

CLAIMS

What is claimed is:

- 5 1. A process for producing a catalyst composition comprising:
mixing a catalyst compound having a transition metal atom, a support, and optionally
an activator, to form a supported catalyst mixture; and
drying the supported catalyst mixture at a pressure of about 10 kPa or less and a
temperature of about 60 °C or greater for a period of about 6 hours or less, wherein aliphatic
10 hydrocarbon is not introduced to the supported catalyst mixture after drying.
2. The process of claim 1, consisting of: (a) mixing the catalyst compound, the support,
and optional activator to form the supported catalyst mixture; (b) drying the supported
catalyst mixture; and (c) obtaining the catalyst composition.
- 15 3. A catalyst composition comprising:
a catalyst compound having a transition metal atom;
an aluminum activator; and
a support,
20 wherein the catalyst composition has from about 0.5 wt% to about 1.5 wt% aromatic
hydrocarbon; and
wherein the catalyst composition has less than 1 wt% of aliphatic hydrocarbon.
4. The catalyst composition of claim 3, wherein the catalyst composition is made by a
25 process comprising:
mixing a catalyst compound having a transition metal atom, a support, and
optionally an activator, to form a supported catalyst mixture; and
obtaining the catalyst composition by drying the supported catalyst mixture at a
pressure of about 10 kPa or less and a temperature of about 60°C or greater for a period of
30 about 6 hours or less, wherein aliphatic hydrocarbon is not introduced to the catalyst
compound after drying.
5. A process for producing polyolefins, the process comprising:
introducing a catalyst composition and at least one olefin to a polymerization reactor,

wherein the catalyst composition comprises:

a catalyst compound having a transition metal atom,
an aluminum activator, and
a support;

5 wherein the catalyst composition has:

about 0.5 wt% to about 1.5 wt% aromatic hydrocarbon content, and
less than 1 wt% of aliphatic hydrocarbon content; and

obtaining a polyolefin having about 300 ppb or less aromatic hydrocarbon.

10 6. The process of claim 5, wherein the catalyst composition has about 1.2 wt% or less toluene.

7. The process of claim 5 or claim 6, wherein the catalyst composition has about 1.2 wt% or less aromatic hydrocarbon content.

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8. The process of claim 7, wherein the catalyst composition has about 0.8 wt % to about 1.2 wt% aromatic hydrocarbon content.

9. The process of any one of claims 5-8, wherein the polyolefin has one or both of: an
20 aluminum content of about 1 ppm to about 5 ppm, and a silica content of about 50 ppm or greater.

10. The process of claim 5, further comprising extruding the polyolefin to form a polyolefin film having one or both of: a toluene concentration of about 0.05 mg/m² or less;
25 and a weight percent of aluminum of about 0.01 wt% or greater.

11. The process of any one of claims 5-10, wherein the catalyst compound is selected from the group consisting of:

30 bis(1-methyl, 3-n-butyl cyclopentadienyl) zirconium dichloride;
dimethylsilyl bis(tetrahydroindenyl) zirconium dichloride;
bis(n-propylcyclopentadienyl) hafnium dimethyl;
dimethylsilyl (tetramethylcyclopentadienyl)(cyclododecylamido)titanium dimethyl;
dimethylsilyl (tetramethylcyclopentadienyl)(cyclododecylamido)titanium dichloride;
dimethylsilyl (tetramethylcyclopentadienyl)(t-butylamido)titanium dimethyl;

- dimethylsilyl (tetramethylcyclopentadienyl)(*t*-butylamido)titanium dichloride;
 μ -(CH₃)₂Si(cyclopentadienyl)(1-adamantylamido)M(R)₂;
 μ -(CH₃)₂Si(3-*tert*butylcyclopentadienyl)(1-adamantylamido)M(R)₂;
 μ -(CH₃)₂(tetramethylcyclopentadienyl)(1-adamantylamido)M(R)₂;
 5 μ -(CH₃)₂Si(tetramethylcyclopentadienyl)(1-adamantylamido)M(R)₂;
 μ -(CH₃)₂C(tetramethylcyclopentadienyl)(1-adamantylamido)M(R)₂;
 μ -(CH₃)₂Si(tetramethylcyclopentadienyl)(1-*tert*butylamido)M(R)₂;
 μ -(CH₃)₂Si(fluorenyl)(1-*tert*butylamido)M(R)₂;
 μ -(CH₃)₂Si(tetramethylcyclopentadienyl)(1-cyclododecylamido)M(R)₂;
 10 μ -(C₆H₅)₂C(tetramethylcyclopentadienyl)(1-cyclododecylamido)M(R)₂; and
 μ -(CH₃)₂Si(η^5 -2,6,6-trimethyl-1,5,6,7-tetrahydro-*s*-indacen-1-yl)(*tert*butylamido)M(R)₂;

wherein M is selected from Ti, Zr, and Hf; and R is selected from halogen or C1 to C5 alkyl.

- 15 12. The process of claim 11, wherein the activator is selected from the group consisting of
 N,N-dimethylanilinium tetra(perfluorophenyl)borate, N,N-dimethylanilinium
 tetrakis(perfluoronaphthyl)borate, N,N-dimethylanilinium tetrakis(perfluorobiphenyl)borate,
 N,N-dimethylanilinium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, triphenylcarbenium
 tetrakis(perfluoronaphthyl)borate, triphenylcarbenium tetrakis(perfluorobiphenyl)borate,
 20 triphenylcarbenium tetrakis(3,5-bis(trifluoromethyl)phenyl)borate, triphenylcarbenium
 tetra(perfluorophenyl)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-diethylanilinium
 25 tetrakis(perfluoronaphthyl)borate, N,N-dimethyl-(2,4,6-trimethylanilinium)
 tetrakis(perfluoronaphthyl)borate, and tropillium tetrakis(perfluoronaphthyl)borate.

13. The process of claim 12, wherein the support is selected from the group consisting of
 Al₂O₃, ZrO₂, SiO₂, SiO₂/Al₂O₂, silica clay, and mixture(s) thereof.
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14. The process of any one of claims 5-13, wherein the at least one olefin comprises
 ethylene, and the polymerization reactor is a gas phase polymerization reactor.

15. The process of claim 14, wherein the polyolefin has a silica content of about 200 ppm or less.
16. The process of any one of claims 5-15, further comprising obtaining a polyethylene resin having:
- a toluene content of about 300 ppb or less;
 - an aluminum content of about 5 ppm or greater;
 - a silica content of about 50 ppm or greater;
 - a Mw of from about 15,000 g/mol to about 2,000,000 g/mol;
 - a Mn of from about 2,500 g/mol to about 2,500,00 g/mol;
 - a MI of from about 0.2 g/10min to about 1.5 g/10min (190°C/2.16 kg);
 - a PDI of from about 1 to about 3;
 - a g' vis of about 0.85 or greater; and
 - a density of from about 0.91 to about 0.93.
17. A polyethylene resin having:
- a toluene content of about 300 ppb or less;
 - an aluminum content of about 5 ppm or greater; and
 - a silica content of about 50 ppm or greater.
18. The polyethylene resin of claim 17, further comprising:
- a Mw of from about 15,000 g/mol to about 2,000,000 g/mol;
 - a Mn of from about 2,500 g/mol to about 2,500,00 g/mol;
 - a MI of from about 0.2 g/10min to about 1.5 g/10min (190°C/2.16 kg);
 - a PDI of from about 1 to about 3;
 - a g' vis of about 0.85 or greater; and
 - a density of from about 0.91 to about 0.93.
19. The polyethylene resin of claim 17 or claim 18, wherein the polyethylene resin is made by a process according to any one of claims 5 to 15.