TWO ATOM BRIDGED DICARBONATE COMPOUNDS AS INTERNAL DONORS IN CATALYSTS FOR POLYPROPYLENE MANUFACTURE

This application is a non-provisional application claiming priority from the U.S. Provisional Patent Application No. 61/265,931, filed on December 2, 2009, entitled "TWO ATOM BRIDGED DICARBONATE COMPOUNDS AS INTERNAL DONORS IN CATALYSTS FOR POLYPROPYLENE MANUFACTURE," the teachings of which are incorporated by reference herein, as if reproduced in full hereinbelow.

This invention relates to components useful in propylene polymerization catalysts, and particularly relates to electron donor components used in combination with magnesium-containing supported titanium-containing catalyst components.

BACKGROUND AND SUMMARY ~~OF THE INVENTION~~

Use of solid, transition metal-based, olefin polymerization catalyst components is well known in the art including such solid components supported on a metal oxide, halide or other salt such as widely-described magnesium-containing, titanium halide-based catalyst components. Such catalyst components are commonly referred to as "supported". Although many polymerization and copolymerization processes and catalyst systems have been described for polymerizing or copolymerizing alpha-olefins, it is advantageous to tailor a process and catalyst system to obtain a specific set of properties of a resulting polymer or copolymer product. For example, in certain applications, a combination of acceptably high activity, good morphology, desired particle size distribution, acceptable bulk density, and the like are required together with polymer characteristics such as stereospecificity, molecular weight distribution, and the like.

Typically, supported catalyst components useful for polymerizing propylene and higher alpha-olefins, as well as for polymerizing propylene and higher olefins with minor amounts of ethylene and other alpha-olefins contain an internal electron donor component. Such internal electron donor is an integral part of the solid supported catalyst component and is distinguished from an external electron donor component, which together with an aluminum alkyl component, typically comprises the catalyst system. While the internal electron donor is an integral part of the solid supported component, the external electron donor may be combined with the solid supported component shortly before the combination is contacted with an olefin monomer or in the presence of olefin monomer. The external

The ~~invention~~disclosure described relates to use of an internal modifier (internal electron donor) in a propylene polymerization catalyst component, which contains at least two carbonate functionalities.

In a first aspect, there is provided a solid, hydrocarbon-insoluble, catalyst component useful in polymerizing olefins, said catalyst component containing magnesium, titanium, and halogen, and further containing an internal electron donor having a structure:

$[R_1\text{-O-C(O)-O-}]_xR_2$

wherein R_1 is independently at each occurrence, an aliphatic or aromatic hydrocarbon, or substituted hydrocarbon group containing from 1 to 20 carbon atoms; x is 2-4; and R_2 is an aliphatic or aromatic hydrocarbon, or substituted hydrocarbon group containing from 1 to 20 carbon atoms, provided that there are 2 atoms in the shortest chain connecting a first R_1-O-C(O)-O- group and a second R_1-O-C(O)-O- group, wherein said substituted hydrocarbon group, at each occurrence, means a hydrocarbyl group that is substituted with one or more nonhydrocarbyl substituent groups selected from the group consisting of a heteroatom, a hydrocarbyl group substituted with one or more halogen atoms and a silicon-containing hydrocarbyl group.

Accordingly, one embodiment of the ~~invention~~disclosure is a solid, hydrocarbon-insoluble, catalyst component useful in polymerizing olefins, said catalyst component containing magnesium, titanium, and halogen, and further containing an internal electron donor comprising a compound having a structure:

$$[R_1\text{-O-C(O)-O-}]_xR_2$$

wherein R_1 is independently at each occurrence, an aliphatic or aromatic hydrocarbon, or substituted hydrocarbon group containing from 1 to 20 carbon atoms; x is 2-4; and R_2 is an aliphatic or aromatic hydrocarbon, or substituted hydrocarbon group containing from 1 to 20 carbon atoms, provided that there are 2 atoms in the shortest chain connecting a first R_1-O-C(O)-O- group and a second R_1-O-C(O)-O- group.

In a second aspect, there is provided a method of polymerizing an olefin comprising contacting the olefin with a catalyst component containing magnesium, titanium, and halogen, and further containing an internal electron donor having a structure:

$[R_1\text{-O-C(O)-O-}]_xR_2$

wherein R_1 is independently at each occurrence, an aliphatic or aromatic hydrocarbon, or substituted hydrocarbon group containing from 1 to 20 carbon atoms; x is 2-4; and R_2 is an aliphatic or aromatic hydrocarbon, or substituted hydrocarbon group containing from 1 to 20 carbon atoms, provided that there are 2 atoms in the shortest chain connecting a first R_1-O-C(O)-O- group and a second R_1-O-C(O)-O- group, wherein said substituted hydrocarbon group, at each occurrence, means a hydrocarbyl group that is substituted with one or more nonhydrocarbyl substituent groups selected from the group consisting of a heteroatom, a hydrocarbyl group substituted with one or more halogen atoms and a silicon-containing hydrocarbyl group.

In a third aspect, there is provided a method of polymerizing an olefin comprising contacting the olefin with a catalyst component as defined above.

DETAILED DESCRIPTION OF THE INVENTION

DEFINITIONS

All references to the Periodic Table of the Elements herein shall refer to the Periodic Table of the Elements, published and copyrighted by CRC Press, Inc., 2003. Also, any references to a Group or Groups shall be to the Groups or Groups reflected in this Periodic Table of the Elements using the IUPAC system for numbering groups. Unless stated to the contrary, implicit from the context, or customary in the art, all parts and percents are based on weight. For purposes of United States patent practice, the contents of any patent, patent application, or publication referenced herein are hereby incorporated by reference in their entirety (or the equivalent US version thereof is so incorporated by reference), especially with respect to the disclosure of synthetic techniques, definitions (to the extent not inconsistent with any definitions provided herein) and general knowledge in the art.

The term "comprising," and derivatives thereof, is not intended to exclude the presence of any additional component, step or procedure, whether or not the same is disclosed herein. In order to avoid any doubt, all compositions claimed herein through use of the term "comprising" may include any additional additive, adjuvant, or compound whether polymeric or otherwise, unless stated to the contrary. In contrast, the term, "consisting essentially of" excludes from the scope of any succeeding recitation any other component, step or procedure, excepting those that are not essential to operability. The term

WHAT IS CLAIMED IS:

1. A solid, hydrocarbon-insoluble, catalyst component useful in polymerizing olefins, said catalyst component containing magnesium, titanium, and halogen, and further containing an internal electron donor having a structure:

$[R_1\text{-}O\text{-}C(O)\text{-}O\text{-}]_xR_2$

wherein R_1 is independently at each occurrence, an aliphatic or aromatic hydrocarbon, or substituted hydrocarbon group containing from 1 to 20 carbon atoms; x is 2-4; and R_2 is an aliphatic or aromatic hydrocarbon, or substituted hydrocarbon group containing from 1 to 20 carbon atoms, provided that there are 2 atoms in the shortest chain connecting a first R_1-O-C(O)-O- group and a second R_1-O-C(O)-O- group, wherein said substituted hydrocarbon group, at each occurrence, means a hydrocarbyl group that is substituted with one or more nonhydrocarbyl substituent groups selected from the group consisting of a heteroatom, a hydrocarbyl group substituted with one or more halogen atoms and a silicon-containing hydrocarbyl group.

2. The catalyst component of claim 1 where each R_1 is an aliphatic hydrocarbon.

3. The catalyst component of claim 1 where each R_1 is an aromatic hydrocarbon.

4. The catalyst component of claim 1 where R_2 is a 1,2-substituted phenyl moiety.

5. The catalyst component of claim 1 where R_2 is a 1,2- or 3,4-substituted naphthyl moiety.

6. The catalyst component of claim 1 where R_2 is an straight or branched alkyl moiety, provided that there are 2 atoms in the shortest chain connecting a first R_1-O-C(O)-O- group and a second R_1-O-C(O)-O- group.

7. The catalyst component of claims 4-6 where each R_1 is an aliphatic or aromatic hydrocarbon group.

8. The catalyst component of claims 4-6 where each R_1 is ethyl, or phenyl.

9. The catalyst component of claim 1 where the internal electron donor comprises one of the following compounds: 5-tert-butyl-3-methyl-1,2-phenylene diethyl dicarbonate, 5-tert-butyl-3-methyl-1,2-phenylene diphenyl dicarbonate, or 3,5-diisopropyl-1,2-phenylene diethyl dicarbonate.

10. The catalyst component of any of the claims 1-9 which is optionally combined with a single component SCA, a mixed component SCA, or an activity limiting agent.

11. The catalyst component of claim 10 where the mixed component SCA contains an activity limiting agent or an organic ester as a component.

12. The catalyst component of claim 11 which is optionally combined with an organoaluminum compound.

13. A method of polymerizing an olefin comprising contacting the olefin with a catalyst component containing magnesium, titanium, and halogen, and further containing an internal electron donor having a structure:

$[R_1\text{-}O\text{-}C(O)\text{-}O\text{-}]_xR_2$

wherein R_1 is independently at each occurrence, an aliphatic or aromatic hydrocarbon, or substituted hydrocarbon group containing from 1 to 20 carbon atoms; x is 2-4; and R_2 is an aliphatic or aromatic hydrocarbon, or substituted hydrocarbon group containing from 1 to 20 carbon atoms, provided that there are 2 atoms in the shortest chain connecting a first R_1-O-C(O)-O- group and a second R_1-O-C(O)-O- group, wherein said substituted hydrocarbon group, at each occurrence, means a hydrocarbyl group that is substituted with one or more nonhydrocarbyl substituent groups selected from the group consisting of a heteroatom, a hydrocarbyl group substituted with one or more halogen atoms and a silicon-containing hydrocarbyl group.

14. A method of polymerizing an olefin comprising contacting the olefin with a catalyst component of any of the claims 2-12.