also discloses applying such a composition to eating utensils or a tumbler. Further, Patent Documents 4 and 5 disclose synthetic paper made of a composition comprising an inorganic substance and a polyolefin resin.

Citation List

Patent Documents

[0006]

Patent Document 1: JP 2012-082388 A

Patent Document 2: JP 2017-132920 A

Patent Document 3: WO 2017/209215

Patent Document 4: JP 2001-071378 A

Patent Document 5: WO 2018/092494

Summary

[0006a]

In an aspect of the present disclosure, there is provided a resin composition (X) comprising:

10 to 50 parts by mass of a 4-methyl-1-pentene·α-olefin copolymer (A-1); and

50 to 90 parts by mass of an inorganic substance (B) (assuming that the total amount of the 4-methyl-1-pentene·α-olefin copolymer (A-1) and the inorganic substance (B) is 100

parts by mass), and satisfying the following requirements (a) and (b):

a requirement (a); having a tan δ peak temperature of 0°C or higher and 60°C or lower, the tan δ peak temperature being obtained by performing dynamic viscoelastic measurement at a frequency of 10 rad/s (1.6 Hz) in the temperature range of -40 to 150°C, and

a requirement (b); having a tan δ peak value of 0.8 or more and 5.0 or less, the tan δ peak value being obtained by performing dynamic viscoelastic measurement at a frequency of 10 rad/s (1.6 Hz) in the temperature range of -40 to 150°C.

[0006b]

In another aspect of the present disclosure, there is provided a resin composition (X) comprising:

10 to 50 parts by mass of a thermoplastic resin (A); and

50 to 90 parts by mass of an inorganic substance (B) (assuming that the total amount of the thermoplastic resin (A) and the inorganic substance (B) is 100 parts by mass), and satisfying the following requirements (a) and (b):

a requirement (a); having a tan δ peak temperature of 0°C or higher and 60°C or lower, the tan δ peak temperature being obtained by performing dynamic viscoelastic measurement at a frequency of 10 rad/s (1.6 Hz) in the temperature range of -40 to 150°C; and

a requirement (b); having a tan δ peak value of 0.8 or more and 5.0 or less, the tan δ peak value being obtained by performing dynamic viscoelastic measurement at a frequency of 10 rad/s (1.6 Hz) in the temperature range of -40 to 150°C.

[0006c]

In a further aspect of the present disclosure, there is provided a molded article comprising the resin composition disclosed herein.

[0006d]

In another aspect of the present disclosure, there is provided a sheet comprising the resin composition disclosed herein.

[0006e]

In a further aspect of the present disclosure, there is provided a toy comprising the resin composition disclosed herein.

[0006f]

In another aspect of the present disclosure, there is provided a daily good comprising the resin composition disclosed herein.

[0006g]

In a further aspect of the present disclosure, there is provided an electronic equipment housing comprising the resin composition disclosed herein.

Technical Problem

[0007]

The above-mentioned materials described in Patent Documents 1 and 2 have a high tan δ peak value at room temperature but may cause problems such as occurrence of stickiness on the surface of a molded article and deterioration in injection moldability due to the viscosity. Therefore, to avoid such problems, each of the materials described in Patent Documents 1 and 2 needs to be made into a

5.0 or less. This peak value of the tan δ is preferably 0.6 or more and 4.5 or less, more preferably 0.8 or more and 3.5 or less.

[0027]

Tan δ can be calculated using storage modulus (G') and loss modulus (G"), which are obtained when the dynamic viscoelasticity is measured, as a ratio of the loss modulus (G") to the storage modulus (G'), (G"/G': loss tangent).

[0028]

In the present invention, a temperature at which tan δ takes a peak value (maximum value) in the range of -40 to 150°C is defined as the above-described temperature at which tan δ takes a peak value (hereinafter, also referred to as "tan δ peak temperature"), and the value of the tan δ on that occasion is defined as the above-described peak value of the tan δ (hereinafter, also referred to as "tan δ peak value"). The peak is considered to arise from the glass transition temperature of the thermoplastic resin composition.

[0029]

Hereinafter, the thermoplastic resin (A) and the inorganic substance (B), which form the resin composition (X) of the present invention, will be described.

<Thermoplastic Resin (A)>

The resin composition (X) of the present invention comprises the thermoplastic resin (A).

870 to 830 kg/m^3, more preferably 865 to 830 kg/m^3, further preferably 855 to 830 kg/m^3. Note that the details such as the measurement condition are as described in the section of Examples mentioned later.

[0049]

The density can appropriately be changed by the comonomer composition ratio in the copolymer (A-1), and the copolymer (A-1) having a density within the range described above is advantageous in producing a lightweight sheet.

Requirement (j);

The 4-methyl-1-pentene·α-olefin copolymer (A-1) preferably has a melt flow rate (MFR; Melt Flow Rate) (measured at 230°C with a load of 2.16 kg according to ASTM D1238) of 4.0 to 30 g/10 min, more preferably 7.0 to 15 g/10 min, further preferably 7.0 to 13 g/10 min. The copolymer (A-1) having a melt flow rate within the range described above is advantageous in producing a pellet and a sheet which are satisfactory in molding, and a molded article.

[0050]

A particularly preferred embodiment of the 4-methyl-1-pentene·α-olefin copolymer (A-1) further satisfies the requirement (g) in addition to the requirements (c) to (f), and a most especially preferred embodiment further satisfies one or more, preferably two or more selected from the

[0055]

The polymerization temperature is preferably -50°C or higher and 200°C or lower, more preferably 0°C or higher and 100°C or lower, further preferably 20°C or higher and 100°C or lower.

The polymerization pressure is preferably normal pressure or higher and 10 MPa gauge pressure or less, more preferably normal pressure or higher and 5 MPa gauge pressure or less.

[0056]

In order to control the molecular weight of the polymer to be produced or the polymerization activity, hydrogen may be added when polymerization is performed. As the amount of hydrogen to be added, approximately 0.001 NL or more and 100 NL or less per 1 kg of the total amount of the monomers that derive the constitutional unit (i) to the constitutional unit (iii) is proper.

[0057]

«Styrene Elastomer (A-2)»

Examples of the styrene elastomer (A-2) include a block copolymer of a polystyrene block which is a hard segment (or crystalline segment) and a diene monomer block which is a soft segment (or amorphous segment), and the hard segment may be present at both ends of the soft segment. Examples of the styrene elastomer (A-2) include styrene·butadiene-styrene

be used include unsaturated carboxylic acids known in the art. The derivative of the unsaturated carboxylic acid is not particularly limited as long as the derivative of the unsaturated carboxylic acid is a compound having a reactive double bond and having a group which can be derived from a carboxylic acid group, and examples thereof include anhydrides, esters, acid halides, amides, and imides of unsaturated carboxylic acids.

[0079]

Examples of the unsaturated carboxylic acid include unsaturated monocarboxylic acids such as acrylic acid, methacrylic acid, crotonic acid, and isocrotonic acid, and unsaturated dicarboxylic acids such as maleic acid, fumaric acid, tetrahydrophthalic acid, itaconic acid, citraconic acid, norbornene dicarboxylic acid, and nadic acid (endo-cis-bicyclo[2.2.1]hept-5-ene-2,3-dicarboxylic acid). By using the unsaturated carboxylic acid, a modified hydrocarbon resin having a carboxylic acid group is obtained.

[0080]

As the anhydride of the unsaturated carboxylic acid, anhydrides of the unsaturated dicarboxylic acids described above can be used. Specific examples thereof include maleic anhydride, itaconic anhydride, citraconic anhydride, tetrahydrophthalic anhydride, and nadic anhydride (endo-cis-

butylphenol)), phosphorus antioxidants (such as tetrakis(2,4-di-t-butylphenyl)-4,4-biphenylene diphosphonate), and amine antioxidants (such as N,N-diisopropyl-p-phenylenediamine). n-Octadecyl 3-(4'-hydroxy-3',5'-di-t-butylphenyl)propionate which is used in Examples mentioned later corresponds to a phenol antioxidant.

[0092]

Examples of the flame retardant include phosphoric acid esters and other phosphorus compounds, such as ammonium polyphosphate, ethylenebistris(2-cyanoethyl)phosphonium chloride, tris(tribromophenyl)phosphate, and tris(3-hydroxypropyl)phosphine oxide, chlorine flame retardants such as chlorinated paraffin, chlorinated polyolefins, and perchlorocyclopentadecane, bromine flame retardants such as hexabromobenzene, ethylenebisdibromonorbornanedicarboximide, ethylenebistetrabromophthalimide, tetrabromobisphenol A derivatives, tetrabromobisphenol S, and tetrabromodipentaerythritol, and mixtures thereof.

[0093]

Examples of the ultraviolet absorber include benzotriazole ultraviolet absorbers, benzophenone ultraviolet absorbers, salicylic acid ultraviolet absorbers, and acrylate ultraviolet absorbers.

130°C for 12 hours, to give 44.0 g of a powdery 4-methyl-1-pentene α-olefin copolymer (A-1-2) (hereinafter, referred to as "copolymer A-1-2"). Results of measuring the physical properties of the obtained copolymer A-1-2 are shown in Table 1.

[0130]

In the copolymer A-1-2, the content by percentage of 4-methyl-1-pentene was 84.1% by mol, and the content by percentage of propylene was 15.9% by mol. The copolymer A-1-2 had a density of 838 kg/m^3. The copolymer A-1-2 had an intrinsic viscosity [η] of 1.5 dl/g, a weight-average molecular weight (Mw) of 340,000, a molecular weight distribution (Mw/Mn) of 2.1, and a melt flow rate (MFR) of 11 g/10 min. The copolymer A-1-2 had a melting point (Tm) of 132°C.

[0131]

[Table 1]

Table 1

			Copolymer A-1-1	Copolymer A-1-2
Composition	Content by percentage of 4MP1 unit	mol%	72.5	84.1
	α-Olefin that forms AO unit		Propylene	Propylene
	Content by percentage of AO unit	mol%	27.5	15.9
Intrinsic viscosity [η]		dl/g	1.5	1.5
Weight-average molecular weight (Mw)			337000	340000
Molecular weight distribution (Mw/Mn)			2.1	2.1
Melt flow rate (MFR)		g/10 min	11	11
Density		kg/m^3	839	838
Melting point (T_m)		°C	Not observed	132
tan δ peak: peak temperature		°C	30	43