performance. The present disclosure also provides a method for producing the supported catalyst composition for olefin polymerization comprising the steps of:

a) forming a suspension comprising one or more porous particulate supports, one or more activator compounds and one or more catalyst compounds in one or more liquid diluents; and

b) spray drying the suspension to form a supported catalyst composition;

wherein step b) is performed at a rate sufficient to produce at least 200 kg of supported catalyst composition in a time of 10 hours or less. The spray drying step allows for large scale rapid drying of the suspension formed in step a) to yield the supported catalyst composition with an overall shorter batch process time.

[0005a] In one aspect, there is provided a method for producing a supported catalyst composition for olefin polymerization comprising the steps of:

a) forming a suspension comprising one or more porous particulate supports, one or more activator compounds and one or more catalyst compounds in one or more liquid diluents, wherein step a) is performed in a time of 5 hours or less; and

b) spray drying the suspension to form a supported catalyst composition;

wherein step b) is performed at a rate sufficient to produce at least 200 kg of supported catalyst composition in a time of 5 hours or less.

[0006] Step b) may be performed at a rate sufficient to produce at least 200 kg of supported catalyst composition in a time of 9 hours or less, or 8 hours or less, or 7 hours or less, or 6 hours or less, or 5 hours or less, or 4 hours or less, or 3 hours or less.

[0007] Forming the suspension in step a) may be performed in a time of 9 hours or less, or 8 hours or less, or 7 hours or less, or 6 hours or less, or 5 hours or less, or 4 hours or less, or 3 hours or less.

[0008] The supported catalyst composition may have a residual liquid content after spray drying of 10% by weight or less, or 7% by weight or less, or 5% by weight or less, or 4% by weight or less, or 3% by weight or less, or 2% by weight or less.

[0009] Step b) may be performed at a rate sufficient to produce at least 300 kg of supported catalyst composition, or at least 400 kg, or at least 500 kg, in a time of 10 hours or less.

[0010] An advantage of the presently disclosed methods is that drying of the supported catalyst composition to acceptably low levels of residual diluent may be achieved in significantly shorter times than with conventional vacuum drying methods.

[0011] For example, a supported catalyst composition having a batch size (total solids content) of about 550 kg may be spray dried from a toluene suspension in about 5 hours. This may compare to about 15 hours of drying time using conventional vacuum drying.

[0012] The time taken for step a) may be substantially the same as the time taken for step b). The time taken for step a) may be within 2 hours of the time taken for step b). The time taken for step a) may be within 1 hour of the time taken for step b).

[0013] Further, and surprisingly, supported catalyst compositions prepared by the presently disclosed methods may have equivalent or higher activities in olefin polymerization than catalyst compositions prepared by conventional vacuum drying methods.

wherein M is Zr or Hf, and X is selected from F, Cl, Br, I, Me, benzyl, CH_2SiMe_3, and C_1 to C_5 alkyls or alkenyls.

[0022] The method may comprise any one or more of the above disclosed features in any combination.

[0023] The present disclosure further provides a supported catalyst composition for olefin polymerization formed by any one of the hereinbefore disclosed methods.

[0023a] In another aspect, there is provided a supported catalyst composition formed by a method as described herein, wherein the supported catalyst composition has a residual liquid content after spray drying of 10% by weight or less, or 7% by weight or less, or 5% by weight or less, or 4% by weight or less, or 3% by weight or less, or 2% by weight or less and wherein the porous particulate support is dehydrated at an elevated temperature, and wherein the porous particulate support has an average particle size in the range of from 0.1 to 500 μm, or from 1 to 200 μm, or from 1 to 50 μm, or from 5 to 50 μm.

[0024] The present disclosure additionally provides a process for polymerizing olefins, the process comprising:

contacting olefins with one or more supported catalyst compositions prepared by any one of the methods as hereinbefore disclosed in a reactor under polymerization conditions to produce an olefin polymer or copolymer.

[0024a] In another aspect, there is provided a process for polymerizing olefins, the process comprising:

contacting olefins with one or more supported catalyst compositions prepared by a method as described herein in a reactor under polymerization conditions to produce an olefin polymer or copolymer, wherein the supported catalyst composition has a residual liquid content after spray drying of 10% by weight or less, or 7% by weight or less, or 5% by weight or less, or 4% by weight or less, or 3% by weight or less, or 2% by weight or less and wherein the porous particulate support is dehydrated at an elevated temperature, and wherein the porous particulate support has an average particle size in the range of from 0.1 to 500 μm, or from 1 to 200 μm, or from 1 to 50 μm, or from 5 to 50 μm.

DETAILED DESCRIPTION

[0025] Before the present compounds, components, compositions, and/or methods are disclosed and described, it is to be understood that unless otherwise indicated this invention is not limited to specific compounds, components, compositions, reactants, reaction conditions,

ligands, transition metal compounds, or the like, as such may vary, unless otherwise specified. It is also to be understood that the terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting.

[0026] It must also be noted that, as used in the specification and the appended claims, the singular forms "a," "an" and "the" include plural referents unless otherwise specified. Thus, for example, reference to "a halogen atom" as in a moiety "substituted with a halogen atom" includes more than one halogen atom, such that the moiety may be substituted with two or more halogen atoms, reference to "a substituent" includes one or more substituents, reference to "a ligand" includes one or more ligands, and the like.

[0027] As used herein, all reference to the Periodic Table of the Elements and groups thereof is to the NEW NOTATION published in HAWLEY'S CONDENSED CHEMICAL DICTIONARY, Thirteenth Edition, John Wiley & Sons, Inc., (1997) (reproduced there with permission from IUPAC), unless reference is made to the Previous IUPAC form noted with Roman numerals (also appearing in the same), or unless otherwise noted.

[0028] Disclosed herein are advantageous methods for the preparation of supported catalyst compositions for the polymerization of olefins. The methods are characterized in that they utilize spray drying as a step in the catalyst preparation. The supported catalyst compositions may be prepared in much shorter times relative to previously described methods and are capable of operating in a polymerization process continuously with good productivity.

CLAIMS

What is claimed is:

1. A method for producing a supported catalyst composition for olefin polymerization comprising the steps of:

a) forming a suspension comprising one or more porous particulate supports, one or more activator compounds and one or more catalyst compounds in one or more liquid diluents, wherein step a) is performed in a time of 5 hours or less; and

b) spray drying the suspension to form a supported catalyst composition;

wherein step b) is performed at a rate sufficient to produce at least 200 kg of supported catalyst composition in a time of 5 hours or less.

2. A method according to claim 1 wherein supported catalyst composition has a residual liquid content after spray drying of 10% by weight or less, or 7% by weight or less, or 5% by weight or less, or 4% by weight or less, or 3% by weight or less, or 2% by weight or less.

3. A method according to any one of claims 1 and 2 wherein the suspension has a weight percent of solids in the liquid diluent between 5% by weight and 60 % by weight, or between 10 % by weight and 50 % by weight, or between 20 % by weight and 40 % by weight, wherein the porous particulate support comprises (i) a particulate Group 2, 3, 4, 5, 13 and 14 oxide or chloride or (ii) a particulate silica, and wherein the suspension is spray dried at a rate between 100 kg/hr and 1000 kg/hr, or between 200 kg/hr and 800 kg/hr.

4. A method according to any one of claims 1 to 3 wherein the porous particulate support is dehydrated at an elevated temperature, and wherein the porous particulate support has an average particle size in the range of from 0.1 to 500 μm, or from 1 to 200 μm, or from 1 to 50 μm, or from 5 to 50 μm.

5. A method according to any one of claims 1 to 4 wherein the one or more activator compounds comprises an organometallic compound, an alumoxane or a neutral or ionic stoichiometric activator, or a methylalumoxane or a modified methylalumoxane.

6. A method according to any one of claims 1 to 3 wherein the liquid diluent comprises (i) an aliphatic or aromatic hydrocarbon or (ii) toluene, and wherein the one or more catalyst compounds comprises a titanium, a zirconium or a hafnium atom.

7. A method according to any one of claims 1 to 6 wherein a suspension in toluene liquid diluent of particulate silica, methylalumoxane, and one or more catalyst compounds is spray dried at a rate sufficient to produce at least 200 kg of supported catalyst composition in a time of 5 hours or less and having a toluene content of 7% by weight or less, where spray drying the suspension to form the supported catalyst composition includes proving the suspension a residence time of 5 seconds to 60 seconds in a drying chamber.

8. A supported catalyst composition formed by a method according to claim 1, wherein the supported catalyst composition has a residual liquid content after spray drying of 10% by weight or less, or 7% by weight or less, or 5% by weight or less, or 4% by weight or less, or 3% by weight or less, or 2% by weight or less and wherein the porous particulate support is dehydrated at an elevated temperature, and wherein the porous particulate support has an average particle size in the range of from 0.1 to 500 μm, or from 1 to 200 μm, or from 1 to 50 μm, or from 5 to 50 μm.

9. A process for polymerizing olefins, the process comprising:
contacting olefins with one or more supported catalyst compositions prepared by a method according to claim 1 in a reactor under polymerization conditions to produce an olefin polymer or copolymer, wherein the supported catalyst composition has a residual liquid content after spray drying of 10% by weight or less, or 7% by weight or less, or 5% by weight or less, or 4% by weight or less, or 3% by weight or less, or 2% by weight or less and wherein the porous particulate support is dehydrated at an elevated temperature, and wherein the porous particulate support has an average particle size in the range of from 0.1 to 500 μm, or from 1 to 200 μm, or from 1 to 50 μm, or from 5 to 50 μm.