FLUORINATED CATALYST SUPPORTS AND CATALYST SYSTEMS

BACKGROUND

[0001] A number of catalyst compositions containing single site catalysts have been used to prepare polyolefins, producing relatively homogeneous copolymers at good polymerization rates. In contrast to traditional Ziegler-Natta catalyst compositions, single site catalyst compositions, such as metallocene catalysts, are catalytic compounds in which each catalyst particle contains one or only a few types of polymerization sites.

[0002] To achieve acceptable and economically viable polymerization activities with single site catalyst systems, a large amount of activator such as methylaluminoxane ("MAO") is often required. Such activators are often expensive and the large amount of activator required to produce an active single site catalyst for polymerization has been a substantial impediment to the commercialization of single site catalysts for polyolefin production.

SUMMARY

[0003] An exemplary embodiment described herein provides a method for making a catalyst support. The method includes forming a mixture of a support material and a fluoride donor. The mixture is added to a fluidized bed reactor. The mixture is fluidized to form a fluidized bed while maintaining a ratio of a pressure drop across a distributor plate to a pressure drop across the fluidized bed of greater than about 7 %. The mixture is calcined to decompose the fluoride donor, forming a fluorinated support.

[0003a] In one aspect, there is provided a method for making a fluorinated catalyst support, comprising:

forming a mixture of a support material that can be fluorinated and a fluoride donor;

adding the mixture to a fluidized bed reactor;

fluidizing the mixture in the fluidized bed reactor with a fluidizing gas while maintaining a ratio of a pressure drop across a distributor plate to a pressure drop across the fluidized bed of greater than about 7 %; and

calcining the mixture to decompose the fluoride donor to form the fluorinated catalyst support.

[0004] Another exemplary embodiment described herein provides a catalyst system. The catalyst system includes a catalyst compound, a fluorinated support, and an aluminoxane compound. The fluorinated support is generated by heating a catalyst support and a fluoride donor compound at a temperature sufficient to decompose the fluoride donor compound in a fluidized bed reactor while maintaining a ratio of a pressure drop across a distributor plate to a

pressure drop across the fluidized bed of greater than about 7 %. The aluminoxane is present in an amount of about 10 mmol or less per gram of the support.

[0004a] In another aspect, there is provided a method of forming a catalyst system, comprising combining a catalyst compound with a fluorinated catalyst support as defined herein, and an aluminoxane, wherein the aluminoxane is present in an amount of about 10 mmol or less per gram of the fluorinated catalyst support.

[0004b] In another aspect, there is provided a method of forming a catalyst system, comprising:

combining a catalyst compound and an aluminoxane to produce a first mixture; and

adding a fluorinated catalyst support as defined herein to the first mixture and drying to produce a catalyst system.

[0004c] In another aspect, there is provided a catalyst system, comprising:

a catalyst compound;

a support comprising a fluorinated support, wherein the fluorinated support is generated by heating a catalyst support that can be fluorinated and a fluoride donor compound, wherein the catalyst support includes alumina and the fluoride donor compound is ammonium hexafluorosilicate, fluorine, hydrofluoric acid, ammonium fluoride, ammonium bifluoride, ammonium tetrafluoroborate, ammonium hexafluorophosphate, ammonium heptafluorotantalate(V), ammonium hexafluorogermanate(IV), ammonium hexafluorotitanate(IV), ammonium hexafluorozirconate, aluminum fluoride, sodium hexafluoroaluminate, molybdenum(VI) fluoride, bromine pentafluoride, nitrogen trifluoride, difluoroamine, perfluorohexane, hexafluorobenzene, fluoromethane, trifluoroethanol, freons, derivatives thereof, or any combination thereof, at a temperature sufficient to decompose the fluoride donor compound in a fluidized bed reactor with a fluidizing gas, to provide a fluidized bed while maintaining a ratio of a pressure drop across a distributor plate to a pressure drop across a fluidized bed of greater than about 7 %; and

an aluminoxane, wherein the aluminoxane is present in an amount of about 10 mmol or less per gram of the support.

DESCRIPTION OF THE DRAWINGS

[0005] The advantages of the present techniques are better understood by referring to the following detailed description and the attached drawings, in which:

[0006] Figure 1 is a simplified process flow diagram of a catalyst activator system that may be used in embodiments;

[0007] Figure 2 is a simplified process flow diagram of another catalyst activator that may be used in embodiments;

combining a catalyst compound and an aluminoxane to produce a first mixture; and

adding a fluorinated catalyst support of any one of claims 1-9 to the first mixture and drying to produce a catalyst system.

12. A catalyst system, comprising:

a catalyst compound;

a support comprising a fluorinated support, wherein the fluorinated support is generated by heating a catalyst support that can be fluorinated and a fluoride donor compound, wherein the catalyst support includes alumina and the fluoride donor compound is ammonium hexafluorosilicate, fluorine, hydrofluoric acid, ammonium fluoride, ammonium bifluoride, ammonium tetrafluoroborate, ammonium hexafluorophosphate, ammonium heptafluorotantalate(V), ammonium hexafluorogermanate(IV), ammonium hexafluorotitanate(IV), ammonium hexafluorozirconate, aluminum fluoride, sodium hexafluoroaluminate, molybdenum(VI) fluoride, bromine pentafluoride, nitrogen trifluoride, difluoroamine, perfluorohexane, hexafluorobenzene, fluoromethane, trifluoroethanol, freons, derivatives thereof, or any combination thereof, at a temperature sufficient to decompose the fluoride donor compound in a fluidized bed reactor with a fluidizing gas, to provide a fluidized bed while maintaining a ratio of a pressure drop across a distributor plate to a pressure drop across a fluidized bed of greater than about 7 %; and

an aluminoxane, wherein the aluminoxane is present in an amount of about 10 mmol or less per gram of the support.

13. The catalyst system of claim 12, wherein a fluidized bed reactor with a height to depth ratio of a fluidized bed of at least about 2.3.

14. The catalyst system of claim 12, wherein a flow rate of a fluidizing gas greater than about 0.35 ft. / sec is maintained at temperatures greater than about 370 °C.

15. The catalyst system of claim 12, wherein a flow rate of a fluidizing gas of about 0.1 ft. / sec is maintained at temperatures less than about 370 °C.

16. The catalyst system of claim 12, wherein a flow rate of a fluidizing gas is increased from about 0.1 ft. / sec. to about 0.4 ft./ sec starting at a temperature of between about 350 °C and about 370 °C.

17. The catalyst system of claim 12, wherein the support has a fluoride concentration ranging from about 1 wt. % to about 10 wt. %, based on a weight of the support and an alumina concentration ranging from about 3 wt. % to about 40 wt. % based on the weight of the support; or