controlling the shape of a solid titanium catalyst component for producing a propylene block polymer.

Citation List

Patent Literature

[0006]

PTL 1

Japanese Patent Application Laid-Open No. 2017-132870

PTL 2

Japanese Patent Application Laid-Open No. 2002-356507

Summary ~~of Invention~~

Technical Problem

[0007] However, when a propylene block copolymer was produced by the method described in PTL 1, adhesion to the inner wall of a polymerizer could not sufficiently be suppressed.

[0008] Although PTL 2 discloses that a propylene block copolymer having high flowability despite a high rubber content can be provided, calculations based on the experimental data have suggested that the rubber component in propylene block copolymers with high rubber contents disclosed in Examples is a rubber component that has a relatively low ethylene unit content (that is relatively hard and less easily flows).

[0009] The present ~~invention~~ disclosure has been made in view of the above-described problems of the related art, and an object thereof is to provide a propylene block copolymer whose adhesion to the inner wall of a polymerizer can be sufficiently suppressed, a method for producing the propylene block copolymer, and a solid titanium catalyst component for producing the propylene block copolymer. Preferably, the propylene block copolymer is a

pore distribution index of 2 or more,

the first pore distribution index being represented by formula I:

First pore distribution index = x/y...(I)

where x is a cumulative pore volume of pores with a size of 0.001 to 0.1 μm, and y is a cumulative pore volume of pores with a size of 0.1 to 1.0 μm, the cumulative pore volumes being measured with a mercury porosimeter,

a titanium compound represented by formula IV:

$Ti(OR)_gX_{4-g}$...(IV)

where R is a hydrocarbon group, X is a halogen atom, and g is an integer satisfying $0 \leq g \leq 4$, and

an electron donor

into contact with each other; and

a second polymerization step of polymerizing the crystalline propylene (co)polymer prepared in the first polymerization step and a raw material of a polymer selected from the group consisting of rubber components, amorphous or low-crystallinity ethylene·propylene copolymers (EPR), and amorphous ethylene·α-olefin copolymers.

[4a] In one aspect, the present disclosure provides a method for producing a propylene block copolymer, the method comprising:

a first polymerization step of preparing a crystalline propylene (co)polymer by polymerizing propylene and an optional α-olefin in the presence of a solid titanium catalyst component (i) produced by bringing

a solid compound (S) containing a magnesium compound (II-0) and having a first pore distribution index of 2 or more and a second pore distribution index of more than 0.5,

the first pore distribution index being represented by formula I:

First pore distribution index = x/y...(I)

where x is a cumulative pore volume of pores with a size of 0.001 to 0.1 μm, and y is a cumulative pore volume of pores with a size of 0.1 to 1.0 μm, the cumulative pore

volumes being measured with a mercury porosimeter,

the second pore distribution index being represented by formula I':

Second pore distribution index = xα/xβ...(I')

where xα is a cumulative pore volume of pores with a size of 0.01 to 0.1 μm, and xβ is a cumulative pore volume of pores with a size of 0.001 to 1.0 μm, the cumulative pore volumes being measured with a mercury porosimeter,

a titanium compound represented by formula IV:

$Ti(OR)_gX_{4-g}$...(IV)

where R is a hydrocarbon group, X is a halogen atom, and g is an integer satisfying $0 \leq g \leq 4$, and

an electron donor

into contact with each other; and

a second polymerization step of polymerizing the crystalline propylene (co)polymer prepared in the first polymerization step and a raw material of a polymer selected from the group consisting of rubber components, amorphous or low-crystallinity ethylene·propylene copolymers (EPR), and amorphous ethylene·α-olefin copolymers.

[5] The method for producing a propylene block copolymer according to [4], wherein the first polymerization step and the second polymerization step are both performed in the presence of hydrogen.

[6] The method for producing a propylene block copolymer according to [4] or [5], wherein the magnesium compound (II-0) is a solid complex compound represented by formula II:

$MgX_aRs_b \cdot (RtOH)_m$...(II)

where X is a halogen atom, Rs is a heteroatom-containing hydrocarbon group, Rt is a hydrocarbon group optionally containing a heteroatom, m is a real number satisfying $2.0 \leq m \leq 3.3$, a is an integer satisfying $0 \leq a \leq 2$, b is an integer satisfying $0 \leq b \leq 2$, and a plus

b is 2,

provided that when a is 0 in formula II, g is not 4 in formula IV.

[7] A solid titanium catalyst component produced by bringing

a solid compound (S) containing a magnesium compound (II-0) and having a first pore distribution index of 2 or more,

the first pore distribution index being represented by formula I:

First pore distribution index = x/y...(I)

where x is a cumulative pore volume of pores with a size of 0.001 to 0.1 μm, and y is a cumulative pore volume of pores with a size of 0.1 to 1.0 μm, the cumulative pore volumes being measured with a mercury porosimeter,

a titanium compound represented by formula IV:

$Ti(OR)_gX_{4-g}$...(IV)

where R is a hydrocarbon group, X is a halogen atom, and g is an integer satisfying $0 \leq g \leq 4$, and

an electron donor

into contact with each other.

[7a] In another aspect, the present disclosure provides a solid titanium catalyst component produced by bringing

a solid compound (S) containing a magnesium compound (II-0) and having a first pore distribution index of 2 or more and a second pore distribution index of more than 0.5,

the first pore distribution index being represented by formula I:

First pore distribution index = x/y...(I)

where x is a cumulative pore volume of pores with a size of 0.001 to 0.1 μm, and y is a cumulative pore volume of pores with a size of 0.1 to 1.0 μm, the cumulative pore volumes being measured with a mercury porosimeter,

the second pore distribution index being represented by formula I':

Second pore distribution index = xα/xβ...(I')

where xα is a cumulative pore volume of pores with a size of 0.01 to 0.1 μm, and xβ is a cumulative pore volume of pores with a size of 0.001 to 1.0 μm, the cumulative pore volumes being measured with a mercury porosimeter,

a titanium compound represented by formula IV:

$Ti(OR)_gX_{4-g}$...(IV)

where R is a hydrocarbon group, X is a halogen atom, and g is an integer satisfying $0 \leq g \leq 4$, and

an electron donor

into contact with each other.

Advantageous Effects of ~~Invention~~Disclosure

[0011] According to the present ~~invention~~disclosure, a propylene block copolymer whose adhesion to the inner wall of a polymerizer can be sufficiently suppressed and a method for producing the propylene block copolymer are provided.

Brief Description of Drawings

[0012]

FIG. 1 is a schematic view of a funnel used to obtain the evaluated flowability value of a propylene block copolymer of the present invention.

CLAIMS

~~Claim 1 A propylene block copolymer having an evaluated flowability value of 40% or less,~~

~~the evaluated flowability value being calculated by the following formula:~~

~~Evaluated flowability value (%) = {(Y/X) - 1} × 100~~

~~where X (sec) is the number of seconds required for 100 g of the copolymer at normal temperature to fall through a stainless steel funnel having an inner diameter of 11.9 mm, and~~

~~Y (sec) is the number of seconds required for 100 g of the copolymer after being held at 80°C for 24 hours under a load of 10 kg to fall through the funnel having an inner diameter of 11.9 mm.~~

~~Claim 2 The propylene block copolymer according to claim 1, wherein a Dsol content relative to 100mass% of a total amount of a component soluble in n-decane at 23°C (Dsol) and a component insoluble in n-decane at 23°C (Dinsol) is 30mass% or more and 40mass% or less.~~

~~Claim 3 The propylene block copolymer according to claim 2, wherein the Dsol has an ethylene unit content of 36.0mol% or more.~~

Claim 1~~4~~ ~~(Amended)~~ A method for producing a propylene block copolymer, the method comprising:

a first polymerization step of preparing a crystalline propylene (co)polymer by polymerizing propylene and an optional α-olefin in the presence of a solid titanium catalyst component (i) produced by bringing

a solid compound (S) containing a magnesium compound (II-0) and having a first pore distribution index of 2 or more and a second pore distribution index of more than 0.5,

the first pore distribution index being represented by formula I:

First pore distribution index = x/y...(I)

where x is a cumulative pore volume of pores with a size of 0.001 to 0.1 μm, and y is a cumulative pore volume of pores with a size of 0.1 to 1.0 μm, the cumulative pore volumes being measured with a mercury porosimeter,

the second pore distribution index being represented by formula I':

Second pore distribution index = xα/xβ...(I')

where xα is a cumulative pore volume of pores with a size of 0.01 to 0.1 μm, and xβ is a cumulative pore volume of pores with a size of 0.001 to 1.0 μm, the cumulative pore volumes being measured with a mercury porosimeter,

a titanium compound represented by formula IV:

$Ti(OR)_gX_{4-g}$...(IV)

where R is a hydrocarbon group, X is a halogen atom, and g is an integer satisfying $0 \leq g \leq 4$, and

an electron donor

into contact with each other; and

a second polymerization step of polymerizing the crystalline propylene (co)polymer prepared in the first polymerization step and a raw material of a polymer selected from the group consisting of rubber components, amorphous or low-crystallinity ethylene·propylene copolymers (EPR), and amorphous ethylene·α-olefin copolymers.

Claim 2~~5~~ The method for producing a propylene block copolymer according to claim 1~~4~~, wherein the first polymerization step and the second polymerization step are both performed in the presence of hydrogen.

Claim 3~~6~~ The method for producing a propylene block copolymer according to claim 1~~4~~ ~~or 5~~, wherein the magnesium compound (II-0) is a solid complex compound represented by formula II:

$MgX_aRs_b \cdot (RtOH)_m$...(II)

where X is a halogen atom, Rs is a heteroatom-containing hydrocarbon group, Rt is a hydrocarbon group optionally containing a heteroatom, m is a real number satisfying 2.0

≤ m ≤ 3.3, a is an integer satisfying 0 ≤ a ≤ 2, b is an integer satisfying 0 ≤ b ≤ 2, and a plus b is 2,

provided that when a is 0 in formula II, g is not 4 in formula IV.

Claim 4~~7~~ ~~(Amended)~~ A solid titanium catalyst component produced by bringing

a solid compound (S) containing a magnesium compound (II-0) and having a first pore distribution index of 2 or more and a second pore distribution index of more than 0.5,

the first pore distribution index being represented by formula I:

First pore distribution index = x/y...(I)

where x is a cumulative pore volume of pores with a size of 0.001 to 0.1 μm, and y is a cumulative pore volume of pores with a size of 0.1 to 1.0 μm, the cumulative pore volumes being measured with a mercury porosimeter,

the second pore distribution index being represented by formula I':

Second pore distribution index = xα/xβ...(I')

where xα is a cumulative pore volume of pores with a size of 0.01 to 0.1 μm, and xβ is a cumulative pore volume of pores with a size of 0.001 to 1.0 μm, the cumulative pore volumes being measured with a mercury porosimeter,

a titanium compound represented by formula IV:

$Ti(OR)_gX_{4-g}$...(IV)

where R is a hydrocarbon group, X is a halogen atom, and g is an integer satisfying 0 ≤ g ≤ 4, and

an electron donor

into contact with each other.

Claim 5~~8~~ ~~(Added)~~ The method for producing a propylene block copolymer according to claim 1~~any one of claims 4 to 6~~, wherein the first pore distribution index is 2 or more and 12 or less.