composition that is highly balanced in rigidity and impact resistance.

CITATION LIST

PATENT LITERATURE

[0010]

[Patent Literature 1] JP-A-2007-84806

[Patent Literature 2] JP-A-2012-237013

[Patent Literature 3] JP-T-1996-502303

[Patent Literature 4] JP-A-2001-527589

[Patent Literature 5] JP-A-2002-105132

[Patent Literature 6] JP-A-2007-39540

[Patent Literature 7] JP-A-2007-39541

[Patent Literature 8] JP-A-2009-144148

SUMMARY [0010a] In one aspect of the present disclosure, there is provided a propylene-based resin composition characterized by comprising from 1 to 99 parts by weight of a propylene-based polymer (α) whose melt flow rate (MFR) at 230°C under a load of 2.16 kg obtained according to ASTM D1238E is from 0.1 to 500 g/10 min and from 1 to 99 parts by weight of an olefin-based resin (β) satisfying the following requirements (I) to (V) (in which a sum of the (α) and the (β) is 100 parts by weight):

(I) the olefin-based resin (β) includes a grafted olefin-based polymer [R1] having a main chain comprising an ethylene/α-olefin copolymer and at least one side chain comprising an ethylene polymer;

(II) the olefin-based resin (β) has a melting peak in a range of from 60 to 130°C in a differential scanning calorimetry (DSC) measurement and a melting heat quantity ΔH at the melting peak is in a range of from 5 to 100 J/g;

(III) a percentage E of an ortho-dichlorobenzene soluble component at 20°C or lower measured by cross-fractionation chromatography (CFC) is 45% by weight or less;

(IV) a glass transition temperature Tg measured by differential scanning calorimetry (DSC) is in a range of from −80 to −30°C; and

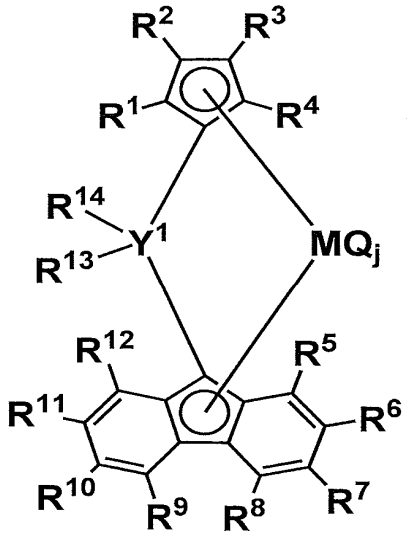
(V) an intrinsic viscosity [η] measured in decalin at 135°C is in a range of from 0.1 to 12 dl/g.

[0010b] In another aspect of the present disclosure, there is provided a method for producing the olefin-based resin (β) disclosed herein, comprising a step of copolymerizing ethylene with at least one α-olefin selected from α-olefins having 3 to 20 carbon atoms in the presence of an olefin polymerization catalyst including the following components (A) to (C):

(A) a crosslinking metallocene compound represented by the following general formula (I);

(B) a transition metal compound represented by the following general formula [B]; and

(C) at least one compound selected from an organometallic compound (C-1), an organoaluminum oxy compound (C-2), and a compound (C-3) that reacts with the crosslinking metallocene compound (A) or the transition metal compound (B) to form a pair of ions,



. . . (I)

(in the formula (I), R^1, R^2, R^3, R^4, R^5, R^8, R^9, and R^{12} each independently represent a hydrogen atom, a hydrocarbon group, a silicon-containing group, or a hetero atom-containing group other than silicon-containing groups, in which adjacent two groups of R^1 to R^4 may bond to each other to form a ring;

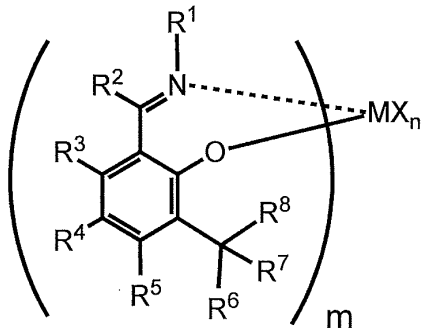
R^6 and R^{11} are the same atom or the same group selected from a hydrogen atom, hydrocarbon groups, silicon-containing groups, and hetero atom-containing groups other than silicon-containing groups, R^7 and R^{10} are the same atom or the same group selected from a hydrogen atom, hydrocarbon groups, silicon-containing groups, and hetero atom-containing groups other than silicon-containing groups, in which R^6 and R^7 may bond to each other to form a ring, and R^{10} and R^{11} may bond to each other to form a ring, provided that not all of R^6, R^7, R^{10}, and R^{11} are hydrogen atoms;

R^{13} and R^{14} each independently represent an aryl group;

M represents a titanium atom, a zirconium atom, or a hafnium atom;

Y^1 represents a carbon atom or a silicon atom;

Q represents a halogen atom, a hydrocarbon group, a halogenated hydrocarbon group, a neutral conjugated or non-conjugated diene having 4 to 10 carbon atoms, an anion ligand, or a neutral ligand capable of being coordinated with a lone pair of electrons, and j represents an integer of from 1 to 4, in which when j is an integer of 2 or larger, a plurality of Qs each may be the same as or different from each other),



· · · [B]

(in the general formula [B], M represents a transition metal atom of group IV or V in the periodic table;

m represents an integer of from 1 to 4;

R^1 represents a hydrocarbon group having 1 to 8 carbon atoms represented by general formula $C_{n'}H_{2n'+1}$ (n' is an integer of from 1 to 8);

R^2 to R^5 may be the same as or different from each other, and represent a hydrogen atom, a halogen atom, a hydrocarbon group, a heterocyclic compound residue, an oxygen-containing group, a nitrogen-containing group, a boron-containing group, a sulfur-containing group, a phosphorous-containing group, a silicon-containing group, a germanium-containing group, or a tin-containing group, in which two or more thereof may bond to each other to form a ring;

R^6 to R^8 are hydrocarbon groups, at least one of which is an aromatic hydrocarbon group, and when m is an integer of 2 or

larger, two of the groups represented by R^2 to R^8 between structural units of formula [B] may be bonded to each other;

n is a value satisfying a valence of M, and X represents 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 phosphorous-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group, or a tin-containing group, in which when n is an integer of from 2 or larger, a plurality of Xs may be the same as or different from each other, an]d the plurality of groups represented by X may bond to each other to form a ring).

[0010c] In a further aspect of the present disclosure, there is provided a molded article comprising the propylene-based resin composition disclosed herein.

Technical Problem

[0011]

It is an object of the present invention to provide a propylene-based resin composition that has an excellent balance between rigidity and impact resistance.

Solution to Problem

[0012]

The present inventors conducted intensive and extensive studies to solve the above problem and consequently found that a propylene-based resin composition including an olefin-based

CLAIMS

1. A propylene-based resin composition characterized by comprising from 1 to 99 parts by weight of a propylene-based polymer (α) whose melt flow rate (MFR) at 230°C under a load of 2.16 kg obtained according to ASTM D1238E is from 0.1 to 500 g/10 min and from 1 to 99 parts by weight of an olefin-based resin (β) satisfying the following requirements (I) to (V) (in which a sum of the (α) and the (β) is 100 parts by weight):

(I) the olefin-based resin (β) includes a grafted olefin-based polymer [R1] having a main chain comprising an ethylene/α-olefin copolymer and at least one side chain comprising an ethylene polymer;

(II) the olefin-based resin (β) has a melting peak in a range of from 60 to 130°C in a differential scanning calorimetry (DSC) measurement and a melting heat quantity ΔH at the melting peak is in a range of from 5 to 100 J/g;

(III) a percentage E of an ortho-dichlorobenzene soluble component at 20°C or lower measured by cross-fractionation chromatography (CFC) is 45% by weight or less;

(IV) a glass transition temperature Tg measured by differential scanning calorimetry (DSC) is in a range of from −80 to −30°C; and

(V) an intrinsic viscosity [η] measured in decalin at 135°C is in a range of from 0.1 to 12 dl/g.

2. The propylene-based resin composition according to claim 1, wherein the side chain of the grafted olefin-based polymer [R1] has a weight average molecular weight in a range of from 500 to 10000.

3. The propylene-based resin composition according to claim 1, wherein the side chain is present with an average frequency of from 0.3 to 20 per 1000 carbon atoms included in the main chain of the grafted olefin-based polymer [R1].

4. The propylene-based resin composition according to claim 1, wherein the olefin-based resin (β) further satisfies the following requirement (VI):

(VI) when the MFR of the olefin-based resin (β) at 190°C under the load of 2.16 kg obtained according to ASTM D1238E is M g/10 min and the intrinsic viscosity [η] of the olefin-based resin (β) measured in decalin at 135°C is H g/dl, a value A represented by the following relational equation (Eq-1) is in a range of from 30 to 280:

$$A = M/\exp(-3.3H) \quad \ldots \text{(Eq-1)}$$

5. The propylene-based resin composition according to claim 1, wherein the olefin-based resin (β) further satisfies the following requirement (VII):

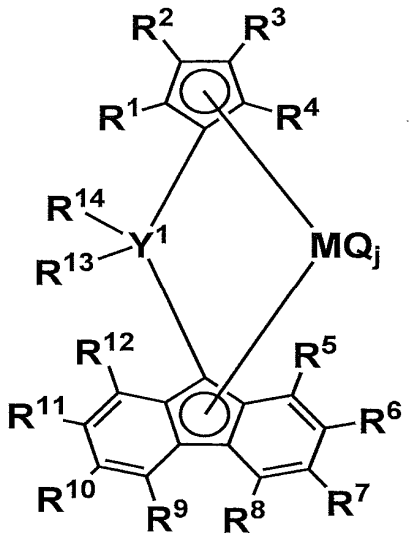
(VII) in a four-component approximation by a Lorentz function performed for a free induction decay curve obtained by a Carr Purcell Meiboom Gill method in a pulsed nuclear magnetic resonance (pulsed NMR) measurement at 200°C., a spin-spin relaxation time (T2) of a component having a highest mobility is in a range of from 150 to 500 ms and an abundance ratio of the component is in a range of from 15 to 50%.

6. A method for producing the olefin-based resin (β) according to claim 1, comprising a step of copolymerizing ethylene with at least one α-olefin selected from α-olefins having 3 to 20 carbon atoms in the presence of an olefin polymerization catalyst including the following components (A) to (C):

(A) a crosslinking metallocene compound represented by the following general formula (I);

(B) a transition metal compound represented by the following general formula [B]; and

(C) at least one compound selected from an organometallic compound (C-1), an organoaluminum oxy compound (C-2), and a compound (C-3) that reacts with the crosslinking metallocene compound (A) or the transition metal compound (B) to form a pair of ions,



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(in the formula (I), R^1, R^2, R^3, R^4, R^5, R^8, R^9, and R^{12} each independently represent a hydrogen atom, a hydrocarbon group, a silicon-containing group, or a hetero atom-containing group other than silicon-containing groups, in which adjacent two groups of R^1 to R^4 may bond to each other to form a ring;

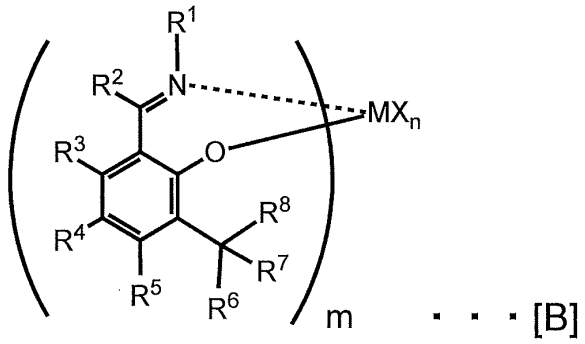
R^6 and R^{11} are the same atom or the same group selected from a hydrogen atom, hydrocarbon groups, silicon-containing groups, and hetero atom-containing groups other than silicon-containing groups, R^7 and R^{10} are the same atom or the same group selected from a hydrogen atom, hydrocarbon groups, silicon-containing groups, and hetero atom-containing groups other than silicon-containing groups, in which R^6 and R^7 may bond to each other to form a ring, and R^{10} and R^{11} may bond to each other to form a ring, provided that not all of R^6, R^7, R^{10}, and R^{11} are hydrogen atoms;

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R^2 to R^5 may be the same as or different from each other,

and represent a hydrogen atom, a halogen atom, a hydrocarbon group, a heterocyclic compound residue, an oxygen-containing group, a nitrogen-containing group, a boron-containing group, a sulfur-containing group, a phosphorous-containing group, a silicon-containing group, a germanium-containing group, or a tin-containing group, in which two or more thereof may bond to each other to form a ring;

R^6 to R^8 are hydrocarbon groups, at least one of which is an aromatic hydrocarbon group, and when m is an integer of 2 or larger, two of the groups represented by R^2 to R^8 between structural units of formula [B] may be bonded to each other;

n is a value satisfying a valence of M, and X represents 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 phosphorous-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group, or a tin-containing group, in which when n is an integer of from 2 or larger, a plurality of Xs may be the same as or different from each other, and the plurality of groups represented by X may bond to each other to form a ring).

7. The method for producing the olefin-based resin (β) according to claim 6, wherein the copolymerizing step is a step of copolymerizing by a solution polymerization method in a temperature range of from 80 to 300°C.

8. A molded article comprising the propylene-based resin composition according to claim 1.