence of a solvent at a ratio of a olefin to solvent of from about 1:0 to about 1:10.
16. The process of claim 1, wherein a molar ratio of catalyst to activator is from about 10:1 to about 1:1,000.
17. The process of claim 16, wherein the molar ratio of catalyst to activator is about 1:3.
18. The process of claim 1, wherein a catalyst loading is from about 0.0001 mol% to about 5 mol%.
19. The process of claim 1, wherein a turnover number (TON) of the catalyst is of from about 10 to about 10,000.
20. The process of claim 1, wherein introducing is performed at a temperature of from about 20°C to about 250°C.
21. The process of claim 20, wherein introducing is performed at a pressure of from 0 psig to about 1,000 psig
22. The process of claim 21, wherein the reaction time is from 1 minute to 72 hours.
23. The process of any of claim 1 comprising: polymerizing the feed of claim 1 by contacting the branched C₅-C₃₀ internal olefin with the catalyst, in one or more polymerization reactors, in series or in parallel, at a reactor pressure of from 0 psig to about 1,000 psig and a reactor temperature from about 120°C or less, to form the C₆-C₁₀₀ polyolefin product.
24. The process of any of claim 1 comprising: polymerizing the feed of claim 2 comprising a linear C₄-C₃₀ internal olefin by contacting the linear C₄-C₃₀ internal olefin with the catalyst, in one or more polymerization reactors, in series or in parallel, at a reactor pressure of from 0 psig to

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about 1,000 psig, and a reactor temperature from about 120°C or less, to form the C₆-C₁₀₀ polyolefin product.

25. The process of claim 1, wherein the feed is converted to the C₆-C₁₀₀ polyolefin product at a conversion (%) of from about 2% to about 99%.

26. A C₆-C₁₀₀ polyolefin product having one or more of:
less than 3 sp² hybridized carbons;
one olefin;
a methylene content of from about 1 wt% to about 98 wt%, based on the total weight of the C₆-C₁₀₀ polyolefin product; and
a methyl content of from about 1 wt% to about 75 wt%, based on the total weight of the C₆-C₁₀₀ polyolefin product.

27. The polyolefin product of claim 26, wherein the polyolefin product is a C₁₀-C₂₅ polyolefin product.

28. The polyolefin product of claim 26, wherein the polyolefin product has:
a methylene content of from about 30 wt% to about 98 wt%, based on the total weight of the C₆-C₁₀₀ polyolefin product; and
a methyl content of from about 10 wt% to about 50 wt%, based on the total weight of the C₆-C₁₀₀ polyolefin product.

29. A C₆-C₁₀₀ hydrogenated polyolefin product having:
a methylene content of from about 1 wt% to about 98 wt%, based on the total weight of the C₆-C₁₀₀ hydrogenated polyolefin product, as determined by GC measurements;
a methyl content of from about 1 wt% to about 75 wt%, based on the total weight of the C₆-C₁₀₀ hydrogenated polyolefin product, as determined by GC measurements; and
a cetane number of about 48 or greater,
wherein the hydrogenated polyolefin product is substantially free of olefin content and substantially free of sp² hybridized carbon atoms.

30. The hydrogenated polyolefin product of claim 29, wherein the polyolefin product is a hydrogenated C₁₀-C₂₅ polyolefin product.

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31. The hydrogenated polyolefin product of claim 29, wherein the hydrogenated polyolefin product has:

a methylene content of from about 30 wt% to about 98 wt%, based on the total weight of the C₆-C₁₀₀ hydrogenated polyolefin product, as determined by GC measurements; and

a methyl content of from about 10 wt% to about 50 wt%, based on the total weight of the C₆-C₁₀₀ hydrogenated polyolefin product, as determined by GC measurements.

32. The hydrogenated polyolefin product of claim 29, wherein the hydrogenated polyolefin product comprises:

a 2,3,6-trimethylheptane content of from 0 wt% to about 12 wt%;

a 2,3,5-trimethylheptane content of from 0 wt% to about 1 wt%;

a 2,5-dimethyloctane content of from 0 wt% to about 5 wt%;

a 2,7-dimethyloctane content of from 0 wt% to about 5 wt%;

a 5-ethyl-2-methylheptane content of from 0 wt% to about 5 wt%;

a 2,6-dimethyloctane content of from 0 wt% to about 15 wt%;

a 3,6-dimethyloctane content of from 0 wt% to about 5 wt%;

a 2,3-dimethyloctane content of from 0 wt% to about 10 wt%;

a 4-Me-nonane content of from 0 wt% to about 20 wt%;

a 2-Me-nonane content of from 0 wt% to about 3 wt%;

a 3-Et-octane content of from 0 wt% to about 16 wt%;

a 3-Me-nonane content of from 0 wt% to about 10 wt%; and

a decane content of from 0 wt% to about 10 wt%, based on the total weight of the hydrogenated polyolefin products%.