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ning of each regular issue of the PCT Gazette.

(54) Title: PROPYLENE BASED RESIN COMPOSITION

(57) Abstract: Disclosed is a propylene based resin composition comprising 1 to 99% by weight of a specific propylene based polymer (A) and 99 to 1% by weight of an olefin based block copolymer (B) comprising specific polymer segments (B1), (B1') and (B2) (wherein the total amount of the propylene based polymer (A) and the olefin based block copolymer (B) is 100% by weight).



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DESCRIPTION
PROPYLENE BASED RESIN COMPOSITION

TECHNICAL FIELD

5 The present invention relates to a propylene based resin composition. More specifically, the invention relates to a propylene based resin composition which is suitably used in an extrusion molded product or inflation molded product such as a film, sheet and the like.

10

BACKGROUND ART

In the past, a method in which an elastomer such as an ethylene/propylene copolymer and an ethylene/butene copolymer is blended to a polypropylene resin as a
15 modifier for the purpose of improvement for impact resistance of the polypropylene resin, has been well used.

However, for many of molded articles of the polypropylene resin, heat resistance is pursued as well that no deformation or appearance change, etc. of a
20 molded article takes place even at high temperature, in addition to impact resistance. In addition, excellent transparency at high temperature is also pursued depending on use. With the conventional method wherein an elastomer is blended as a modifier, impact resistance

improved, but excellent heat resistance and transparency were difficult to obtain.

In addition, for example, in manufacturing a soft resin composition which comprises a polypropylene resin,
5 a large amount of rubber may be blended to the polypropylene resin.

However, with just blending the elastomer such as the ethylene/propylene copolymer and the ethylene/butene copolymer in a large amount, which is publicly-known in
10 the past, excellent rubber elasticity was not obtained, and further there is room for improvement in terms of heat resistance.

In relation to this, Patent Document 1 discloses a propylene based resin composition which comprises a
15 polypropylene resin, a specific block copolymer, an ethylene copolymer and an inorganic filler, in order to obtain a propylene based resin composition which is excellent in balance between rigidity and tensile elongation at break, and in balance between rigidity and
20 impact resistance.

However, with the composition described in Patent Document 1, excellent transparency was not obtained, and heat resistance was not also sufficient. In addition, a soft resin was not disclosed.

[Patent Document 1] JP-A No. 2004-204057

DISCLOSURE OF the INVENTION

An object of the present invention is to provide a
5 propylene based resin composition which is excellent in
impact resistance and heat resistance. In addition,
another object of the present invention is to provide a
propylene based resin composition which is excellent in
transparency as well as in impact resistance and heat
10 resistance, and further which has hardly appearance
change even at high temperature. In addition, a further
another object of the present invention is to provide a
composition which is excellent in flexibility and rubber
elasticity as well as in heat resistance.

15 The present inventors have studied extensively to
solve above problems, and as a result, have found that a
propylene based resin composition comprising a specific
propylene based polymer (A) and a specific olefin based
block copolymer (B) comprising polymer segments (B1),
20 (B1') and (B2), is excellent in impact resistance and
heat resistance.

The propylene based resin composition according to
the invention comprises:

[A] 1 to 99% by weight of a propylene based polymer

(A) (i) having a melt flow rate (MFR: 230°C and a load of 2.16 kg) of 0.1 to 400 g/10 min, (ii) containing 0.01 to 30% by weight of the component soluble in n-decane at normal temperature having an intrinsic viscosity $[\eta]$, as measured in decalin at 135°C, of 0.2 to 10 dl/g, and (iii) having pentad isotacticity (I_5), as determined by ^{13}C -NMR spectra analysis of the component insoluble in n-decane at normal temperature, of 0.95 or more; and

[B] 99 to 1% by weight of an olefin based block copolymer (B) comprising polymer segments (B1), (B1') and (B2) in which the polymer segments (B1) and (B1') are each independently a polymer of at least one monomer selected from the group consisting of ethylene and α -olefin having 3 to 20 carbon atoms and are each independently a polymer segment of an ethylene based polymer having (i) the ethylene content of 95 to 100 mol% and (ii) a weight average molecular weight (M_w), as measured by high temperature GPC, of 2,000 to 100,000; and in which the polymer segment (B2) is a copolymer of ethylene and at least one selected from an α -olefin having 3 to 20 carbon atoms and is a polymer segment of an ethylene/ α -olefin copolymer having (iii) the ethylene content of 50 to 80 mol% and (iv) a weight average molecular weight (M_w), as measured by high temperature

GPC, of 10,000 to 300,000,

which olefin block copolymer is a block copolymer comprising a linear

triblock structure of (B1)-(B2)-(B1') and has (v) a peak
5 assigned to $\beta\beta$ methylene in its ^{13}C -NMR spectrum, (vi) a
glass transition temperature (T_g), as measured by
differential scanning calorimeter (DSC), of -50°C or less,
(vii) an endothermic peak assigned to a melting point
(T_m) of 105°C or more as measured by DSC, (viii) a
10 endothermic enthalpy, as determined from a melting peak
area, as measured by DSC, in the range of 20 to 60 J/g,
(ix) a density of 0.870 to 0.910 g/cm³, (x) a melt flow
rate (MFR: 190°C and a load of 2.16 kg) in the range of
0.3 to 50 g/10 min, and (xi) a ratio ($(G'_{50^\circ\text{C}}) / (G'_{100^\circ\text{C}})$)
15 of a storage elastic modulus at room temperature ($G'_{50^\circ\text{C}}$)
to a storage elastic modulus at 100°C ($G'_{100^\circ\text{C}}$), as
determined by solid viscoelasticity measurements, of 1.0
to 2.0 (wherein the total amount of the propylene based
polymer (A) and the olefin based block copolymer (B) is
20 100% by weight). Further, the resin composition is
sometimes referred to as the "first composition".

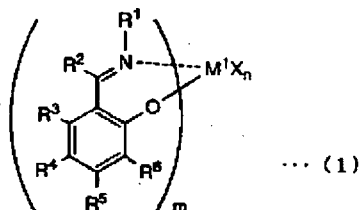
In addition, the propylene based resin composition
according to the invention preferably comprises 40 to 99%
by weight of the propylene based polymer (A) and 60 to 1%

by weight of the olefin based block copolymer (B)

(wherein the total amount of the propylene based polymer (A) and the olefin based block copolymer (B) is 100% by weight), and does not substantially contain an inorganic
5 filler (D).

In addition, the propylene based resin composition according to the invention preferably comprises 1% by weight or more and less than 40% by weight of the propylene based polymer (A) and more than 60% by weight
10 and 99% by weight or less of the olefin block copolymer (B) (wherein the total amount of the propylene based polymer (A) and the olefin based block copolymer (B) is 100% by weight).

The polymer segments (B1), (B1') and (B2) are
15 preferably obtained by polymerization in the presence of a catalyst for olefin polymerization comprising a transition metal compound represented by the following formula (1):



20 wherein M¹ represents a transition metal atom selected from Groups 4 to 5 of the Periodic Table, m represents 1

or 2, R^1 represents an aromatic hydrocarbon group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group wherein in the case that R^1 is a phenyl group, it has at least one substituent which is selected from

5 heteroatoms and heteroatom-containing groups in at least one position of Positions 2 and 6, or it has at least one substituent which is selected from a heteroatom excluding a fluorine atom, a fluorine-containing group which contains one carbon atom and two or less fluorine atoms,

10 a fluorine-containing group which contains two or more carbon atoms and a group which contains a heteroatom excluding a fluorine atom, in at least one position of Positions 3 to 5, when the location of the carbon atom which is bonded to the nitrogen is taken as Position 1,

15 and in the case that R^1 is an aromatic hydrocarbon group other than a phenyl group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group, it has at least one substituent which is selected from heteroatoms and heteroatom-containing groups, R^2 to R^5 represent

20 independently a hydrogen atom, a halogen atom, a halogen-containing group, a hydrocarbon group, a hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group or a sulfur-containing group, which may be the same or different from each other, R^6

represents a halogen atom, a halogen-containing group, a hydrocarbon group or a hydrocarbon-substituted silyl group, n is a number which satisfies the valence of M, X represents an oxygen atom, a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and in the case that n is 2 or more, the plural groups represented by X may be the same or different from each other, and may be bonded to each other to form a ring.

15 The molded product according to the invention preferably comprises the above-mentioned propylene based resin composition.

In addition, the above-mentioned molded product is preferably the extrusion molded product or inflation
20 molded product, and the molded product is preferably the film or sheet.

In addition, the above-mentioned molded product is more preferably the molded product for medical use or molded product for food packaging.

The propylene based resin composition according to the invention ("second composition") comprises:

[A] 1 to 99% by weight of a propylene based polymer

(A) (i) having a melt flow rate (MFR: 230°C and a load of
5 2.16 kg) of 0.1 to 400 g/10 min, (ii) containing 0.01 to
30% by weight of the component soluble in n-decane at
normal temperature having an intrinsic viscosity $[\eta]$, as
measured in decalin at 135°C, of 0.2 to 10 dl/g, and
(iii) having pentad isotacticity (I_5), as determined by
10 ^{13}C -NMR spectra analysis of the component insoluble in n-
decane at normal temperature, of 0.95 or more; and

[BB] 99 to 1% by weight of an olefin based block
copolymer (BB) comprising polymer segments (B1), (B1')
and (B2) in which the polymer segments (B1) and (B1') are
15 each independently a polymer of at least one monomer
selected from the group consisting of ethylene and α -
olefin having 3 to 20 carbon atoms and are each
independently a polymer segment of an ethylene based
polymer having (i) the ethylene content of 95 to 100 mol%
20 and (ii) a weight average molecular weight (M_w), as
measured by high temperature GPC, of 2,000 to 100,000;
and in which the polymer segment (B2) is a copolymer of
ethylene and at least one selected from an α -olefin
having 3 to 20 carbon atoms and is a polymer segment of

an ethylene/ α -olefin copolymer having (iii) the ethylene content of 50 to 80 mol% and (iv) a weight average molecular weight (M_w), as measured by high temperature GPC, of 10,000 to 300,000,

5 which olefin block copolymer has (v) a peak assigned to $\beta\beta$ methylene in its ^{13}C -NMR spectrum, (vi) a glass transition temperature (T_g), as measured by differential scanning calorimeter (DSC), of -50°C or less, (vii) an endothermic peak assigned to a melting point (T_m) of
10 105 $^\circ\text{C}$ or more as measured by DSC, (viii) a endothermic enthalpy, as determined from a melting peak area, as measured by DSC, in the range of 20 to 60 J/g, (ix) a density of 0.870 to 0.910 g/cm³, (x) a melt flow rate (MFR: 190 $^\circ\text{C}$ and a load of 2.16 kg) in the range of 0.3 to
15 50 g/10 min, and (xi) a ratio ($(G'_{50^\circ\text{C}}) / (G'_{100^\circ\text{C}})$) of a storage elastic modulus at room temperature ($G'_{50^\circ\text{C}}$) to a storage elastic modulus at 100 $^\circ\text{C}$ ($G'_{100^\circ\text{C}}$), as determined by solid viscoelasticity measurements, of 1.0 to 2.0
(wherein the total amount of the propylene based polymer
20 (A) and the olefin based block copolymer (BB) is 100% by weight).

The molded product according to the invention preferably comprises the above-mentioned propylene based resin composition ("second composition").

EFFECTS OF the INVENTION

According to the propylene based resin compositions according to the invention, excellent impact resistance and heat resistance are obtained. In addition, according to the polypropylene resin compositions according to the invention, excellent transparency as well as impact resistance and heat resistance are obtained, and further which has hardly appearance change even at high temperature. In addition, according to the propylene based resin compositions according to the invention, excellent flexibility and rubber elasticity as well as heat resistance are obtained.

The above-mentioned propylene based resin compositions are suitably used in various molded products, and particularly, these compositions are suitably used in various uses as the extrusion molded product and the inflation molded product.

BEST Mode FOR CARRYING OUT the INVENTION

Hereinafter, the present invention will be specifically explained.

<Propylene based polymer (A)>

In the invention, a propylene based polymer (A) having the following properties is used. This propylene based polymer (A) may be any one of homopolypropylene, a propylene block copolymer and a propylene random
5 copolymer as long as if it has the following characteristics, but is preferably homopolypropylene or the propylene block copolymer.

A melt flow rate (MFR; ASTM D1238, 230°C and a load of 2.16 kg) of this propylene based polymer (A) is
10 preferably 0.1 to 400 g/10 min, preferably 0.1 to 200 g/10 min. If a MFR value is in the above-mentioned range, a propylene based resin composition is obtained which is excellent in fluidity, and makes it possible to mold a large product as well. If the MFR value is more than 400
15 g/10 min, impact resistance (IZ impact strength) of the molded product may be low.

The propylene based polymer (A) contains the component insoluble in n-decane at normal temperature (23°C) and the component soluble in n-decane at normal
20 temperature (23°C). The former is a high-crystalline polypropylene component (isotactic polypropylene) of the propylene polymer. The latter is a rubber component, and it is preferably an atactic polypropylene or ethylene/propylene polymer. When the propylene based

polymer (A) is propylene block copolymer, it is preferably formed from the high-crystalline polypropylene component (crystalline component) and the ethylene/propylene copolymer (rubber component).

5 The propylene based polymer (A) used in the invention desirably contains the component soluble in n-decane at normal temperature (rubber part) in an amount of 0.01 to 30% by weight, preferably 0.1 to 30% by weight and more preferably 0.1 to 20% by weight. In addition,
10 the propylene based polymer (A) desirably contains the component insoluble in n-decane at normal temperature (crystalline component) in an amount of 99.99 to 70% by weight, preferably 99.9 to 70% by weight and more preferably 99.9 to 80% by weight. If the content of the
15 component soluble in n-decane at normal temperature is less than 0.01% by weight, the improvement effect for impact resistance may not be exerted sufficiently, and on the other hand, if it is over 30% by weight, rigidity may not be sufficient.

20 An intrinsic viscosity $[\eta]$ of this component soluble in n-decane at normal temperature (135°C, measured in decalin) is preferably 0.2 to 10 dl/g, more preferably 0.2 to 8 dl/g.

The above-mentioned component soluble in n-decane at normal temperature desirably contains a unit derived from ethylene in an amount of 30 to 50 mol%, preferably 30 to 45 mol%.

5 The component soluble in n-decane at normal temperature of the propylene based polymer (A) may contain a unit derived from a polymerizable compound other than ethylene and propylene within a range where the object of the present invention is not damaged.

10 Specific examples of other polymerizable compounds include an α -olefin such as 1-butene, 1-pentene, 1-hexene, 1-heptene, 1-octene, 1-decene, 1-dodecene, 1-hexadecene and 4-methyl-1-pentene; a vinyl compound such as vinylcyclopentene, vinylcyclohexane and

15 vinylnorbornane; vinyl ester such as vinyl acetate; an unsaturated organic acid such as maleic anhydride or a derivative thereof and the like.

The content of the component soluble in n-decane at normal temperature of the propylene based polymer (A) is measured as follows. First, 5 g of the sample (propylene based polymer (A)) is soaked in 200 cc of boiling n-decane for 5 hours to be dissolved, and then cooled to room temperature (23°C). The precipitated solid phase is

filtered by a G4 glass filter. Then, it is calculated back from the solid phase weight measured as dried.

As described above, the component insoluble in n-decane at normal temperature is a high-crystalline polypropylene component (isotactic polypropylene) of the propylene based polymer (A). Pentad isotacticity (I_5) of the component insoluble in n-decane at normal temperature, which is determined by a ^{13}C -NMR method, is preferably 0.95 or more, more preferably 0.97 or more. If the pentad isotacticity (I_5) is in the above-mentioned range, the composition having excellent rigidity is obtained.

A pentad isotacticity (I_5) is an isotactic fraction at the pentad unit in the polypropylene molecule chain, which is measured by the ^{13}C -NMR method (magnetic nuclear resonance method) (A. Zambelli, et al., *Macromolecules* 6, 925 (1973)), a fraction of a propylene monomer unit where five propylene units are continuously and isotactically bonded.

Assignment of the peak in the NMR measurement as described above is performed based on description of *Macromolecules* 8, 687(1975). In addition, ^{13}C -NMR can improve the signal detection limit to 0.001 by accumulated measurements of 20000 times at 125 MHz of

frequency with the use of a Fourier transform NMR (500 MHz (in hydrogen measurement)) apparatus.

In addition, if the propylene based polymer (A) used in the invention contains a homopolymer or copolymer of
5 3-methyl-1-butene, 3,3-dimethyl-1-butene, 3-methyl-1-pentene, 3-methyl-1-hexene, 3,5,5-trimethyl-1-hexene, vinylcyclopentene, vinylcyclohexane and vinylbornane or the like, as a prepolymer which is formed, for example, by prepolymerization, the crystallization rate of the
10 propylene based polymer (A) is high.

The propylene based polymer (A) is manufactured by various methods, and for example, it can be manufactured with the use of a known stereoregular catalyst. Specifically, it is manufactured with the use of a
15 catalyst which is formed from a solid titanium catalyst component and an organic metal compound catalyst component, and further an electron donor, if necessary.

Specific examples of the above-mentioned solid titanium catalyst component includes a solid titanium
20 catalyst component wherein titanium trichloride or a titanium trichloride composition is supported on a support which has the specific surface area of 100 m²/g or more; a solid titanium catalyst component which contains magnesium, halogen, an electron donor

(preferably an aromatic carboxylic acid ester or alkyl group-containing ether) and titanium as an essential component, wherein these essential components are supported on a support which has the specific surface area of 100 m²/g or more. Among them, the latter solid titanium catalyst component is preferred.

The above-mentioned organic metal compound catalyst component is preferably an organic aluminum compound, and specific examples of the organic aluminum compound includes trialkylaluminum, dialkylaluminum halide, alkylaluminum sesquihalide, alkylaluminum dihalide and the like. Furthermore, this organic aluminum compound may be suitably selected depending on the kind of the titanium catalyst component to be used.

The above-mentioned electron donor includes, for example, an organic compound containing a nitrogen atom, a phosphorus atom, a sulfur atom, a silicon atom, a boron atom and the like, and specifically an ester compound, an ether compound or the like containing the atom as described above is suitably used.

Such catalyst may be further activated by a method such as co-grinding, and in addition, the above-mentioned olefin may be prepolymerized.

<Olefin based block copolymer (B)>

Next, an olefin based block copolymer (B) used in the invention will be explained. Herein, the block copolymer refers to a copolymer in a form that polymer chains (polymer segments), which are different in the primary structure of a polymer such as monomer species, comonomer species, comonomer composition, comonomer content, comonomer arrangement and stereoregularity, are linked in two or more kinds in one molecular chain. The olefin based block copolymer (B) used in the invention comprises polymer segments (B1) and (B1') of an ethylene based polymer, which are obtained by polymerizing at least one monomer selected from the group consisting of ethylene and α -olefin having 3 to 20 carbon atoms, and a polymer segment (B2) of an ethylene/ α -olefin copolymer, which are obtained by polymerizing ethylene and at least one selected from α -olefins having 3 to 20 carbon atoms. The above-mentioned polymer segments (B1) and (B1') may be the same or different from each other.

The polymer segments (B1) and (B1') of the ethylene based polymer may be an ethylene homopolymer, a homopolymer of a monomer selected from an α -olefin having 3 to 20 carbon atoms, or a copolymer obtained by polymerization of ethylene and one or two or more

monomers selected from an α -olefin having 3 to 20 carbon atoms.

The polymer segment (B2) of the ethylene/ α -olefin copolymer may be a copolymer obtained by polymerization
5 of ethylene and one selected from an α -olefin having 3 to 20 carbon atoms, or a copolymer obtained by polymerization of ethylene and two or more monomers selected from an α -olefin having 3 to 20 carbon atoms.

The α -olefin having 3 to 20 carbon atoms include,
10 for example, propylene, 1-butene, 1-pentene, 1-hexene, 3-methyl-1-butene, 3-methyl-1-pentene, 3-ethyl-1-pentene, 4-methyl-1-pentene, 4-methyl-1-hexene, 4,4-dimethyl-1-pentene, 4-ethyl-1-hexene, 1-octene, 3-ethyl-1-hexene, 1-octene, 1-decene, 1-dodecene, 1-tetradecene, 1-hexadecene,
15 1-octadecene, 1-eicocene and the like.

Among them, the above-mentioned polymer segments (B1) and (B1') are preferably the ethylene homopolymer or copolymer of ethylene and one selected from propylene, 1-butene, 1-hexene and 1-octene, more preferably the
20 ethylene homopolymer. The above-mentioned polymer segment (B2) is preferably a copolymer of ethylene and one selected from propylene, 1-butene, 1-hexene and 1-octene.

Hereinafter, the composition and the molecular weight of each polymer segment, and physical properties and a preparation method of the olefin based block copolymer (B) comprising these polymer segments will be specifically explained.

(i) Ethylene content of polymer segments (B1) and (B1')

The ethylene content of the polymer segments (B1) and (B1') is preferably 95 to 100 mol%, more preferably 97 to 100 mol%. If the ethylene content is less than 95 mol%, rigidity may be reduced when blended to the propylene polymer.

(ii) Molecular weight of polymer segments (B1) and (B1')

For the polymer segments (B1) and (B1'), a weight average molecular weight (in terms of polystyrene), as measured by high temperature GPC, is preferably in the range of 2,000 to 100,000, more preferably in the range of 5,000 to 80,000, and even more preferably in the range of 10,000 to 60,000.

(iii) Ethylene content of polymer segment (B2)

The ethylene content of the polymer segment (B2) is preferably 50 to 80 mol%, more preferably 55 to 70 mol%. If the ethylene content is less than 50 mol%, rigidity

may be reduced when blended to the propylene based polymer (A), and if it is more than 80 mol%, impact resistance may be largely reduced when blended to the propylene based polymer (A).

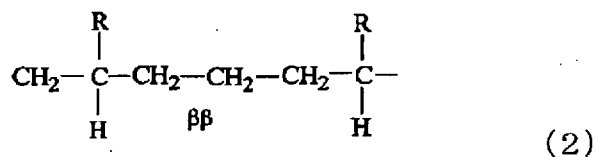
5 (iv) Molecular weight of polymer segment (B2)

For the polymer segment (B2), a weight average molecular weight (in terms of polystyrene) as measured by high temperature GPC is preferably in the range of 10,000 to 300,000, more preferably in the range of 50,000 to 10 250,000, and even more preferably in the range of 100,000 to 200,000.

(v) $\beta\beta$ methylene in olefin based block copolymer (B)

The olefin based block copolymer (B) has a peak which is assigned to $\beta\beta$ methylene in ^{13}C -NMR spectrum.

15 Herein, $\beta\beta$ methylene in ^{13}C -NMR spectrum means methylene carbon which is in a β -Position of two tertiary carbons as shown in the following formula (2):



^{13}C -NMR spectrum of the olefin based block copolymer 20 (B) is measured with the use of an NMR measurement apparatus (for example, JEOL-GX270 manufactured by JEOL, Ltd. and the like). The measurement is performed with

the use of a mixed solution of hexachlorobutadiene/ d_6 -benzene = 2/1 (volume ratio) which is adjusted to have 5% by weight of the sample concentration, on the base of 67.8 MHz, 25°C and d_6 -benzene (128 ppm). The measured ^{13}C -NMR spectrum is analyzed according to Analysis Chemistry, 43, p1245 (1971) by Lindemane Adams, Review Macromolecular Chemistry Physics, C29, 201 (1989) by JC Randall.

If the peak assigned to $\beta\beta$ methylene is not observed, it means molecular chain has a blocky segment of ethylene and α -olefin at high level. Therefore, it represents that distribution of ethylene and the α -olefin is not uniform, and the composition distribution is broad.

(vi) Glass transition temperature of olefin based block copolymer (B)

For the olefin based block copolymer (B), a glass transition temperature as measured by differential scanning calorimeter (DSC) is preferably -50°C or less, more preferably -55°C or less, and even more preferably -60°C or less.

(vii) Melting point of olefin based block copolymer (B)

For the olefin based block copolymer (B), an endothermic peak attributable to a melting point, as

measured by differential scanning calorimeter (DSC), is present at preferably 105°C or more, more preferably 110°C or more, and even more preferably 115°C or more.

(viii) Endothermic enthalpy of olefin based block copolymer (B)

For the olefin based block copolymer (B), an endothermic enthalpy, which is determined from a melting peak area as measured by differential scanning calorimeter (DSC), is preferably in the range of 20 to 80 J/g, more preferably in the range of 20 to 60 J/g, and even more preferably in the range of 30 to 50 J/g.

(ix) Density of olefin based block copolymer (B)

For the olefin based block copolymer (B), a density is preferably in the range of 0.870 to 0.910 g/cm³ and more preferably in the range of 0.875 to 0.900 g/cm³.

(x) Melt flow rate of olefin based block copolymer (B)

For the olefin based block copolymer (B), a melt flow rate (MFR; ASTM D1238, 190°C and a load of 2.16 kg) is preferably in the range of 0.3 to 50 g/10 min and more preferably in the range of 0.8 to 20 g/10 min.

(xi) Viscoelasticity behavior of olefin based block copolymer (B)

For the olefin based block copolymer (B), the ratio
($G'_{50}/G'_{100^{\circ}\text{C}}$) of a storage elastic modulus at room
temperature ($G'_{50^{\circ}\text{C}}$) to a storage elastic modulus at
100°C ($G'_{100^{\circ}\text{C}}$), as determined by solid viscoelasticity
5 measurement, is 1.0 to 2.0.

In addition, the olefin based block copolymer (B) is
an olefin block copolymer comprising the polymer segments
(B1) and (B1') and (B2). The structure that the olefin
based block copolymer (B) includes, for example, (B1)-
10 (B2), (B1)-(B2)-(B1'), (B1)-(B2)-(B1')-(B2)-(B1) and the
like. Herein, (B1) and (B1') may be the same or
different from each other.

The olefin based block copolymer (B) is an olefin block
copolymer comprising the polymer segments (B1), (B1') and
15 (B2), preferably comprising a triblock structure of (B1)-
(B2)-(B1'), and is more preferably a triblock structure
of (B1)-(B2)-(B1').

The olefin based block copolymer (B) used in the
invention preferably has a homogeneous monomer
20 composition in the same polymer segment, but it may be a
tapered polymer wherein the composition of the comonomer
changes continuously in gradated manner within the range
that physical properties of the polymer segments are not
modified remarkably.

In addition, for the olefin based block copolymer (B), the ratio (Mw/Mn) of a weight average molecular weight Mw to a number average molecular weight Mn, which are obtained by high temperature GPC measurement, is preferably 3.0 or less, more preferably 2.0 or less, and even more preferably 1.5 or less. If the molecular weight distribution is broad, modification performance may be reduced by gelation of high molecular weight polymers.

10 The olefin based block copolymer (B) used in the invention may have a functional group on the terminal of the main chain. In addition, the olefin based block copolymer (B) may be further bonded to a part having a structure other than the above-mentioned structure if it has the structure as described above within the range where the object of the present invention is not damaged. In addition, the olefin based block copolymer (B) may be graft modified.

20 The above-mentioned functional group to be used includes preferably an aromatic hydrocarbon group, a halogen atom, an oxygen-containing group, a nitrogen-containing group, a sulfur-containing group, a phosphorus-containing group, a metal atom-containing group and the like.

The above-mentioned aromatic hydrocarbon group includes, for example, phenyl, naphthyl, tolyl, biphenyl, anthryl and the like, and the halogen atom includes fluorine, chlorine, bromine and iodine.

5 The above-mentioned oxygen-containing group is, for example, a group containing 1 to 5 oxygen atoms in the group, which does not include a heterocyclic compound residue described below. In addition, the above-mentioned oxygen-containing group may contain atoms such
10 as a nitrogen atom, a sulfur atom, a phosphorus atom or a halogen atom as long as such atoms are not directly bonded to the oxygen atom. The above-mentioned oxygen-containing group includes specifically a hydroxy group; an alkoxy group such as methoxy, ethoxy, propoxy and
15 butoxy; an aryloxy group such as phenoxy, methylphenoxy, dimethylphenoxy and naphthoxy; an arylalkoxy group such as phenylmethoxy and phenylethoxy; an acetoxy group; a carbonyl group; a carboxyl group; an ester group; an acetyl group and the like. In the case that the above-
20 mentioned oxygen-containing group has a carbon atom, the number of the carbon atoms is preferably in the range of 1 to 30, more preferably in the range of 1 to 20.

The above-mentioned nitrogen-containing group is, for example, a group containing 1 to 5 nitrogen atoms in

the group, which does not include a heterocyclic compound residue described below. The above-mentioned nitrogen-containing group includes specifically an amino group; an alkylamino group such as methylamino, dimethylamino, ethylamino, propylamino, butylamino and cyclohexylamino; an arylamino group such as phenylamino, tolylamino, naphthylamino and the like.

The above-mentioned sulfur-containing group is, for example, a group containing 1 to 5 sulfur atoms in the group, which does not include a heterocyclic compound residue described below. Specific examples of the above-mentioned sulfur-containing group include a sulfonate group such as methyl sulfonate, trifluoromethane sulfonate, phenyl sulfonate, benzyl sulfonate, p-toluene sulfonate, trimethylbenzene sulfonate, triisobutylbenzene sulfonate, p-chlorobenzene sulfonate and pentafluorobenzene sulfonate; a sulfinatate group such as methyl sulfinatate, phenyl sulfinatate, benzyl sulfinatate, p-toluene sulfinatate, trimethylbenzene sulfinatate and pentafluorobenzene sulfinatate; an alkylthio group; an arylthio group and the like. In the case that the above-mentioned sulfur-containing group has carbon atoms, the number of the carbon atoms is preferably in the range of 1 to 30, more preferably in the range of 1 to 20.

The above-mentioned phosphorus-containing group is, for example, a group containing 1 to 5 phosphorus atoms in the group. Specific examples of the above-mentioned phosphorus-containing group include a trialkylphosphine group such as trimethylphosphine, tributylphosphine and tricyclohexylphosphine; a triarylphosphine group such as triphenylphosphine and tritolylphosphine; a phosphite group (a phosphido group) such as methylphosphite, ethylphosphite and phenylphosphite; a phosphonic acid group; a phosphinic acid group and the like.

The above-mentioned metal atom-containing group includes, for example, a group which contains an atom such as silicon, aluminum, boron, zinc and magnesium; a metal atom such as lithium and the like, and specifically, a silicon-containing group, an aluminum-containing group, a boron-containing group, a zinc-containing group, a magnesium-containing group, a lithium atom and the like.

The above-mentioned silicon-containing group is, for example, a group which contains 1 to 5 silicon atoms in the group. Specific examples of the above-mentioned silicon-containing group include a hydrocarbon-substituted silyl group such as phenylsilyl, diphenylsilyl, trimethylsilyl, triethylsilyl, tripropylsilyl, tricyclohexylsilyl, triphenylsilyl,

tritolylsilyl, trinaphthylsilyl and methyldiphenylsilyl;
an alkyl-substituted silyl ether group such as
trimethylsilyl ether; a silicon-substituted alkyl group
such as trimethylsilylmethyl; a silicon-substituted aryl
5 group such as trimethylsilylphenyl; a hydrocarbon-
substituted siloxy group such as trimethylsiloxy and the
like. More specifically, the above-mentioned
hydrocarbon-substituted silyl group is preferably a
trialkylsilyl group such as trimethylsilyl, triethylsilyl,
10 tripropylsilyl and tricyclohexylsilyl.

The above-mentioned aluminum-containing group is,
for example, a group which contains 1 to 5 aluminum atoms
in the group. The above-mentioned aluminum-containing
group includes specifically $-AlR_2$ group (R represents
15 hydrogen, an alkyl group, an optionally-substituted aryl
group, a halogen atom and the like).

The above-mentioned boron-containing group is, for
example, a group which contains 1 to 5 boron atoms in the
group. The above-mentioned boron-containing group
20 includes specifically $-BR_2$ group (R represents hydrogen,
an alkyl group, an optionally-substituted aryl group, a
halogen atom and the like.).

The above-mentioned zinc-containing group is, for
example, a group which contains 1 to 3 zinc atoms in the

group. The above-mentioned zinc-containing group includes specifically -ZnR group (R represents hydrogen, an alkyl group, an optionally-substituted aryl group, a halogen atom and the like.).

5 The above-mentioned magnesium-containing group is, for example, a group which contains 1 to 3 magnesium atoms in the group. The above-mentioned magnesium-containing group includes specifically -MgR group (R represents hydrogen, an alkyl group, an optionally-

10 substituted aryl group, a halogen atom and the like.).

Such olefin based block copolymer (B) containing a functional group on the terminal of the main chain is suitably used in applications such as various additives such as a compatibilizer, a paint and an adhesive, in

15 addition to a resin modifier.

Next, the preparation method of the olefin based block copolymer (B) will be explained.

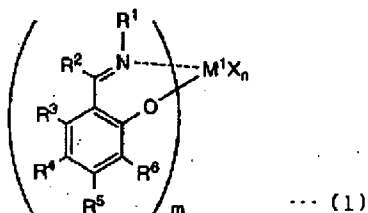
In preparation of the olefin based block copolymer (B), the transition metal compound (Q) represented by the

20 above-mentioned formula (1) may be used alone as an olefin polymerization catalyst, or the transition metal compound (Q) may be used in combination of at least one compound selected from

(R) (R-1) an organic metal compound,

(R-2) an organic aluminumoxy compound, and

(R-3) a compound which forms an ion pair by reaction with the transition metal compound (Q) as the olefin polymerization catalyst.



In the above-mentioned formula (1), M^1 represents a transition metal atom selected from Groups 4 to 5 of the Periodic Table, m represents 1 or 2, R^1 represents an aromatic hydrocarbon group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group wherein in the case that R^1 is a phenyl group, it has at least one substituent which is selected from heteroatoms and heteroatom-containing groups in at least one position of Positions 2 and 6 (in this case, it may have at least one atom or group which are selected from heteroatoms and heteroatom-containing groups, in a position other than the location selected from Positions 2 and 6), or it has at least one substituent which is selected from a heteroatom excluding a fluorine atom, a fluorine-containing group which contains one carbon atom and two or less fluorine atoms, a fluorine-containing group which

10

15

20

contains two or more carbon atoms, and a group which contains a heteroatom excluding a fluorine atom, in at least one position of Positions 3 to 5 (in this case, it may have at least one atom or group which are selected

5 from heteroatoms (it may be a fluorine atom) and heteroatom (it may be a fluorine atom)-containing groups, in a position other than the location selected from Positions 3 to 5), when the location of the carbon atom which is bonded to the nitrogen is taken as Position 1,

10 and in the case that R^1 is an aromatic hydrocarbon group other than a phenyl group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group, it has at least one substituent which is selected from heteroatoms and heteroatom-containing groups, R^2 to R^5 represent

15 independently a hydrogen atom, a halogen atom, a halogen-containing group, a hydrocarbon group, a hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group or a sulfur-containing group, which may be the same or different from each other, R^6

20 represents a halogen atom, a halogen-containing group, a hydrocarbon group or a hydrocarbon-substituted silyl group, n is a number which satisfies the valence of M , X represents an oxygen atom, a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a

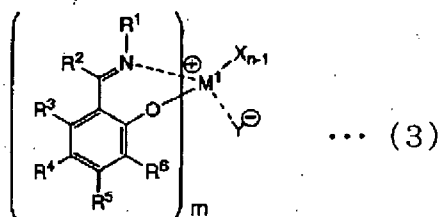
sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and in the case that n is 2 or more, the plural groups represented by X may be the same or different from each other, and may be bonded to each other to form a ring.

10 Among them, M^1 is more preferably a Ti atom. In addition, R^1 is more preferably an aromatic hydrocarbon group, even more preferably a phenyl group. In the case that R^1 is a phenyl group, it has more preferably heteroatoms at all of the places of Positions 2 to 6, respectively when the location of the carbon atom which is bonded to the nitrogen is taken as Position 1, and the heteroatom is even more preferably a fluorine atom. In addition, R^2 to R^5 are more preferably each independently a hydrogen atom, a halogen atom, a hydrocarbon group having 1 to 4 carbon atoms. R^6 is preferably a halogen atom or a hydrocarbon group having 1 to 4 carbon atoms. X is more preferably a halogen atom.

Such transition metal compound includes, for example, the corresponding compounds among those described in

pages 104 to 107 of the publication pamphlet of WO
2001/55231.

In the case that the transition metal compound (Q)
is combined with the component (R), the transition metal
5 compound (Q) forms a compound represented by the
following formula (3) in the polymerization system.



In the above-mentioned formula (3), R¹ to R⁶, M¹, m,
n and X are the same as described for R¹ to R⁶, M¹, m, n
10 and X in the above-mentioned formula (1), and Y
represents the so-called weak coordination anion. In the
above-mentioned formula (3), the bond of the metals M and
Y may be either a covalent bond or an ion bond.

Y includes, for example, the weak coordination anion
15 which is described in

- (1) Chemical Review, Vol. 88, p. 1405 (1988),
- (2) Chemical Review, Vol. 93, p. 927 (1993), and
- (3) WO98/30612, p. 6

and the like, and specifically

20 AlR₄⁻

(R may be the same or different from each other, and represents an oxygen atom, a nitrogen atom, a phosphorus atom, a hydrogen atom, a halogen atom or a substituent which contains them; an aliphatic hydrocarbon group, an aromatic hydrocarbon group or an alicyclic hydrocarbon group; an aliphatic hydrocarbon group, an aromatic hydrocarbon group or an alicyclic hydrocarbon group, which is substituted with an oxygen atom, a nitrogen atom, a phosphorus atom or a halogen atom; or an aliphatic hydrocarbon group, an aromatic hydrocarbon group or an alicyclic hydrocarbon group, which is substituted with a substituent containing an oxygen atom, a nitrogen atom, a phosphorus atom or a halogen atom),

BR_4^- (R may be the same or different from each other, and represents an oxygen atom, a nitrogen atom, a phosphorus atom, a halogen atom or a substituent which contains them; an aliphatic hydrocarbon group, an aromatic hydrocarbon group or an alicyclic hydrocarbon group; an aliphatic hydrocarbon group, an aromatic hydrocarbon group or an alicyclic hydrocarbon group, which is substituted with an oxygen atom, a nitrogen atom, a phosphorus atom or a halogen atom; or an aliphatic hydrocarbon group, an aromatic hydrocarbon group or an alicyclic hydrocarbon group, which is substituted with a

substituent containing an oxygen atom, a nitrogen atom, a phosphorus atom or a halogen atom), PF_6^- , SbF_5^- , trifluoromethane sulfonate, p-toluene sulfonate and the like.

5 In polymerization of the olefin based block copolymer (B), ethylene and an α -olefin having 3 to 20 carbon atoms are subjected to copolymerization in the presence of the catalyst for olefin polymerization as described above to give a polymer. The α -olefin having 3
10 to 20 carbon atoms includes the same those as described above.

In polymerization of the olefin based block copolymer (B), any of a liquid-phase polymerization method such as solution polymerization and suspension
15 polymerization, and a gas phase polymerization method may be used.

Specific examples of the inert hydrocarbon solvent used in the above-mentioned liquid-phase polymerization method include an aliphatic hydrocarbon such as propane,
20 butane, pentane, hexane, heptane, octane, decane, dodecane and coal oil; an alicyclic hydrocarbon such as cyclopentane, cyclohexane and methylcyclopentane; aromatic hydrocarbon such as benzene, toluene and xylene; a halogenated hydrocarbon such as ethylene chloride,

chlorobenzene and dichloromethane; a mixture thereof and the like, and the olefin itself may be used as a solvent.

In polymerization of the olefin having 2 to 20 carbon atoms with the use of the catalyst for olefin polymerization as described above, the transition metal compound (Q) is used usually in an amount of 10^{-12} to 1 mol, preferably 10^{-10} to 10^{-2} mole per liter of reaction volume.

In the case that the component (R-1) is used, it is desirably used in an amount that the molar ratio [(R-1)/M] of the component (R-1) to a transition metal atom (M) in the transition metal compound (Q) is usually 0.01 to 100,000, and preferably 0.05 to 50,000. In the case that the component (R-2) is used, it is desirably used in an amount that the molar ratio [(R-2)/M] of an aluminum atom in the component (R-2) to the transition metal atom (M) in the transition metal compound Q is usually 10 to 500,000, and preferably 20 to 100,000. In the case that the component (R-3) is used, it is desirably used in an amount that the molar ratio [(R-3)/M] of the component (R-3) to the transition metal atom (M) in the transition metal compound (Q) is usually 1 to 10, and preferably 1 to 5.

If the polymerization is carried out by coexisting ethylene and at least one of α -olefins, which are selected from an α -olefin having 3 to 20 carbon atoms, and have different polymerization reactivity, in the presence of a catalyst for olefin polymerization which contains the transition metal compound (Q), it is possible to prepare an olefin based block copolymer (B) comprising polymer segments where monomer compositions of two or more kinds change continuously.

10 Herein, the olefin based block copolymer (B) refers to a copolymer in a form that polymer chains (polymer segment), which have differences in the primary structures of the polymer due to monomer species, comonomer species, comonomer composition, comonomer content, comonomer arrangement and stereoregularity or the like, are linked in two or more kinds in one molecular chain as described above. This copolymer is synthesized by successively adding different monomer species or monomers of different monomer compositions in a living polymerization where no chain transfer reaction substantially takes place.

The olefin based block copolymer (B) used in the invention is specifically prepared by, for example, conducting the process (1) and the process (2), and then

repeating the process (3) in any number, if necessary. Thereby, the olefin based block copolymer (B) which comprises the plural polymer segments is prepared.

In the process (1), ethylene alone, or ethylene and
5 at least one selected from an α -olefin having 3 to 20 carbon atoms, are polymerized in the presence of the catalyst for olefin polymerization described above to prepare the polymer segments as described above. The α -olefin having 3 to 20 carbon atoms may be used alone or
10 in combination of two or more kinds.

In the process (1), the polymerization temperature is usually in the range of -40 to $+200^{\circ}\text{C}$, preferably 0 to $+150^{\circ}\text{C}$. The polymerization pressure is usually normal pressure to 100 kg/cm^2 , preferably normal pressure to 50
15 kg/cm^2 .

In the process (2), in the presence of the polymer segment prepared in the process (1), ethylene is polymerized with at least one selected from an α -olefin having 3 to 20 carbon atoms, to prepare the polymer
20 segment as described above, which is different from the polymer segment prepared in the process (1). The α -olefin having 3 to 20 carbon atoms may be used alone or in combination of two or more kinds.

Herein, the different polymer segment refers to those which are different in at least one of the primary structure of the polymer such as monomer species, comonomer species, comonomer composition, comonomer content, comonomer sequence and stereoregularity.

In the process (2), the polymerization temperature is usually in the range of -40 to +200°C, preferably 0 to +150°C. The polymerization pressure is usually normal pressure to 100 kg/cm², preferably normal pressure to 50 kg/cm².

In the process (3), ethylene alone, or ethylene is polymerized with at least one α -olefin selected from an α -olefins having 3 to 20 carbon atoms in the presence of the polymer segments obtained in the process (1) and the process (2), to prepare the polymer segment as described above, which is different from the polymer segment prepared in the process (2). The α -olefin having 3 to 20 carbon atoms may be used alone or in combination of two or more kinds.

In the process (3), the polymerization temperature is usually in the range of -40 to +200°C, preferably 0 to +150°C. The polymerization pressure is usually under the conditions of normal pressure to 100 kg/cm², preferably normal pressure to 50 kg/cm².

This process (3) may be repeated in any number with changing the kind of the α -olefin, or combination or polymerization conditions.

According to the preparation method as described above, an olefin based block copolymer (B), which has high molecular weight and narrow molecular weight distribution with high polymerization activity, is obtained at high polymerization temperature.

In addition, by bringing this olefin block copolymer into contact with a functional group-containing compound, an olefin based block copolymer (B) may be obtained, which has a functional group on the terminal.

Furthermore, in this preparation method, the olefin is polymerized in the presence of a catalyst which advances a living polymerization of the olefin, and polymerization can be performed with the use of a catalyst obtained by breaking the bond of the catalyst and the produced polymer chain, which is formed in the polymerization, by the chain transfer reaction.

The progress of the living polymerization can be ascertained by narrow molecular weight distribution of the obtained polymer, and increase in the molecular weight of the produced polymer with the polymerization time. According to this, for example, it is possible to

prepare the above-mentioned monodisperse polyolefin, olefin copolymer, tapered polymer, or olefin block copolymer.

The progress of the above-mentioned living
5 polymerization is preferably ascertained, for example, by polymerization of the olefin under the condition where a chain transfer agent is excluded. The molecular weight of the obtained polymer can be controlled by controlling a monomer/catalyst ratio, a polymerization time and the
10 like.

According to the preparation method as described above, an olefin based block copolymer (B), which has an exactly controlled structure as well as high molecular weight and a narrow molecular weight distribution with
15 high polymerization activity, is obtained at high polymerization temperature.

Furthermore, the block copolymer (B) of the invention may be graft modified by at least one compound selected from an unsaturated carboxylic acid and a
20 derivative thereof. The above-mentioned unsaturated carboxylic acid includes, for example, maleic anhydride and the like. The graft modification can be performed with a usual method.

<Inorganic filler (D)>

Specific examples of an inorganic filler (D) include a powdery filler such as natural silicic acid or silicate such as fine powder talc, kaolinite, calcined clay, pyrophyllite, sericite and wollastonite; carbonate such as precipitated calcium carbonate, heavy calcium carbonate and magnesium carbonate; hydroxide such as aluminum hydroxide and magnesium hydroxide; oxide such as zinc oxide, zinc white and magnesium oxide; synthesized silicic acid or silicate such as hydrated calcium silicate, hydrated aluminum silicate, hydrated silicate and anhydrous silicic acid;

a flaky filler such as mica;

a fibrous filler such as basic magnesium sulfate whisker, calcium titanate whisker, aluminum borate whisker, sepiolite, PMF (Processed Mineral Fiber), xonotlite, potassium titanate and ellestadite;

a balloon filler such as glass balloon and fly ash balloon; and the like.

Among them, preferably talc, more preferably fine powder talc having an average particle size of 0.01 to 10 μm is used in the invention. Furthermore, the average particle size of talc can be measured by a liquid phase sedimentation method.

In addition, the inorganic filler used in the invention, particularly talc may be of no treatment or of a surface treatment in advance. This surface treatment includes specifically a chemical or physical treatment with the use of a treatment agent such as a silane coupling agent, higher fatty acid, fatty acid metal salt, unsaturated organic acid, organic titanate, resin acid and polyethylene glycol. If talc which has been subjected to such surface treatment is used, a molded product is obtained, which is excellent in mechanical property and formability.

In the case that the inorganic filler as described above is used in the invention, it may be used alone or in combination of two or more kinds. In addition, an organic filler such as high-styrenes, lignin and recycled rubber may be combined with such inorganic filler.

<Other copolymers>

"Other copolymers" (elastomer, resin for elastomer) may be contained if necessary in the propylene polymer composition according to the invention (wherein the above-mentioned composition means the "first composition" and the "second composition" described below).

The "other copolymers" are not particularly limited, but, include, for example, an ethylene/ α -olefin random copolymer (C) and the like. These copolymers may be used alone or in combination of two or more kinds.

5 The "other copolymers" may be contained in an amount of usually 1 to 80 parts by weight, preferably 10 to 70 parts by weight per 100 parts by weight of the total amount of the propylene based polymer (A) and the olefin based block copolymer (B), or per 100 parts by weight of
10 the total amount of the propylene based polymer (A) and the olefin based block copolymer (BB).

The ethylene/ α -olefin random copolymer (C) which may be used in the invention is not particularly limited, but, for example, it is desirably a soft ethylene/ α -olefin
15 copolymer having a density of 0.855 g/cm³ or more and less than 0.895 g/cm³, preferably 0.860 to 0.890 g/cm³, and a melt flow rate (MFR; ASTM D 1238, 190°C and a load of 2.16 kg) of, for example, 0.001 to 30 g/10 min, preferably 1 to 20 g/10 min.

20 The α -olefin which is subjected to copolymerization with ethylene is an α -olefin having 3 to 20 carbon atoms, specifically propylene, 1-butene, 1-pentene, 1-hexene, 1-heptene, 1-octene, 1-nonene, 1-decene, 1-undecene, 1-dodecene, 1-hexadecene, 1-octadecene, 1-nonadecene, 1-

eicocene, 4-methyl-1-pentene and the like. Among them, the α -olefin having 3 to 10 carbon atoms is preferred. These α -olefins may be used alone, or in combination of two or more kinds.

5 The ethylene/ α -olefin random copolymer (C) desirably contains a unit derived from ethylene in an amount of 60 to 90 mol%, and a unit derived from an α -olefin having 3 to 20 carbon atoms in an amount of 10 to 40 mol% (wherein the total amount of the unit derived from ethylene and
10 the unit derived from the α -olefin having 3 to 20 carbon atoms is 100 mol%).

In addition, the ethylene/ α -olefin random copolymer (C) may contain a unit derived from other polymerizable monomers, in addition to these units, within the range
15 where the object of the present invention is not damaged.

The above-mentioned other polymerizable monomers include, for example, vinyl compounds such as styrene, vinylcyclopentene, vinylcyclohexane and vinylnorbornane;
vinyl esters such as vinyl acetate;
20 unsaturated organic acid such as maleic anhydride or a derivative thereof;
conjugated dienes such as butadiene, isoprene, pentadiene and 2,3-dimethylbutadiene;

nonconjugated polyenes such as 1,4-hexadiene, 1,6-octadiene, 2-methyl-1,5-hexadiene, 6-methyl-1,5-heptadiene, 7-methyl-1,6-octadiene, dicyclopentadiene, cyclohexadiene, dicyclooctadiene, methylene norbornene, 5-vinylnorbornene, 5-ethylidene-2-norbornene, 5-methylene-2-norbornene, 5-isopropylidene-2-norbornene, 6-chloromethyl-5-isopropenyl-2-norbornene, 2,3-diisopropylidene-5-norbornene, 2-ethylidene-3-isopropylidene-5-norbornene and 2-propenyl-2,2-norbornadiene; and the like.

The ethylene/ α -olefin random copolymer (C) may further contain a unit derived from the other polymerizable monomers in an amount of 10 mol% or less, preferably 5 mol% or less, and more preferably 3 mol% or less, per 100 mol% of the total amount of the unit derived from ethylene and the unit derived from an α -olefin having 3 to 20 carbon atoms.

Specific examples of the ethylene/ α -olefin random copolymer (C) include an ethylene/propylene random copolymer, an ethylene/1-butene random copolymer, an ethylene/propylene/1-butene random copolymer, an ethylene/propylene/ethylidenenorbornene random copolymer, an ethylene/propylene/dicyclopentadiene random copolymer, an ethylene/1-hexene random copolymer, an ethylene/1-

octene random copolymer and the like. Among them, the ethylene/propylene random copolymer, the ethylene/1-butene random copolymer, the ethylene/1-hexene random copolymer, the ethylene/1-octene random copolymer, the ethylene/propylene/ethylidenenorbornene random copolymer and the ethylene/propylene/dicyclopentadiene random copolymer are particularly preferably used. These copolymers may be used in combination of two or more kinds.

10 In addition, the ethylene/ α -olefin random copolymer (C) used in the invention has the crystallization degree of usually 40% or less, preferably 0 to 39%, and more preferably 0 to 35%, as measured by an X ray diffraction method.

15 In addition, the ethylene/ α -olefin random copolymer (C) may be crosslinked and contained in the propylene based resin composition according to the invention.

The ethylene/ α -olefin random copolymer (C) as described above can be prepared by a conventionally known method with the use of a vanadium-based catalyst, a titanium-based catalyst or a metallocene-based catalyst and the like.

<Propylene based resin composition>

The olefin based block copolymer (B) prepared as described above is useful as a modifier, and blending it with the propylene based polymer (A) gives a propylene based resin composition which has desired properties. A
5 propylene based resin composition comprising the propylene based polymer (A) in an amount of 1 to 99% by weight and the olefin based block copolymer (B) in an amount of 99 to 1% by weight (wherein the total amount of the propylene based polymer (A) and the olefin based
10 block copolymer (B) is 100% by weight) is excellent in impact resistance and heat resistance.

In addition, a propylene based resin composition (I) which contains the propylene based polymer (A) in an amount of 40 to 99% by weight, preferably 50 to 90% by
15 weight and the olefin based block copolymer (B) in an amount of 60 to 1% by weight, preferably 50 to 10% by weight (wherein the total of the propylene based polymer (A) and the olefin based block copolymer (B) is 100% by weight), and further substantially contains no inorganic
20 filler (D), is excellent in transparency as well as in impact resistance and heat resistance, and further has hardly appearance change even at high temperature.

In addition, a propylene based resin composition (II) which contains the propylene based polymer (A) in an

amount of less than 40% by weight and 1% by weight or more, preferably 30 to 1% by weight and the olefin based block copolymer (B) in an amount of more than 60% by weight and 99% by weight or less, preferably 70 to 99% by weight (wherein the total amount of the propylene based polymer (A) and the olefin based block copolymer (B) is 100% by weight) is excellent in flexibility and rubber elasticity as well as in heat resistance.

Herein, substantially containing no inorganic filler (D) means containing 1 part by weight or less, preferably 0.5 part by weight or less, and more preferably 0.1 part by weight or less of the inorganic filler (D), or no containing it, per 100 parts by weight of the total amount of the propylene based polymer (A) and the olefin based block copolymer (B).

In addition, the above-mentioned composition (II) may contain an inorganic filler (D) such as talc in order to improve flame retardance, which is contained in an amount of preferably 10 to 800 parts by weight, more preferably 100 to 500 parts by weight, per 100 parts by weight of the composition (II).

It is preferable that the propylene based resin composition has a loss tangent ($\tan \delta$) peak caused from the glass transition temperature of the propylene polymer

[A] and a loss tangent ($\tan \delta$) caused from the glass transition temperature of the ethylene block copolymer [B], when the temperature-dependence of the elasticity is measured at intervals of 2°C and plotted, and that these peaks be separated from each other. It is judged that these peaks be "separated," when the two peaks are distinctly observed, i.e., there is a local minimum point (relative minimum point) between the tops of these peaks. The propylene based resin composition which has two "separated" peaks is excellent both in impact resistance and rigidity.

The propylene based resin composition according to the invention is prepared by kneading the propylene based polymer (A) and the olefin based block copolymer (B) in a conventionally known method such as mixing by internal mixers such as Banbury mixer, a kneader and intermix.

In addition, an apparatus for continuous kneading/discharge such as an extruder is suitably used in the modification of the resin as described above. Kneading is desirably performed at more than the melting point or softening point of the resin to be discharged, and further 400°C or less.

<Additive>

The propylene based resin composition according to the invention (wherein the above-mentioned composition means the "first composition" and the "second composition" described below) may contain an additive
5 such as a nucleating agent, an antioxidizing agent, a hydrochloric acid absorbent, a heat-resistant stabilizer, a light stabilizer, an ultraviolet absorbent, a lubricant, an antistatic agent, a flame retardant, a pigment, a dye, a dispersant, a copper inhibitor, a neutralizer, a
10 foaming agent, a plasticizer, a bubble inhibitor, a crosslinking agent, a crosslinking aid, a silane coupling agent, a peroxide, an agent for improvement of weld strength and the like, in addition to each component as described above within limits not harmful to the object
15 of the invention.

The above-mentioned antioxidizing agent includes, for example, a phenol-based antioxidizing agent, a sulfur-based antioxidizing agent, a phosphorus-based antioxidizing agent and the like.

20 The above-mentioned phenol-based antioxidizing agent includes, for example, phenols such as 2,6-di-tert-butyl-p-cresol, stearyl(3,3-dimethyl-4-hydroxybenzyl)thioglycolate, stearyl- β -(4-hydroxy-3,5-di-tert-butylphenol)propionate, distearyl-3,5-di-tert-butyl-

4-hydroxybenzyl phosphonate, 2,4,6-tris(3',5'-di-tert-butyl-4'-hydroxybenzylthio)-1,3,5-triazine, distearyl(4-hydroxy-3-methyl-5-tert-butylbenzyl)malonate, 2,2'-methylene-bis(4-methyl-6-tert-butylphenol), 4,4'-

5 methylene-bis(2,6-di-tert-butylphenol), 2,2'-methylene-bis[6-(1-methylcyclohexyl)p-cresol], bis[3,5-bis[4-hydroxy-3-tert-butylphenyl)butyric acid]glycolester, 4,4'-butylidenebis(6-tert-butyl-m-cresol), 1,1,3-tris(2-methyl-4-hydroxy-5-tert-butylphenyl)butane, bis[2-tert-

10 butyl-4-methyl-6-(2-hydroxy-3-tert-butyl-5-methylbenzyl)phenyl]terephthalate, 1,3,5-tris(2,6-dimethyl-3-hydroxy-4-tert-butyl)benzyl isocyanurate, 1,3,5-tris(3,5-di-tert-butyl-4-hydroxybenzyl)-2,4,6-trimethylbenzene, tetrakis[methylene-3-(3,5-di-tert-

15 butyl-4-hydroxyphenyl)propionate]methane, 1,3,5-tris(3,5-di-tert-butyl-4-hydroxybenzyl)isocyanurate, 1,3,5-tris[(3,5-di-tert-butyl-4-hydroxyphenyl)propionyloxyethyl]isocyanurate, 2-octylthio-4,6-di(4-hydroxy-3,5-di-tert-butyl)phenoxy-

20 1,3,5-triazine and 4,4'-thiobis(6-tert-butyl-m-cresol), polyvalent phenol/carbonate oligoesters such as carbonate oligoester of 4,4'-butylidenebis(2-tert-butyl-5-methylphenol) (having a degree of polymerization of, for example, 2 to 10) and the like.

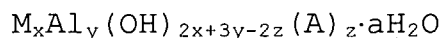
The above-mentioned sulfur-based antioxidizing agent includes, for example, dialkyl thiodipropionates such as dilauryl, dimyristyl or distearyl thiodipropionates; and esters (e.g., pentaerythritol tetralaurylthiopropionate) of alkyl thiopropionates such as butyl, octyl, lauryl or stearyl thiopropionates and polyhydric alcohols (e.g., glycerin, trimethylol ethane, trimethylol propane, pentaerythritol or trishydroxyethylisocyanurate).

The above-mentioned phosphorus-based antioxidizing agent includes, for example, trioctylphosphite, trilaurylphosphite, tridecylphosphite, octyl-diphenylphosphite, tris(2,4-di-tert-butylphenyl)phosphite, triphenyl phosphite, tris(butoxyethyl)phosphite, tris(nonylphenyl)phosphite, distearylpentaerythritoldiphosphite, tetra(tridecyl)-1,1,3-tris(2-methyl-5-tert-butyl-4-hydroxyphenyl)butanediphosphite, tetra(C₁₂ to C₁₅ mixed alkyl)-4,4'-isopropylidendiphenyl diphosphite, tetra(tridecyl)-4,4'-butylidenebis(3-methyl-6-tert-butylphenol)diphosphite, tris(3,5-di-tert-butyl-4-hydroxyphenyl)phosphite, tris(mono/di mixed nonylphenyl)phosphite, hydride-4,4'-isopropylidendiphenol polyphosphite, bis(octylphenyl)/bis[4,4'-butylidenebis(3-methyl-6-tert-butylphenol)]/1,6-hexanediol diphosphite,

phenyl/4,4'-
isopropylidendiphenol/pentaerythritoldiphosphite,
bis(2,4-di-tert-butylphenyl)pentaerythritoldiphosphite,
bis(2,6-di-tert-butyl-4-
5 methylphenyl)pentaerythritoldiphosphite, tris[4,4'-
isopropylidenebis(2-tert-butylphenol)]phosphite,
phenyl/diisodecyl phosphite,
di(nonylphenyl)pentaerythritoldiphosphite), tris(1,3-di-
stearoyloxyisopropyl)phosphite, 4,4'-isopropylidenebis(2-
10 tert-butylphenol)/di(nonylphenyl)phosphite, 9,10-di-
hydro-9-oxa-9-oxa-10-phosphaphenanthrene-10-oxide,
tetrakis(2,4-di-tert-butylphenyl)-4,4'-
biphenylenediphosphonite and the like.

Furthermore, other antioxidizing agents include a
15 derivative of 6-hydroxychromane, for example, various
tocopherols of α , β , γ and δ and a mixture thereof, 2,5-
dimethyl substitution product, 2,5,8-trimethyl
substitution product and 2,5,7,8-tetramethyl substitution
product of 2-(4-methyl-penta-3-enyl)-6-hydroxychromane,
20 2,2,7-trimethyl-5-tert-butyl-6-hydroxychromane, 2,2,5-
trimethyl-7-tert-butyl-6-hydroxychromane, 2,2,5-
trimethyl-6-tert-butyl-6-hydroxychromane, 2,2-dimethyl-5-
tert-butyl-6-hydroxychromane and the like.

In addition, a complex compound represented by the following formula:



(wherein M is Mg, Ca or Zn; A is an anion other than a hydroxyl group; "x", "y" and "z" are each a positive number; and "a" is 0 or a positive number), for example, Mg₆Al₂(OH)₁₆CO₃·4H₂O, Mg₆Al₂(OH)₂₀CO₃·5H₂O, Mg₅Al₂(OH)₁₄CO₃·4H₂O, Mg₁₀Al₂(OH)₂₂(CO₃)₂·4H₂O, Mg₆Al₂(OH)₁₆HPO₄·4H₂O, Ca₆Al₂(OH)₁₆CO₃·4H₂O, Zn₆Al₂(OH)₁₆CO₃·4H₂O, Zn₆Al₂(OH)₁₆SO₄·4H₂O, Mg₆Al₂(OH)₁₆SO₃·4H₂O, Mg₆Al₂(OH)₁₂CO₃·3H₂O and the like may be used as a hydrochloric acid absorbent.

The above-mentioned light stabilizer includes, for example, hydroxybenzophenones such as 2-hydroxy-4-methoxybenzophenone, 2-hydroxy-4-n-octoxybenzophenone, 2,2'-di-hydroxy-4-methoxybenzophenone and 2,4-dihydroxybenzophenone, benzotriazoles such as 2-(2'-hydroxy-3'-tert-butyl-5'-methylphenyl)-5-chlorobenzotriazole, 2-(2'-hydroxy-3',5'-di-tert-butylphenyl)-5-chlorobenzotriazole, 2-(2'-hydroxy-5'-methylphenyl)benzotriazole and 2-(2'-hydroxy-3',5'-di-tert-butylphenyl)benzotriazole, benzoates such as phenyl salicylate, p-tert-butylphenyl salicylate, 2,4-di-tert-butylphenyl-3,5-di-tert-butyl-4-hydroxybenzoate and hexadecyl-3,5-di-tert-butyl-4-hydroxybenzoate, nickel

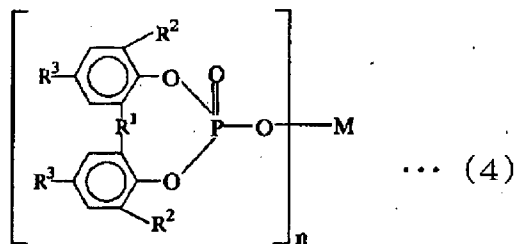
compounds such as 2,2'-thiobis(4-tert-octylphenol)Ni salt,
[2,2'-thiobis(4-tert-octylphenolate)]-n-butylamine Ni and
(3,5-di-tert-butyl-4-hydroxybenzyl)phosphonic acid
monoethylester Ni salt, substituted acrylonitriles such
5 as methyl α -cyano- β -methyl- β -(p-methoxyphenyl)acrylate,
oxalic acid dianilides such as N'-2-ethylphenyl-N-ethoxy-
5-tert-butylphenyl oxalic acid diamide and N-2-
ethylphenyl-N'-2-ethoxyphenyl oxalic acid diamide, a
hindered amine compound such as a condensate of
10 bis(2,2,6,6-tetramethyl-4-piperidine)cebaciate, poly[[(6-
(1,1,3,3-tetramethylbutyl)imino)-1,3,5-triazine-2,4-
diyl{4-(2,2,6,6-tetramethylpiperidyl)imino}hexamethylene]
or 2-(4-hydroxy-2,2,6,6-tetramethyl-1-piperidyl)ethanol
with dimethyl succinate and the like.

15 Examples of the lubricants include aliphatic
hydrocarbons such as paraffin wax, polyethylene wax and
polypropylene wax; higher fatty acids such as capric acid,
lauric acid, myristic acid, palmitic acid, margaric acid,
stearic acid, arachidic acid and behenic acid; metal
20 salts of the higher fatty acids such as lithium, calcium,
sodium, magnesium and potassium salts; aliphatic alcohols
such as palmityl alcohol, cetyl alcohol and stearyl
alcohol; aliphatic amides such as caproic amide, caprylic
amide, capric amide, lauric amide, myristic amide,

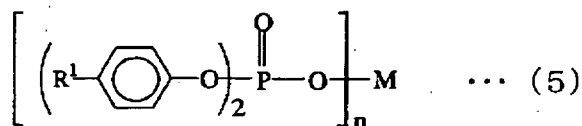
palmitic amide and stearic amide; esters formed between fatty acids and alcohols; and fluorine compounds such as fluoroalkylcarboxylic acids and metal salts thereof, and metal salts of fluoroalkylsulfonic acids.

5 The above additive is used in an amount of preferably 0.0001 to 10 parts by weight, per 100 parts by weight of the total amount of the propylene based polymer (A) and the olefin based block copolymer (B), or per 100 parts by weight of the total amount of the propylene
10 based polymer (A) and the olefin based block copolymer (BB) described below. The above-mentioned propylene based resin composition can contain the above-mentioned additive to form a molded product having further improved physical property balance, durability, coating property,
15 print property, scratch resistance and formability.

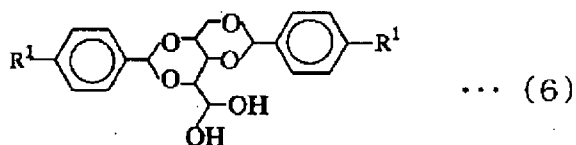
 In addition, the propylene based resin composition according to the invention may contain a nucleating agent. Various nucleating agents known in the past are used without any particular limitation. In particular, the
20 nucleating agent such as aromatic phosphoric ester salt represented by the following formulae (4) and (5), and dibenzylidene sorbitol represented by the following formula (6) is suitably used.



wherein R¹ is oxygen, sulfur or a hydrocarbon group having 1 to 10 carbon atoms; R² and R³ are each independently hydrogen, or a hydrocarbon group having 1 to 10 carbon atoms, may be identical or different from each other and R²'s, R³'s, or R² and R³ may be bonded to each other to form a ring structure; M is a metal atom having 1 to 3 valences; and n is an integer of 1 to 3.



wherein R¹ is hydrogen or a hydrocarbon group having 1 to 10 carbon atoms; M is a metal atom having 1 to 3 valences; and n is an integer of 1 to 3.



wherein R¹ is hydrogen or a hydrocarbon group having 1 to 10 carbon atoms.

Specific examples of the nucleating agent represented by the aforementioned formula (4) include

sodium-2,2'-methylene-bis(4,6-di-t-butylphenyl)phosphate,
sodium-2,2'-ethylidene-bis(4,6-di-t-butylphenyl)phosphate,
lithium-2,2'-methylene-bis(4,6-di-t-butylphenyl)phosphate,
lithium-2,2'-ethylidene-bis(4,6-di-t-
5 butylphenyl)phosphate, sodium-2,2'-ethylidene-bis(4-i-
propyl-6-t-butylphenyl)phosphate, lithium-2,2'-methylene-
bis(4-methyl-6-t-butylphenyl)phosphate, lithium-2,2'-
methylene-bis(4-ethyl-6-t-butylphenyl)phosphate, calcium-
bis[2,2'-thiobis(4-methyl-6-t-butylphenyl)phosphate],
10 calcium-bis[2,2'-thiobis(4-ethyl-6-t-
butylphenyl)phosphate], calcium-bis[2,2'-thiobis-(4,6-di-
t-butylphenyl)phosphate], magnesium-bis-[2,2'-
thiobis(4,6-di-t-butylphenyl)phosphate], magnesium-
bis[2,2'-thiobis-(4-t-octylphenyl)phosphate], sodium-
15 2,2'-butylidene-bis(4,6-di-methylphenyl)phosphate,
sodium-2,2'-butylidene-bis(4,6-di-t-butylphenyl)phosphate,
sodium-2,2'-t-octylmethylene-bis(4,6-di-
methylphenyl)phosphate, sodium-2,2'-t-octylmethylene-
bis(4,6-di-t-butylphenyl)phosphate, calcium-bis-(2,2'-
20 methylene-bis(4,6-di-t-butylphenyl)phosphate), magnesium-
bis[2,2'-methylene-bis(4,6-di-t-butylphenyl)phosphate],
barium-bis[2,2'-methylene-bis(4,6-di-t-
butylphenyl)phosphate], sodium-2,2'-methylene-bis(4-
methyl-6-t-butylphenyl)phosphate, sodium-2,2'-methylene-

bis(4-ethyl-6-t-butylphenyl)phosphate, sodium(4,4'-
dimethyl-5,6'-di-t-butyl-2,2'-biphenyl)phosphate,
calcium-bis[(4,4'-dimethyl-6,6'-di-t-butyl-2,2'-
biphenyl)phosphate], sodium-2,2'-ethylidene-bis(4-m-
5 butyl-6-t-butylphenyl)phosphate, sodium-2,2'-methylene-
bis(4,6-di-methylphenyl)phosphate, sodium-2,2'-methylene-
bis(4,6-di-ethylphenyl)phosphate, potassium-2,2'-
ethylidene-bis(4,6-di-t-butylphenyl)phosphate, calcium-
bis[2,2'-ethylidene-bis(4,6-di-t-butylphenyl)phosphate],
10 magnesium-bis[2,2'-ethylidene-bis(4,6-di-t-
butylphenyl)phosphate], barium-bis[2,2'-ethylidene-
bis(4,6-di-t-butylphenyl)phosphate], aluminum-tris[2,2'-
methylene-bis(4,6-di-t-butylphenyl)phosphate, and
aluminum-tris[2,2'-ethylidene-bis(4,6-di-t-
15 butylphenyl)phosphate. The nucleating agents can be used
alone or in combination of two or more kinds. In
particular, sodium-2,2'-methylene-bis(4,6-di-t-
butylphenyl)phosphate is preferable.

Specific examples of the nucleating agent
20 represented by the aforementioned formula (5) include
sodium-bis(4-t-butylphenyl)phosphate, sodium-bis(4-
methylphenyl)phosphate, sodium-bis(4-
ethylphenyl)phosphate, sodium-bis(4-i-
propylphenyl)phosphate, sodium-bis(4-t-

octylphenyl)phosphate, potassium-bis(4-t-butylphenyl)phosphate, calcium-bis(4-t-butylphenyl)phosphate, magnesium-bis(4-t-butylphenyl)phosphate, lithium-bis(4-t-butylphenyl)phosphate, and aluminum-bis(4-t-butylphenyl)phosphate. The nucleating agents can be used alone or in combination of two or more kinds. In particular, sodium-bis(4-t-butylphenyl)phosphate is preferable.

10 Specific examples of the nucleating agent represented by the aforementioned formula (6) include 1,3,2,4-dibenzylidene sorbitol, 1,3-benzylidene-2,4-p-methylbenzylidene sorbitol, 1,3-benzylidene-2,4-p-ethylbenzylidene sorbitol, 1,3-p-methylbenzylidene-2,4-
15 benzylidene sorbitol, 1,3-p-ethylbenzylidene-2,4-benzylidene sorbitol, 1,3-p-methylbenzylidene-2,4-p-ethylbenzylidene sorbitol, 1,3-p-ethylbenzylidene-2,4-p-methylbenzylidene sorbitol, 1,3,2,4-di(p-methylbenzylidene) sorbitol, 1,3,2,4-di(p-ethylbenzylidene) sorbitol, 1,3,2,4-di(p-n-propylbenzylidene) sorbitol, 1,3,2,4-di(p-i-propylbenzylidene) sorbitol, 1,3,2,4-di(p-n-butylbenzylidene) sorbitol, 1,3,2,4-di(p-s-butylbenzylidene) sorbitol, 1,3,2,4-di(p-t-

butylbenzylidene) sorbitol, 1,3,2,4-di(2',4'-
dimethylbenzylidene) sorbitol, 1,3,2,4-di(p-
methoxybenzylidene) sorbitol, 1,3,2,4-di(p-
ethoxybenzylidene) sorbitol, 1,3-benzylidene-2,4-p-
5 chlorobenzylidene sorbitol, 1,3-p-chlorobenzylidene-2,4-
benzylidene sorbitol, 1,3-p-chlorobenzylidene-2,4-p-
methylbenzylidene sorbitol, 1,3-p-chlorobenzylidene-2,4-
p-ethylbenzylidene sorbitol, 1,3-p-methylbenzylidene-2,4-
p-chlorobenzylidene sorbitol, 1,3-p-ethylbenzylidene-2,4-
10 p-chlorobenzylidene sorbitol, 1,3,2,4-di-(p-
chlorobenzylidene) sorbitol and a combination thereof. In
particular, 1,3,2,4-dibenzylidene sorbitol, 1,3,2,4-di(p-
methylbenzylidene) sorbitol, 1,3,2,4-di(p-
ethylbenzylidene) sorbitol, 1,3-p-chlorobenzylidene-2,4-p-
15 methylbenzylidene sorbitol, and 1,3,2,4-di(p-
chlorobenzylidene) sorbitol are preferable. The
nucleating agents can be used alone or in combination of
two or more kinds.

Further, examples of the nucleating agent used
20 include a metal salt of an aromatic carboxylic acid and
an aliphatic carboxylic acid, and specifically aluminum
benzoate, aluminum p-t-butylbenzoate, sodium adipate,
sodium thiophenecarboxylate, and sodium
pyrrolecarboxylate. Furthermore, an inorganic compound

such as talc may be used as the nucleating agent.

The nucleating agent is preferably contained in the composition in an amount of preferably 0.001 to 10 parts by weight, more preferably 0.01 to 5 parts by weight, and even more preferably 0.1 to 3 parts by weight, per 100 parts by weight of the total amount of the propylene based polymer (A) and the olefin based block copolymer (B), or per 100 parts by weight of the total amount of the propylene based polymer (A) and the olefin based block copolymer (BB) described below. When the nucleating agent is contained in the composition, the crystallization rate of the propylene based resin composition is improved, crystal particles can be made finer during crystallization and the molding process can be carried out at higher rate.

<Molded article comprising propylene based resin composition>

The propylene based resin composition according to the invention is widely used in polyolefin applications conventionally known, but is suitably used in a molded product of various shapes, e.g., sheet, unstretched film or stretched film. Further, the molded product comprising the propylene based resin composition may be

formed from partially the resin composition or completely the resin composition. The former includes, for example, multilayer films comprising at least one layer comprising the propylene copolymer composition, and more
5 specifically multilayer films, multilayer sheets, multilayer containers, multilayer tubes, multilayer coating laminates contained as one component of water-based coatings.

The propylene based resin composition according to
10 the invention is used as various molded products such as films, sheets and pipes by a known thermoforming method such as extrusion molding, inflation molding and calendar molding. In particular, the molded products obtained by extrusion molding and inflation molding are suitably used.
15 Therefore, the molded product having strain recovery properties is obtained.

When the molded product according to the invention is an extrusion-molded product, it is not particularly limited in shape and product type, but examples thereof
20 include sheet, unstretched or stretched film, pipe, hose, wire coating, tube and catheter. In particular, sheet (skin material), unstretched or stretched film, tube, and catheter are preferable.

When the propylene based resin composition is

extrusion-molded, a conventionally known extruder and conventionally known molding conditions can be used. For example, the molten composition can be extruded by a single-screw, kneading, ram or gear extruder through a
5 specific die or the like into a desired shape.

The stretched film may be obtained by stretching the above extruded sheet or extruded film (unstretched) by a known stretching process, e.g., tenter
(longitudinal/transverse or transverse/longitudinal
10 stretching), simultaneous biaxial stretching or monoaxial stretching to obtain a stretched film.

The sheet or film (unstretched) is stretched at a stretching ratio usually in the range of about 20 to 70 folds in the case of biaxial stretching, and about 2 to
15 10 folds in the case of monoaxial stretching. The thickness of the stretched film obtained by stretching is preferably about 5 to 200 μm .

Further, an inflation film may also be produced as a film-shaped molded product. Less draw down occurs in
20 inflation moldings.

The film or sheet made of the propylene based resin composition is hardly charged and has excellent rigidity such as modulus in tension, heat resistance, stretch property, impact resistance, aging resistance,

transparency, gloss, rigidity, moisture-proofness and gas barrier property. Thus, it is widely used for a packing film, a sealing sheet or the like. In this case, the above film and the sheet may be a multilayer laminate
5 comprising at least one layer comprising a propylene based polymer composition.

The molded product according to the invention is suitably used for food packaging and medical care. Specifically, the molded product for food packaging
10 includes food containers such as retortable pouch and bottle containers. The molded product for medical care includes medical containers and infusion bags. Further, there may be exemplified by containers or packaging materials other than the aforementioned containers or
15 packaging materials. When the molded product according to the invention is used for the molded product for food packaging, the molded product for medical care or the other containers, the molded product formed of the aforementioned propylene based resin composition (I) is
20 preferably used. In particular, such composition is preferable in that it is excellent in impact resistance, heat resistance and transparency and its appearance is hardly changed even at high temperature.

Further, when the molded product according to the

invention comprises the propylene polymer composition (II), the molded product has excellent rubber elasticity and heat resistance.

Furthermore, another resin composition according to
5 the invention is a propylene based resin composition which comprises:

[A] 1 to 99% by weight of a propylene based polymer (A) (i) having a melt flow rate (MFR: 230°C and a load of 2.16 kg) of 0.1 to 400 g/10 min, (ii) containing 0.01 to
10 30% by weight of component soluble in n-decane at normal temperature having an intrinsic viscosity $[\eta]$, as measured in decalin at 135°C, of 0.2 to 10 dl/g, and (iii) having pentad isotacticity (I_5), as determined by ^{13}C -NMR spectra analysis of the component insoluble in n-
15 decane at normal temperature, of 0.95 or more; and

[BB] 99 to 1% by weight of an olefin based block copolymer (BB) comprising polymer segments (B1), (B1') and (B2) in which the polymer segments (B1) and (B1') are each independently a polymer at least one monomer
20 selected from the group consisting of ethylene and α -olefin having 3 to 20 carbon atoms and are each independently a polymer segment of an ethylene based polymer having (i) the ethylene content of 95 to 100 mol% and (ii) a weight average molecular weight (M_w), as

measured by high temperature GPC, of 2,000 to 100,000;
and in which the polymer segment (B2) is a copolymer of
ethylene and at least one selected from an α -olefin
having 3 to 20 carbon atoms and is a polymer segment of
5 an ethylene/ α -olefin copolymer having (iii) the ethylene
content of 50 to 80 mol% and (iv) a weight average
molecular weight (Mw), as measured by high temperature
GPC, of 10,000 to 300,000,

which olefin block copolymer has (v) a peak assigned
10 to $\beta\beta$ methylene in its ^{13}C -NMR spectrum, (vi) a glass
transition temperature (T_g), as measured by differential
scanning calorimeter (DSC), of -50°C or less, (vii) an
endothermic peak assigned to a melting point (T_m) of
105 $^\circ\text{C}$ or more as measured by DSC, (viii) a endothermic
15 enthalpy, as determined from a melting peak area, as
measured by DSC, in the range of 20 to 60 J/g, (ix) a
density of 0.870 to 0.910 g/cm³, (x) a melt flow rate
(MFR: 190 $^\circ\text{C}$ and a load of 2.16 kg) in the range of 0.3 to
50 g/10 min, and (xi) a ratio ($(G'_{50^\circ\text{C}}) / (G'_{100^\circ\text{C}})$) of a
20 storage elastic modulus at room temperature ($G'_{50^\circ\text{C}}$) to a
storage elastic modulus at 100 $^\circ\text{C}$ ($G'_{100^\circ\text{C}}$), as determined
by solid viscoelasticity measurements, of 1.0 to 2.0
(wherein the total amount of the propylene based polymer
(A) and the olefin based block copolymer (BB) is 100% by

weight). Further, the resin composition is sometimes referred to as the "second composition".

The propylene based polymer (A) includes the same propylene polymer as exemplified in the aforementioned first composition. Further, the olefin based block copolymer (BB) is the olefin block copolymer comprising the polymer segments (B1), (B1') and (B2). Structures of the olefin based block copolymer (BB) include (B1)-(B2), (B1)-(B2)-(B1') and (B1)-(B2)-(B1')-(B2)-(B1). Herein, (B1) and (B1') may be identical or different from each other. The olefin based block copolymer (BB) may be an olefin block copolymer comprising the polymer segments (B1), (B1') and (B2), i.e., a copolymer comprising polymer segments other than the polymer segments (B1), (B1') and (B2). In particular, the olefin based block copolymer (BB) is an olefin block copolymer comprising the polymer segments (B1), (B1') and (B2), preferably the aforementioned olefin based block copolymer (B) comprising a triblock structure of (B1)-(B2)-(B1'), and more preferably a triblock structure of (B1)-(B2)-(B1').

Such second composition preferably comprises 40 to 99% by weight of the propylene based polymer (A) and 60 to 1% by weight of the olefin based block copolymer (BB) (wherein the total amount of the propylene based polymer

(A) and the olefin based block copolymer (BB) is 100% by weight), and does not substantially contain an inorganic filler (D).

Furthermore, the second composition preferably
5 comprises 1% by weight or more and less than 40% by weight of the propylene based polymer (A) and more than 60% by weight and 99% by weight or less of the block copolymer (BB) (wherein the total amount of the propylene based polymer (A) and the olefin based block copolymer
10 (BB) is 100% by weight).

In such second composition, the compounding proportion of the propylene based polymer (A) and the olefin based block copolymer (BB), preferable properties, the kinds, the amounts and the like of additives which
15 may be added, of the propylene based polymer (A) and the olefin based block copolymer (BB) can be exemplified by the same those as the first composition.

The second molded product of the invention comprises the above-mentioned second composition. The applications
20 or the like of the second molded product of the invention include the same as those described in the above-mentioned first composition.

MER was determined in accordance with ASTM D-1238 at 190°C under a load of 2.16 kg.

<T_m and Glass Transition Temperature>

The glass transition temperature was determined from the endothermic curve. The measurement was conducted by heating the sample from room temperature at 30°C/min to 200°C, at which it was held for 5 minutes, then cooling it at 10°C/min to -100°C, and heating it again at 10°C/min, there determining the endothermic curve.

10 <Crystallinity>

The crystallinity was determined by dividing the endothermic enthalpy per unit mass, found from the DSC-determined endothermic peak, by 70 cal/g as the endothermic enthalpy of the polyethylene crystal.

15 <Solid Viscoelasticity>

Temperature-dependence of dynamic viscoelasticity was measured using RDS II manufactured by Rheometric Scientific, Inc. at a frequency of 62.5 rad/sec in the temperature range from -80 to 150°C, and storage elastic modulus at 50°C ($G'_{50^\circ\text{C}}$) and storage elastic modulus at 100°C ($G'_{100^\circ\text{C}}$) were determined to calculate a ratio ($G'_{50^\circ\text{C}}/G'_{100^\circ\text{C}}$) of storage elastic modulus.

2. Physical properties of propylene based polymer

(A) and ethylene copolymer (C)

<Density>

A strand obtained after measurement of the melt flow rate at 190°C under a load of 2.16 kg was subjected to
5 heat treatment at 120°C for 1 hour, and was slowly cooled to room temperature over 1 hour, and subsequently the density was measured using a density-gradient tube method.

< α -olefin content>

The α -olefin content was determined by ^{13}C -NMR
10 spectrum.

<Melt Tension (MT)>

The melt tension was determined by measuring a stress given when a molten polymer was stretched at a constant rate. Pellets of the polymer were used as a
15 measuring sample, and the measurement was carried out using a MT measuring apparatus (manufactured by Toyo Seiki Seisaku-Sho, Ltd.) under the conditions of a resin temperature of 190°C, an extrusion speed of 15 mm/min, a winding speed of 10 to 20 m/min, a nozzle diameter of
20 2.09 mm ϕ and a nozzle length of 8 mm.

<MFR>

MFR was determined in accordance with ASTM D-1238 at a given temperature under a load of 2.16 kg.

<Tm>

T_m was regarded as the temperature at the peak positions of the maximum peak in the endothermic curve determined by a DSC. Measurement was conducted by heating the sample put in an aluminum pan at 10°C/min to 5 200°C, at which it was held for 5 minutes, then cooling it at 20°C/min to room temperature, and heating it again at 10°C/min, thereby determining the endothermic curve.

3. Physical properties of propylene based resin
10 composition

< Modulus in Tension (YM) >

The modulus in tension was determined in accordance with JIS K6301 using a JIS No. 3 dumbbell under the conditions of a span of 30 mm, a tensile speed: 30 mm/min
15 and temperature of 23°C

<Izod Impact Strength (IZ) >

The Izod impact strength was determined in accordance with ASTM D256 under the condition of 0°C by using the test specimen having a thickness of 6 mm
20 (notched later).

<Transparency (Haze) >

The transparency was measured using a digital haze meter (Model NDH-20D manufactured by NIPPON DENSYOKU INDUSTRY Co., Ltd.) with the test specimen having a

thickness of 1 mm.

<Whitening Resistance>

The whitening resistance was measured using a digital turbidimeter (Model NDH-20D manufactured by
5 NIPPON DENSYOKU INDUSTRY Co., Ltd.) with respect to haze values after heating the test specimen having a thickness of 1 mm at 121°C for 20 minutes.

<Elongation Set>

A load was applied to a 1 mm thick dumbbell piece
10 having a shape with a length of 50 mm, a length between marked lines (L₀) of 30 mm and a width of 5 mm at a distance between chucks of 30 mm and a tensile speed of 30 mm/min to give 100% set (distance between chucks of 60 mm) and hold for 10 minutes. Then, a length (L; mm)
15 between marked lines at 10 minutes after removing the load was measured. Elongation set was obtained as follows:

$$\text{Elongation Set (\%)} = [(L - L_0)/L_0] \times 100$$

[Heat Resistance (TMA)]

20 TMA curve was measured in accordance with JIS K7196 using a test specimen having a thickness of 1 mm with a needle of 1.8 mmφ under the conditions of a pressure of 2 kg/cm² and an increasing temperature rate of 5°C/min, and needle penetration temperature was determined from the

TMA curve.

[Preparation Example 1]

Olefin based block copolymer (B)

5 To a 1000 mL capacity glass autoclave thoroughly
purged with nitrogen, 800 mL of toluene was introduced,
and the liquid phase and the gas phase were saturated
with a mixing gas of ethylene/nitrogen (ethylene: 30 L/h,
nitrogen: 70 L/h). Thereafter, ethylene and nitrogen
10 feeds were stopped and 15 mmol (in terms of aluminum
atom) of methylaluminoxane was added while feeding
nitrogen to the gas phase, and successively 0.15 mmol of
the titanium compound (1) was added to initiate
polymerization. The reaction was conducted at 25°C for 5
15 minutes, and then a mixing gas of ethylene/butene
(ethylene: 5 L/h, butene: 95 L/h) was circulated to the
liquid phase for 50 minutes while keeping the temperature
at 25°C. Ethylene and propylene in the liquid phase was
purged with nitrogen by feeding the nitrogen gas (100
20 L/h) to the liquid phase for 30 minutes and further
feeding the ethylene gas (100 L/h) to the liquid phase
for 2.5 minutes, and then 25 ml of methanol was added to
terminate the polymerization. After the polymerization
was completed, to the reaction product was added 5.0 ml

of concentrated hydrochloric acid and a large amount of methanol to precipitate a polymer in the whole amount. Then, filtration was effected. The resulting polymer was dried under reduced pressure at 80°C for 10 hours to obtain 11.2 g of a block copolymer (b-2) (PE-EBR-PE). The weight average molecular weight (Mw) of the obtained polymer was 185,200 (in terms of PS), Mw/Mn thereof was 1.25, and the ethylene content in the polymer was 72 mol%.

Then, the weight average molecular weight of the PE segment was calculated as follows. To a 1000 mL capacity glass autoclave thoroughly purged with nitrogen, 800 mL of toluene was introduced, and the liquid phase and the gas phase were saturated with a mixing gas of ethylene/nitrogen (ethylene: 30 L/h, nitrogen: 70 L/h).

Thereafter, ethylene and nitrogen feeds were stopped and 15 mmol (in terms of aluminum atom) of methylaluminoxane was added while feeding nitrogen to the gas phase, and successively 0.15 mmol of the titanium compound (1) was added to initiate polymerization. The reaction was conducted at 25°C for 5 minutes, and then 25 ml of methanol was added to terminate the polymerization. After the polymerization was completed, to the reaction product was added 5.0 ml of concentrated hydrochloric acid and a large amount of methanol to precipitate a

polymer in the whole amount. Then, filtration was effected. The resulting polymer was dried under reduced pressure at 80°C for 10 hours to obtain PE. Mw of the obtained PE was 20,000.

5 Therefore, in the olefin block copolymer (b-2), Mw of each PE segment was 20,000, Mw of the EBR segment was 145,200 and the butene content was 36 mol%.

<Olefin block copolymer (b-4)>

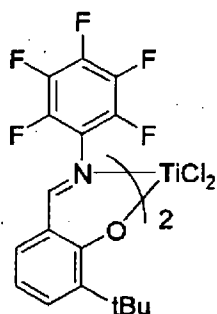
To a 1000 mL capacity glass autoclave thoroughly
10 purged with nitrogen, 800 mL of toluene was introduced,
and the liquid phase and the gas phase were saturated
with a mixing gas of ethylene/nitrogen (ethylene: 50 L/h,
nitrogen: 50 L/h). Thereafter, ethylene and nitrogen
feeds were stopped and 15 mmol (in terms of aluminum
15 atom) of methylaluminoxane was added while feeding
nitrogen to the gas phase, and successively 0.15 mmol of
the titanium compound (1) was added to initiate
polymerization. The reaction was conducted at 25°C for 5
minutes and 40 mL of hexene was added thereto, and then
20 ethylene (3 L/h) was circulated to the liquid phase for
90 minutes while keeping the temperature at 25°C.
Monomer in the liquid phase was purged with nitrogen by
feeding the nitrogen gas (100 L/h) to the liquid phase
for 30 minutes and further feeding the ethylene gas (100

L/h) to the liquid phase for 3.0 minutes, and then 25 ml of methanol was added to terminate the polymerization. After the polymerization was completed, to the reaction product was added 5.0 ml of concentrated hydrochloric acid and a large amount of methanol to precipitate a polymer in the whole amount. Then, filtration was effected. The resulting polymer was dried under reduced pressure at 80°C for 10 hours to obtain 11.5 g of a block copolymer (b-4) (PE-EHR-PE). The weight average molecular weight (Mw) of the obtained polymer was 196,000 (in terms of PS), Mw/Mn thereof was 1.30, and the ethylene content in the polymer was 79 mol%.

Then, the weight average molecular weight of the PE segment was calculated as follows. To a 1000 mL capacity glass autoclave thoroughly purged with nitrogen, 800 mL of toluene was introduced, and the liquid phase and the gas phase were saturated with a mixing gas of ethylene/nitrogen (ethylene: 50 L/h, nitrogen: 50 L/h). Thereafter, ethylene and nitrogen feeds were stopped and 15 mmol (in terms of aluminum atom) of methylaluminumoxane was added while feeding nitrogen to the gas phase, and successively 0.15 mmol of the titanium compound (1) was added to initiate polymerization. The reaction was conducted at 25°C for 5 minutes, and then 25 ml of

methanol was added to terminate the polymerization. After the polymerization was completed, to the reaction product was added 5.0 ml of concentrated hydrochloric acid and a large amount of methanol to precipitate a
5 polymer in the whole amount. Then, filtration was effected. The resulting polymer was dried under reduced pressure at 80°C for 10 hours to obtain PE. Mw of the obtained PE was 28,000.

Therefore, in the block copolymer (b-4), Mw of each
10 PE segments was 28,000, Mw of the EHR segment was 140,000 and the 1-hexene content was 30 mol%.



Properties of the olefin block copolymers (b-2) and (b-4) obtained are shown in Table 1.

[Table 1]

	b-2	b-4
Structure [B1-B2-B1']	PE-EBR-PE	PE-HER-PE
[B1 and B1' segments]		
Mw	Each 20,000	Each 28,000
α -olefin content (mol%)	0	0
B2 segment		
α -olefin	1-butene	1-hexene
Content (mol%)	36	30
[B1-B2-B1' as a whole]		
$\beta\beta$ methylene peak	Present	Present
Density (g/cm ³)	0.874	0.875
Mw	185,200	196,000
Mw/Mn	1.25	1.3
Tg (°C)	-68.2	-63
Tm (°C)	116.4	121
Endothermic enthalpy (mJ/mg)	28.9	39.7
(G' _{50°C})/(G' _{100°C})	1.4	1.9
MFR (g/10 min)	1.6	1.1

[Preparation Example 2]

Ethylene copolymer (C)

5 845 ml of hexane kept at 23°C was introduced to a 2-liter capacity SUS autoclave equipped with a stirrer, which was thoroughly purged with nitrogen. 30 ml of 1-butene was added with rotating the agitator, while it was cooled with ice water, to the autoclave. Then, the inside

10 of the autoclave was heated to 60°C, and pressurized with ethylene to 8 kg/cm² (0.8 MPa) as the total pressure. When the inside pressure reached 8 kg, 1.0 ml of a 1.0 mM/ml decane solution of triisobutylaluminum (TIBA) was

carried by nitrogen into the autoclave under pressure, and then 0.3 ml of a toluene solution prepared beforehand to contain 0.3 mM (in terms of Al) of methylaluminumoxane and 0.001 mM of rac-dimethylsilylene-bis[1-(2-methyl-4-phenyl-indenyl)]zirconium dichloride was carried by
5 nitrogen into the autoclave under pressure, to initiate the polymerization.

Temperature in the autoclave was controlled at 60°C and ethylene was directly fed to keep the pressure in the
10 autoclave at 8 kg/cm² (0.8 MPa) for 30 minutes. Methanol (5 ml) was pumped into the autoclave 30 minutes after the polymerization was initiated to terminate the polymerization, and the pressure in the autoclave was released to the atmospheric pressure. Then, 2 L of
15 acetone was added to the reaction solution with stirring.

The solvent-containing, rubber ball-shaped polymer thus prepared was dried under the conditions of 130°C and 600 torr for 13 hours to obtain 58 g of an ethylene/1-butene copolymer containing 16 mol% of 1-butene.

20 Properties of the ethylene/1-butene copolymer (c-1) obtained are shown in Table 2.

[Table 2]

Copolymer	c-1
Kind of α -olefin	1-butene
α -olefin content (mol%)	16
Ethylene content (mol%)	84
Density (g/cm ³)	0.872
[η]	1.4
Mw/Mn	
MFR (g/10 min)	4.1
MFR ₁₀ /MFR ₂	
MT (g)	0.5
Tg (°C)	-59
Tm (°C)	56
400 × d - 250	99
T _{$\alpha\beta$} /T _{$\alpha\alpha$}	<0.01
B value	1.03

<Propylene based polymer (A)>

The following polymer was used as the propylene
 5 based polymer (A).

Propylene polymer (a-1): manufactured by Mitsui
 Chemicals, Inc.; F327D (MFR = 7 g/10 min, Tm = 139°C,
 amount of n-decane-soluble component = 4.7% by weight,

$[\eta] = 1.4$ dl/g, I_5 of n-decane-insoluble component = 0.95)

Propylene polymer (a-2): manufactured by Mitsui Chemicals, Inc.; J104W (MFR = 6 g/10 min, $T_m = 162^\circ\text{C}$, amount of n-decane-soluble component = 1.7% by weight, $[\eta] = 1.2$ dl/g, I_5 of n-decane-insoluble component = 0.95)

[Example 1]

10 To 30% by weight of the olefin block copolymer (b-2) was added 70% by weight of the propylene polymer (a-1) and the resulting mixture was melt-kneaded at 200°C using a twin-screw extruder to obtain pellets. The pellets obtained was subjected to an injection molding at a
15 cylinder temperature of 200°C and a mold temperature of 40°C using an injection molding machine (Model 55t, manufactured by Toshiba Machine Co., Ltd.). The results of the evaluation of physical properties of the pellets obtained are shown in Table 3.

20

[Examples 2 to 5 and Comparative Examples 1 to 3]

Pellets were formed in the same manner as in Example 1 except that the kind and proportion of the polymer used were changed as shown in Table 3. The results of the

evaluation of physical properties of the pellets obtained are shown in Table 3.

[Table 3]

	Ex. 1	Ex. 2	Ex. 3	Ex. 4	Ex. 5	Comp. Ex. 1	Comp. Ex. 2	Comp. Ex. 3
Propylene polymer								
(a-1)	70	60	60			60		
(a-2)				15	15		15	
Block elastomer								
(b-2)	30	40		85				100
(b-4)			40		85			
Ethylene copolymer								
(c-1)						40	85	
Modulus in Tension (YM) (MPa)	570	450	420	78	59	340		49
IZ (0°C) (J/m)	600	Not broken	Not broken			Not broken		
Transparency (Haze) (%)	52	48	45					
Whitening Resistance (%)	60	55	51			85		
Elongation Set (%)				8	7		25	7
Heat Resistance (TMA)				154	154		65	128

CLAIMS

1. A propylene based resin composition which comprises:

5 [A] 1 to 99% by weight of a propylene based polymer (A) (i) having a melt flow rate (MFR: 230°C and a load of 2.16 kg) of 0.1 to 400 g/10 min, (ii) containing 0.01 to 30% by weight of the component soluble in n-decane at normal temperature having an intrinsic viscosity $[\eta]$, as
10 measured in decalin at 135°C, of 0.2 to 10 dl/g, and (iii) having pentad isotacticity (I_5), as determined by ^{13}C -NMR spectra analysis of the component insoluble in n-decane at normal temperature, of 0.95 or more; and

[B] 99 to 1% by weight of an olefin based block
15 copolymer (B) comprising polymer segments (B1), (B1') and (B2) in which the polymer segments (B1) and (B1') are each independently a polymer of at least one monomer selected from the group consisting of ethylene and α -olefin having 3 to 20 carbon atoms and are each
20 independently a polymer segment of an ethylene based polymer having (i) the ethylene content of 95 to 100 mol% and (ii) a weight average molecular weight (Mw), as measured by high temperature GPC, of 2,000 to 100,000; and in which the polymer segment (B2) is a copolymer of

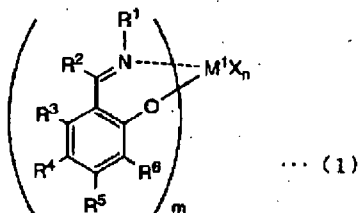
ethylene and at least one selected from an α -olefin having 3 to 20 carbon atoms and is a polymer segment of an ethylene/ α -olefin copolymer having (iii) the ethylene content of 50 to 80 mol% and (iv) a weight average
5 molecular weight (Mw), as measured by high temperature GPC, of 10,000 to 300,000,

which olefin block copolymer is a block copolymer comprising a linear triblock structure of (B1)-(B2)-(B1') and has (v) a peak assigned to $\beta\beta$ methylene in its ^{13}C -
10 NMR spectrum, (vi) a glass transition temperature (T_g), as measured by differential scanning calorimeter (DSC), of -50°C or less, (vii) an endothermic peak assigned to a melting point (T_m) of 105°C or more as measured by DSC, (viii) a endothermic enthalpy, as determined from a
15 melting peak area, as measured by DSC, in the range of 20 to 60 J/g, (ix) a density of 0.870 to 0.910 g/cm³, (x) a melt flow rate (MFR: 190°C and a load of 2.16 kg) in the range of 0.3 to 50 g/10 min, and (xi) a ratio ($(G'_{50^\circ\text{C}})/(G'_{100^\circ\text{C}})$) of a storage elastic modulus at room
20 temperature ($G'_{50^\circ\text{C}}$) to a storage elastic modulus at 100°C ($G'_{100^\circ\text{C}}$), as determined by solid viscoelasticity measurements, of 1.0 to 2.0 (wherein the total amount of the propylene based polymer (A) and the olefin based block copolymer (B) is 100% by weight).

2. The propylene based resin composition according to claim 1, which comprises 40 to 99% by weight of the propylene based polymer (A) and 60 to 1% by weight of the olefin based block copolymer (B) (wherein the total amount of the propylene based polymer (A) and the olefin based block copolymer (B) is 100% by weight), and does not substantially include an inorganic filler (D).

10 3. The propylene based resin composition according to claim 1, which comprises 1% by weight or more and less than 40% by weight of the propylene based polymer (A) and more than 60% by weight and 99% by weight or less of the olefin based block copolymer (B) (wherein the total amount of the propylene based polymer (A) and the olefin based block copolymer (B) is 100% by weight).

4. The propylene based resin composition according to claim 1, wherein the polymer segments (B1), (B1') and (B2) are obtained by polymerization in the presence of a catalyst for olefin polymerization comprising a transition metal compound represented by the following formula (1):



wherein M^1 represents a transition metal atom selected from Groups 4 to 5 of the Periodic Table, m represents 1 or 2, R^1 represents an aromatic hydrocarbon group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group wherein in the case that R^1 is a phenyl group, it has at least one substituent which is selected from heteroatoms and heteroatom-containing groups in at least one position of Positions 2 and 6, or it has at least one substituent which is selected from a heteroatom excluding a fluorine atom, a fluorine-containing group which contains one carbon atom and two or less fluorine atoms, a fluorine-containing group which contains two or more carbon atoms and a group which contains a heteroatom excluding a fluorine atom, in at least one position of Positions 3 to 5, when the location of the carbon atom which is bonded to the nitrogen is taken as Position 1, and in the case that R^1 is an aromatic hydrocarbon group other than a phenyl group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group, it has at least one substituent which is selected from heteroatoms and

heteroatom-containing groups, R^2 to R^5 represent independently a hydrogen atom, a halogen atom, a halogen-containing group, a hydrocarbon group, a hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group or a sulfur-containing group, which may be the same or different from each other, R^6 represents a halogen atom, a halogen-containing group, a hydrocarbon group or a hydrocarbon-substituted silyl group, n is a number which satisfies the valence of M , X represents an oxygen atom, a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and in the case that n is 2 or more, the plural groups represented by X may be the same or different from each other, and may be bonded to each other to form a ring.

5. A molded product which comprises the propylene based resin composition according to any one of claims 1 to 4.

6. The molded product according to claim 5, wherein the molded product is an extrusion molded product or an inflation molded product.

5

7. The molded product according to claim 5 or 6, wherein the molded product is a film or sheet.

8. The molded product according to any one of
10 claims 5 to 7, wherein the molded product is a molded product for medical use.

9. The molded product according to any one of
15 claims 5 to 7, wherein the molded product is a molded product for food packaging.

10. A propylene based resin composition which comprises:

[A] 1 to 99% by weight of a propylene based polymer
20 (A) (i) having a melt flow rate (MFR: 230°C and a load of 2.16 kg) of 0.1 to 400 g/10 min, (ii) containing 0.01 to 30% by weight of the component soluble in n-decane at normal temperature having an intrinsic viscosity $[\eta]$, as measured in decalin at 135°C, of 0.2 to 10 dl/g, and

(iii) having pentad isotacticity (I_5), as determined by ^{13}C -NMR spectra analysis of the component insoluble in n-decane at normal temperature, of 0.95 or more; and

[BB] 99 to 1% by weight of an olefin based block copolymer (BB) comprising polymer segments (B1), (B1') and (B2) in which the polymer segments (B1) and (B1') are each independently a polymer of at least one monomer selected from the group consisting of ethylene and α -olefin having 3 to 20 carbon atoms and are each independently a polymer segment of an ethylene based polymer having (i) the ethylene content of 95 to 100 mol% and (ii) a weight average molecular weight (Mw), as measured by high temperature GPC, of 2,000 to 100,000; and in which the polymer segment (B2) is a copolymer of ethylene and at least one selected from an α -olefin having 3 to 20 carbon atoms and is a polymer segment of an ethylene/ α -olefin copolymer having (iii) the ethylene content of 50 to 80 mol% and (iv) a weight average molecular weight (Mw), as measured by high temperature GPC, of 10,000 to 300,000,

which olefin block copolymer has (v) a peak assigned to $\beta\beta$ methylene in its ^{13}C -NMR spectrum, (vi) a glass transition temperature (T_g), as measured by differential scanning calorimeter (DSC), of -50°C or less, (vii) an

endothermic peak assigned to a melting point (T_m) of
105°C or more as measured by DSC, (viii) a endothermic
enthalpy, as determined from a melting peak area, as
measured by DSC, in the range of 20 to 60 J/g, (ix) a
5 density of 0.870 to 0.910 g/cm³, (x) a melt flow rate
(MFR: 190°C and a load of 2.16 kg) in the range of 0.3 to
50 g/10 min, and (xi) a ratio ($(G'_{50^\circ\text{C}}) / (G'_{100^\circ\text{C}})$) of a
storage elastic modulus at room temperature ($G'_{50^\circ\text{C}}$) to a
storage elastic modulus at 100°C ($G'_{100^\circ\text{C}}$), as determined
10 by solid viscoelasticity measurements, of 1.0 to 2.0
(wherein the total amount of the propylene based polymer
(A) and the olefin based block copolymer (BB) is 100% by
weight).

15 11. A molded product which comprises the propylene
based resin composition according to claim 10.

INTERNATIONALSEARCHREPORT

International application No.

PCT/JP2006/316816

A. CLASSIFICATION OF SUBJECT MATTER		
Int.Cl. C08L23/10 (2006.01) i, C08F4/642 (2006.01) i		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
Int.Cl. C08L23/00-23/36, C08F4/64-4/70, C08F297/08		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Published examined utility model applications of Japan 1922-1996 Published unexamined utility model applications of Japan 1971-2006 Registered utility model specifications of Japan 1996-2006 Published registered utility model applications of Japan 1994-2006		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2004-204058 A (MITSUI CHEMICALS, INC.) 2004.07.22, all documents	1, 2, 4, 5, 10, 11
Y	JP 2004-204057 A (MITSUI CHEMICALS, INC.) 2004.07.22, all documents	1, 2, 4, 5, 10, 11
A	JP 2000-119316 A (MITSUI CHEMICALS, INC.) 2000.04.25, all documents	1-11
A	JP 2001-181332 A (MITSUI CHEMICALS, INC.) 2001.07.03, all documents	1-11
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
* Special categories of cited documents:		
"A"	document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E"	earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P"	document published prior to the international filing date but later than the priority date claimed	
Date of the actual completion of the international search	Date of mailing of the international search report	
20.11.2006	28.11.2006	
Name and mailing address of the ISA/JP	Authorized officer	4J 9362
Japan Patent Office		
3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Telephone No. +81-3-3581-1101 Ext. 3457	

INTERNATIONALSEARCHREPORT

International application No.
PCT/JP2006/316816

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2003-301010 A (MITSUI CHEMICALS, INC.) 2003.10.21, all documents	1-11
A	WO 91/12285 A1 (EXXON CHEMICAL PATENTS INC.) 1991.08.22, all documents	1-11

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
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