

A POLYCARBONATE RESIN COMPOSITION

The present invention relates to a resin composition containing a polycarbonate resin.

Polycarbonate (PC) resins and polymer alloys consisting of these resins with ABS (acrylonitrile-butadiene-styrene) resins blended in are widely used in electrical and electronic equipment, automated office equipment, etc. In recent years, requirements for smaller size and lighter weight have become increasingly more stringent, and a need has arisen for thinner walls of housings and cabinets. In order to meet this need, new molding methods have been tried out, and improvements have also been made from the materials side. For example, in order to achieve thinner walls, low-molecular-weight polycarbonate has been used, and attempts have been made to improve fluidity by increasing the mixing ratio of ABS resin and SAN resin (Japanese Laid-Open Patent No. 83-46269).

However, for example, when the molecular weight of PC in a PC/ABS polymer alloy is decreased, this causes drawbacks such as product defects, including a tendency to develop edge cracks during molding of products such as automated office equipment. On the other hand, when the blending ratio of ABS resin and SAN resin is increased, this causes the drawbacks of decreased thermal resistance and reduced strength. For this reason, the purpose of the present invention is to provide a polycarbonate resin composition which allows thin-wall molding to be carried out while maintaining characteristics such as fluidity, chemical resistance, thermal resistance, and impact resistance. The present invention also has the purpose of providing a polycarbonate resin composition with outstanding flame resistance.

As a result of thorough research conducted on polycarbonate resin compositions, the inventors of the present invention discovered that by setting the molecular weight of the polycarbonate resin forming the matrix to a set level or above, and by limiting the molecular weight of the aromatic vinyl/vinyl cyanide resin forming the dispersed phase, it was possible to obtain a resin composition having favorable chemical resistance and various other properties, particularly fluidity, thus arriving at the present invention.

Specifically, the present invention provides a resin composition containing (A) 90-10 parts by weight of a polycarbonate resin having a viscosity average molecular

weight of 20,000 or above,

(B) 1-50 parts by weight of a copolymer containing (a) an aromatic vinyl monomer component and (b) a vinyl cyanide monomer component as its copolymer constituent and having a weight average molecular weight of 30,000-110,000, and

5 (C) 1-50 parts by weight of a copolymer containing (a) an aromatic vinyl monomer component, (b) a vinyl cyanide monomer component, and (c) a rubber polymer as its copolymer constituent.

The polycarbonate resin used in the present invention is an aromatic polycarbonate produced by means of the well-known phosgene method or melt method (e.g., see
10 Japanese Laid-Open Patent Publication No. 88-215763 and Japanese Laid-Open Patent Publication No. 90-124934. Examples of the diphenyl used as a raw material include 2,2-bis(4-hydroxyphenyl)propane (referred to as bisphenol A), 2,2-bis(3,5-dibromo-4-hydroxyphenyl)propane, 2,2-bis(3,5-dimethyl-4-hydroxyphenyl)propane, 1,1-bis(4-hydroxyphenyl)cyclohexane,
15 1,1-bis(3,5-dimethyl-4-hydroxyphenyl)cyclohexane, 1,1-bis(4-hydroxyphenyl)decane, 1,4-bis(4-hydroxyphenyl)propane, 1,1-bis(4-hydroxyphenyl)cyclododecane, 1,1-bis(3,5-dimethyl-4-hydroxyphenyl)cyclododecane, 4,4-dihydroxydiphenyl ether, 4,4-thiodiphenol, 4,4-dihydroxy-3,3-dichlorodiphenyl ether, and 4,4-dihydroxy-2,5-dihydroxydiphenyl ether. Moreover, examples of precursor
20 substances used to introduce the carbonate include phosgene and diphenyl carbonate.

In the present invention, the polycarbonate resin should have a viscosity average molecular weight (M_v) of 20,000 or above, and preferably 21,000 or above, with a weight of 22,000 or above being particularly preferred. If the molecular weight is
25 excessively low, chemical resistance becomes poor. There are no particular restrictions on the upper limit of viscosity average molecular weight, but for practical purposes, this weight should be 40,000 or below. In the present invention, viscosity average molecular weight was determined by measuring intrinsic viscosity (limiting viscosity) at 20°C in methylene chloride and then calculating the value using the Mark-Houwink viscosity formula shown below:

30 Numerical Formula

$$\eta = KM^a \quad (1)$$

In the formula, η equals limiting viscosity, K and a are constants ($K = 1.23 \times 10^{-4}$, $a = 0.83$), and M = molecular weight.

Next, component (B) is a copolymer containing (a) an aromatic vinyl monomer
35 component and (b) a vinyl cyanide monomer component. Component (B) contributes

towards improving the moldability (fluidity) of the resin composition.

Examples of the (a) aromatic vinyl monomer component include styrene, α -methylstyrene, o-, m-, or p-methylstyrene, vinylxylene, monochlorostyrene, dichlorostyrene, monobromostyrene, dibromostyrene, fluorostyrene, p-tert-butylstyrene, ethylstyrene, and vinylanthracene, and these substances may be used alone or in combinations of two or more. The preferred substances are styrene and α -methylstyrene.

Examples of (b) the vinyl cyanide monomer component include acrylonitrile and methacrylonitrile, and these substances may be used alone or in combinations of two or more. There are no particular restrictions on the composition ratio of these substances, and this should be selected depending on the application.

There are no particular restrictions on the composition ratio of (a)/(b), and preferred amounts in component (B) are 95-50% by weight of (a) and 5-50% by weight of (b), with the amounts of 92-65% by weight of (a) and 8-35% by weight of (b) being particularly preferred.

SAN resin (styrene-acrylonitrile copolymer) can be mentioned as a preferred example of the copolymer of component (B).

There are no particular restrictions on the method of manufacturing the copolymer component (B), and any ordinary method such as block polymerization, melt polymerization, block suspension polymerization, suspension polymerization, and emulsion polymerization, may be used. Moreover, this copolymer may also be obtained by blending separately copolymerized resins.

In the present invention, the weight average molecular weight (M_w) of the copolymer of component (B) should be 30,000-110,000, and preferably 40,000-80,000. If the molecular weight of the copolymer of component (B) is below the aforementioned range, this will cause a decrease in physical properties, and if it is above the aforementioned range, fluidity will be impaired.

(C) is a copolymer containing (a) an aromatic vinyl monomer component, (b) a vinyl cyanide monomer component, and (c) a rubber polymer. Examples of (a) the aromatic vinyl monomer component and (b) the vinyl cyanide monomer components are given above under the description of component (B). Examples of (c) the rubber polymer include random copolymers and block copolymers of polybutadiene, polyisoprene, and styrene-butadiene, hydrogenates of said block copolymers, diene rubbers such as acrylonitrile-butadiene copolymer and butadiene-isoprene copolymer, ethylene-propylene random copolymers and block copolymers, ethylene-butene

random copolymers and block copolymers, copolymers of ethylene and α -olefins, copolymers of ethylene-unsaturated carboxylic acid esters such as ethylene-methacrylate and ethylene-butylacrylate, acrylic acid ester-butadiene copolymers, for example, acrylic flexible polymers such as butylacrylate-butadiene copolymer, copolymers of ethylene and fatty acid vinyl such as ethylene-vinyl acetate, ethylene-propylene non-conjugated diene terpolymers such as ethylene-propylene-ethylidene norbornene copolymers and ethylene-propylene-hexadiene copolymer, butylene-isoprene copolymers, and chlorinated polyethylene, with these substances being used alone or in combinations of two or more. Examples of preferred rubber polymers include ethylene-propylene rubber, ethylene-propylene non-conjugated diene terpolymers, diene rubber, and acrylic flexible polymers, with polybutadiene and styrene-butadiene copolymer being particularly preferred, and the styrene content of this styrene-butadiene copolymer should preferably be 50% by weight or below.

There are no particular restrictions on the composition ratio of components (a), (b), and (c) in component (C), and the various components are blended in depending on the application.

In component (C), in addition to the aforementioned components (a), (b), and (c), a (d) monomer which can be copolymerized with these components may be used in an amount which does not adversely affect the purpose of the present invention. Examples of this copolymerizable monomer include α,β -unsaturated carboxylic acids such as acrylic acid and methacrylic acid, α,β -unsaturated carboxylic acid esters such as methyl(meth)acrylate, ethyl(meth)acrylate, propyl(meth)acrylate, butyl(meth)acrylate, 2-ethyl(meth)acrylate, and 2-ethylhexylmethacrylate, α,β -unsaturated dicarboxylic acid anhydrides such as maleic anhydride and itaconic anhydride, and imide compounds of α,β -unsaturated dicarboxylic acids such as maleimide, N-methylmaleimide, N-ethylmaleimide, N-phenylmaleimide, and N-o-chlorophenylmaleimide, and these monomers may be used alone or in combinations of two or more.

The copolymer of component (C) should preferably be a graft copolymer, etc., formed by graft copolymerization of the other components in the presence of (c) a rubber polymer, with preferred resins being ABS resin (acrylonitrile-butadiene-styrene copolymer), AES resin (acrylonitrile-ethylene-propylene-styrene copolymer), ACS resin (acrylonitrile-chlorinated polyethylene-styrene copolymer), and AAS resin (acrylonitrile-acrylic flexible polymer-styrene copolymer).

The same method as that described above for the (B) copolymer may be used to manufacture the copolymer of component (C).

The aforementioned components (A), (B), and (C) are blended in the following ratio. Specifically, they are used in the amount of 90-10 parts by weight of (A), 1-50 parts by weight of (B), and 1-50 parts by weight of (C) with respect to a total of 100 parts by weight of (A)-(C), with amounts of 85-20 parts by weight of (A), 1-40 parts by weight of (B), and 1-30 parts by weight of (C) being preferred. If the amount of (A) is above the aforementioned range, fluidity is decreased, and if it is below the aforementioned range, thermal resistance decreases. If the amount of (B) is above the aforementioned range, this will cause a decrease in strength, and if it is below the aforementioned range, this will have a detrimental effect on fluidity. If the amount of (C) is above the aforementioned range, stiffness will decrease, and if it is below the aforementioned range, flame resistance will decrease.

In addition to the aforementioned components, (D) a composite rubber graft copolymer formed by grafting a vinyl monomer onto composite rubber containing polyorganosiloxane and polyalkyl(meth)acrylate may be blended into the resin composition of the present invention in order to improve flame resistance. Component (D) is a composite rubber graft copolymer formed by graft polymerization of one or two or more vinyl monomers onto a composite rubber having a composite unified structure in which the polyorganosiloxane rubber component and the polyalkyl(meth)acrylate rubber component are mutually interlinked.

For example, this composite rubber graft copolymer may be manufactured by methods such as that described in the specification of Japanese Laid-Open Patent Publication No. 89-79257.

It is appropriate to manufacture this composite rubber by the method of emulsion polymerization. Preferably, latex should first be prepared from polyorganosiloxane rubber, the monomer for synthesizing alkyl(meth)acrylate rubber should then be used to impregnate rubber particles of polyorganosiloxane rubber latex, and the monomer for synthesis of alkyl(meth)acrylate rubber should then be polymerized.

For example, the polyorganosiloxane rubber component may be prepared by emulsion polymerization using the following organosiloxane shown below and a cross-linking agent (I), and at this time, a graft crossing agent (I) may be used in combination.

An example of this organosiloxane is a chain organosiloxane such as dimethylsiloxane. Moreover, one may also use various cyclic organosiloxanes with 3

or more members, and preferably 3-6 members. Examples include hexamethylcyclotrisiloxane, octamethylcyclotetrasiloxane, decamethylcyclopentasiloxane, dodecamethylchlorohexasiloxane, trimethyltriphenylcyclotrisiloxane, tetramethyltetraphenylcyclotetrasiloxane, and octaphenylcyclotetrasiloxane. These organosiloxanes may be used alone or in mixtures of two or more. The amount thereof used should preferably be 50% by weight of the polyorganosiloxane rubber component, with a percentage of 70% by weight or above being particularly preferred.

A trifunctional or tetrafunctional silane cross-linking agent may be used as the cross-linking agent (I), with examples including trimethoxymethylsilane, triethoxyphenylsilane, tetramethoxysilane, tetraethoxysilane, tetra-n-propoxysilane, and tetrabutoxysilane. Tetrafunctional cross-linking agents are preferred, with tetraethoxysilane being particularly preferred. These cross-linking agents may be used alone or in combinations of two or more. The amount of the cross-linking agent used should preferably be 0.1-30% by weight of the polyorganosiloxane rubber component.

The graft crossing agent (I) should be a compound which can form the units shown in the following formulas:

Chemical Formula 1



Chemical Formula 2



or

Chemical Formula 3



In the above formula, R^1 is a lower alkyl group such as a methyl group, ethyl group, or propyl group, or a phenyl group, R^2 is a hydrogen atom or methyl group, n is 0, 1, or 2, and p is an integer from 1-6. As the (meth)acryloyloxysiloxane which can form the unit of the above formula (I-1) has a high graft efficiency, it offers the advantages of allowing the formation of effective graft chains and showing high impact resistance.

Moreover, methacryloyloxysiloxane is particularly preferred as the substance capable of forming the unit of formula (I-1). Specific examples of methacryloyloxysiloxane include

β -methacryloyloxyethyltrimethoxymethylsilane,

τ -methacryloyloxypropylmethoxydimethylsilane,

τ -methacryloyloxypropyldimethoxymethylsilane,

τ -methacryloyloxypropyltrimethoxysilane,

τ -methacryloyloxypropylethoxydiethylsilane,
 τ -methacryloyloxypropyldiethoxymethylsilane, and
delta-methacryloyloxybutyldiethoxymethylsilane. These substances may be used alone
or in combinations of two or more, and the amount of the crossing agent used should
preferably be 0-10% by weight of the polyorganosiloxane rubber component.

Examples of methods which may be used to manufacture the latex of this
polyorganosiloxane rubber component include the methods described in the
specifications of U.S. Patents Nos. 2891920 and 3294725. In practical implementation
of the present invention, for example, one should preferably produce a mixed solution
of organosiloxane and the cross-linking agent (I-1), and as desired, a graft crossing
agent (I-1) in the presence of a sulfonic acid emulsifier such as alkylbenzene sulfonic
acid or alkylsulfonic acid by the method of shear mixing with water using a
homogenizer, etc. Alkylbenzenesulfonic acid is ideal, as simultaneously with its action
as an organosiloxane emulsifier, it acts as a polymerization starter. At this time, it is
preferable to use a combination with a metal salt of alkylbenzenesulfonic acid, a metal
salt of alkylsulfonic acid, etc., as this has the effect of allowing the stability of the
polymer to be maintained during graft polymerization.

Next, the polyalkyl(meth)acrylate rubber component making up the composite
rubber may be synthesized using the following alkyl(meth)acrylate, a cross-linking
agent (II) and a graft crossing agent (II).

Examples of the alkyl(meth)acrylate include alkylacrylates such as methylacrylate,
ethylacrylate, n-propylacrylate, n-butylacrylate, 2-ethylhexylacrylate and
alkylmethacrylates such as hexylmethacrylate, 2-ethylhexylmethacrylate, and
n-laurylmethacrylate, with the use of n-butylacrylate being preferred.

Examples of the cross-linking agent (II) include ethylene glycol dimethacrylate,
propylene glycol dimethacrylate, 1,3-butylene glycol dimethacrylate, and 1,4-butylene
glycol dimethacrylate.

Examples of the graft crossing agent (II) include arylmethacrylate, triarylcyanoate,
and triarylisocyanurate. Arylmethacrylate may be used as a cross-linking agent. These
cross-linking agents and graft crossing agents may be used alone or in combinations of
two or more. The total amount of these cross-linking agents and graft crossing agents
used should preferably be 0.1-20% by weight of the polyalkyl(meth)acrylate rubber
component.

Polymerization of the polyalkyl(meth)acrylate rubber component is carried out by
adding the aforementioned alkyl(meth)acrylate, a cross-linking agent, and a graft

crossing agent to the latex of the polyorganosiloxane rubber component which has been neutralized by the addition of an alkali aqueous solution such as sodium hydroxide, potassium hydroxide, or sodium carbonate, causing this to impregnate polyorganosiloxane rubber particles, and then using an ordinary radical polymerization initiator. As polymerization progresses, polyalkyl(meth)acrylate rubber cross-links are formed which are mutually interlinked with the polyorganosiloxane rubber cross links, thus obtaining a latex of synthetic rubber containing an essentially inseparable polyorganosiloxane rubber component and a polyalkyl(meth)acrylate rubber component. Moreover, in practical implementation of the present invention, a composite rubber should preferably be used in which the main skeleton of the polyorganosiloxane rubber component has a dimethylsiloxane repeated unit and the main skeleton of the polyalkyl(meth)acrylate rubber component has a n-butylacrylate repeated unit.

The composite rubber prepared in this manner by emulsion polymerization may be graft copolymerized with a vinyl monomer. The gel content of this composite rubber measured in 12-hour extraction at 90°C using triene should preferably be 80% by weight or above.

Moreover, in order to meet the requirements of balanced flame resistance, impact resistance, appearance, etc., the ratio of the polyorganosiloxane rubber component and the polyalkyl(meth)acrylate rubber component in the aforementioned composite rubber should be 97-10% by weight of the latter with respect to 3-90% by weight of the former, and the average particle diameter of the composite rubber should preferably be 0.08-0.6 μm .

Examples of the vinyl monomer graft-polymerized onto the aforementioned composite rubber include various vinyl monomers, e.g., aromatic alkenyl compounds such as styrene, α -methylstyrene, and vinyl triene, methacrylate acid esters such as methyl methacrylate and 2-ethylhexylmethacrylate, acrylic acid esters such as methylacrylate, ethylacrylate, and butylacrylate, and vinyl cyanide compounds such as acrylonitrile and methacrylonitrile, and these substances may be used alone or in combinations of two or more. Methylmethacrylate is particularly preferred as the vinyl monomer. The vinyl monomer should preferably be contained in the amount of 5-70% by weight with respect to 30-95% by weight of the aforementioned composite rubber.

The composite rubber graft copolymer (D) may be isolated and recovered by adding the aforementioned vinyl monomer to the aforementioned latex of the composite rubber, adding a composite rubber graft copolymer latex obtained by

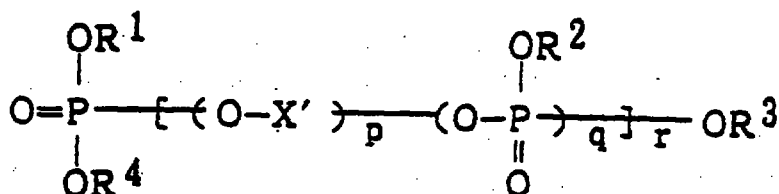
single-stage or multi-stage copolymerization through radical polymerization technology to hot water in which a metal salt such as calcium chloride or magnesium sulfate has been dissolved, and then carrying out salting out and solidification.

For example, this type of composite rubber graft copolymer (D) may be commercially obtained in the form of Methaprene [transliteration uncertain] S-2001 from Mitsubishi Rayon Co., Ltd.

Component (D) should be mixed in in the amount of 0.5-40 parts by weight with respect to a total of 100 parts by weight of (A)-(C), with the amount of 0.5-30 parts by weight being more preferable. When the amount of (D) is above the aforementioned range, there is a decrease in stiffness, and when it is below the aforementioned range, flame resistance tends to decrease.

The resin composition of the present invention may also contain a phosphoric ester component (E) in addition to the aforementioned components. An example of this phosphoric ester component is a compound expressed by the following formula:

Chemical Formula 4



Here, R^1 , R^2 , R^3 , and R^4 are independent hydrogen atoms or organic groups, with the exception of the case of $\text{R}^1 = \text{R}^2 = \text{R}^3 = \text{R}^4 = \text{H}$. X' is an organic group having a valence of 2 or above, p is 0 or 1, q is an integer of 1 or above, such as 30 or below, and r is an integer of 0 or above.

However, there are no particular restrictions on these substances.

In the above formula, the organic group may be a substituted or non-substituted alkyl group, cycloalkyl group, aryl group, etc. Moreover, if the group is substituted, examples of the substituent include an alkyl group, alkoxy group, alkylthio group, halogen, aryl group, aryloxy group, arylthio group, or halogenated aryl group, or a group composed of a combination of these substituents, such as an arylalkoxyalkyl group, or a combined group produced by binding of these substituents to an oxygen

atom, sulfur atom, or nitrogen atom, such as an arylsulfylaryl group. Moreover, the organic group having a valence of 2 or above refers to a group having a valence of 2 or above obtained by removing one or more hydrogen atoms bound to a carbon atom from the aforementioned organic group. Examples include an alkylene group, or preferably, a (substituted) phenylene group, and substances derived from bisphenols such as polynuclear phenols, which contain two or more free atomic valences with an arbitrary relative geometry. Examples of particularly preferred substances include hydroquinone, resorcinol, diphenylol methane, diphenylol dimethylmethane, dihydroxy diphenyl, p,p'-dihydroxydiphenyl sulfone, and dihydroxy naphthalene.

Examples of specific phosphoric ester compounds include trimethylphosphate, triethylphosphate, tributylphosphate, trioctylphosphate, tributoxyethylphosphate, triphenylphosphate, tricresylphosphate, cresylphenylphosphate, octyldiphenylphosphate, diisopropylphenylphosphate, tris(chloroethyl)phosphate, tris(dichloropropyl)phosphate, tris(chloropropyl)phosphate, bis(2,3-dibromopropyl)-2,3-dichloropropylphosphate, tris(2,3-dibromopropyl)phosphate, and bis(chloropropyl)mono-octylphosphate, bisphenol A bisphosphate in which R^1 - R^4 indicate an alkoxy such as methoxy, ethoxy, or propoxy, or preferably, a (substituted) phenoxy such as phenoxy or methyl (substituted) phenoxy, and polyphosphates such as hydroquinone bisphosphate, resorcinol bisphosphate, trioxybenzene triphosphate, with triphenylphosphate and various polyphosphates being preferred.

The above component (E) should be added in the amount of 1-30 parts by weight with respect to a total of 100 parts by weight of components (A)-(C), with the amount of 3-20 parts by weight being preferred.

If the amount of component (E) is too small, flame resistance will tend to be insufficient, and if it is too great, this will have a detrimental effect on thermal resistance.

Moreover, the resin composition of the present invention may also contain a drip prevention agent. Fluorinated polyolefins which may be used as this drip prevention agent may be commercially obtained or manufactured by a well-known method. For example, this drip-prevention agent may be a white solid obtained by polymerization of tetrafluoroethylene in an aqueous medium at a pressure of 100-1,000 psi and a temperature of 0-200°C, and preferably, 20-100°C, while using a free radical catalyst, such as sodium, potassium, or aluminum peroxydisulfate. For details, refer to U.S. Patent Specification No. 2,393,967 by Brubaker, which is incorporated herein by

reference. Although this is not indispensable, it is preferable to use the resin in the form of relatively large particles, such as particles having an average diameter of 0.3-0.7 mm (chiefly 0.5 mm). This is more favorable than the polytetrafluoroolefin powder ordinarily used, which has a particle diameter of 0.05-0.55 mm. The reason why such substances having relatively large particle diameter are preferred is that they can be easily dispersed in the polymer, and they show a tendency to cause bonding among polymers, thus forming a fibrous material. This kind of optimum polytetrafluoroolefin is referred to by the ASTM as Type 3, and it is actually commercially obtainable in the form of Teflon 6 from E.I. Dupont de Nemours and Company. Alternatively, it may be commercially obtained in the form of Teflon 30J from Mitsui Dupont Fluorochemical Co. Fluorinated polyolefins should be used in the amount of 0.01-2 parts by weight with respect to 100 parts by weight of component (A), with an amount of 0.05-1.0 parts by weight being preferred.

In addition to the aforementioned components of the resin composition of the present invention, depending on the application, one may also add additives at the time of mixing or molding, provided that these additives do not impair the physical properties of the invention, with examples including pigments, dyes, reinforcing agents (glass fibers, carbon fibers, etc.), fillers (carbon black, silica, titanium oxide, etc.), thermal resistance agents, antioxidants, weatherproofing agents, lubricants, mold-releasing agents, crystal nucleating agents, plasticizers, fluidity-improving agents, antistatic agents, etc.

There are no particular restrictions on the method used in manufacturing the resin composition of the present invention, and any common method may be satisfactorily used. However, the melt mixing method is generally preferred. It is also possible to use small amounts of solvents, but these are generally not required. Specific examples of the equipment used include extruders, Banbury mixers, rollers, and kneaders, and these may be operated in either batch or continuous operation. There are no particular restrictions on the order of mixing in of the components.

In the present invention, by combining the specified molecular weight ranges of the PC and the aromatic vinyl/vinyl cyanide resin, one can obtain a resin composition with an outstanding balance of various properties and which is suitable for thin-wall molding. Moreover, by adding flame-resistance agents components (D) and (E), it is possible to obtain a resin composition showing outstanding flame resistance.

EXAMPLES

The following is a detailed description of the present invention by means of

practical examples. The following components were used in the practical examples.

Component (A) (PC (3) was used in the comparison examples)

5 PC (1): Polycarbonate of bisphenol A (trademark: LEXAN], manufactured by Nihon G.E. Plastics K.K., intrinsic viscosity 0.46 dl/g as measured at 20°C in methylene chloride, Mv = approx. 20,000 (calculated value).

PC (2): Polycarbonate of bisphenol A (trademark: LEXAN, manufactured by Nihon G.E. Plastics K.K., intrinsic viscosity 0.50 dl/g as measured at 20°C in methylene chloride, Mv = approx. 22,000 (calculated value).

10 PC (3): Polycarbonate of bisphenol A (trademark: LEXAN, manufactured by Nihon G.E. Plastics K.K., intrinsic viscosity 0.42 dl/g as measured at 20°C in methylene chloride, Mv = approx. 18,000 (calculated value).

Component (B) (SAN (1) was used in the comparison examples)

SAN (1): SAN resin, trademark: SR 30B (manufactured by Ube Cycon K.K.), Mw = 117,000.

15 SAN (2): SAN resin, trademark: SR 05B (manufactured by Ube Cycon K.K.), Mw = 63,000.

Component (C)

ABS: ABS resin, trademark: UX 050 (manufactured by Ube Cycon K.K.)

Component (D)

20 Trademark: Methaprene LS-2001, methylmethacrylate-butylacrylate-dimethylsiloxane copolymer, manufactured by Mitsubishi Rayon Co, Ltd.

Component (E)

25 Trademark: CR 733S: phenylresorcin polyphosphate, manufactured by Oya [transliteration uncertain] Kagaku K.K..

Optional components

Trademark: Teflon 30J, polytetrafluoroethylene, manufactured by Mitsui Dupont Fluorochemical Co.

Practical Examples 1-5 and Comparison Examples 1-4

30 The various components were mixed in the ratios shown in Table 1 (weight ratios) and extruded in a biaxial extruder (30 mm) set to 240°C and 150 rpm in order to prepare pellets. Next, these pellets were injection molded at a set temperature of 250°C and a metal mold temperature of 60°C. The molded product obtained was tested for Izod impact strength and melt viscosity (Mv) and was also tested for
35 chemical resistance. Moreover, in Practical Examples 3-5 and Comparison Examples

3-4, flame resistance was also evaluated. The results are shown in Table 1.

The evaluation tests of the resin composition were carried out as follows.

(1) Izod impact strength (Kg-cm/cm)

Measurements were conducted on a notched test piece measuring 1/8 inch in thickness according to ASTM D 256.

(2) Melt viscosity (Mv)

Viscosity was measured at a temperature of 260°C and a shear rate of 1,500 seconds⁻¹ using a capillary rheometer.

(3) Flame resistance test

UL 94/V0, VI, VII tests

Tests were conducted on 5 test bars with a thickness of 1/16 inch according to the test method presented in Bulletin 94 of the Underwriters Laboratories Corporation, "Combustion Tests for Materials Classification" (referred to in the following as UL-94). Using this test method, the sample materials were classified into the grades of UL-94 V-0, V-I, and V-II based on the results for 5 samples. A brief summary of the standards for the various V grades of UL-94 is given below.

V-0: Average flame retention time after removal of ignition flame is 5 seconds or less, and no microparticle flame capable of igniting the absorbent cotton falls off of any of the samples.

V-I: Average flame retention time after removal of ignition flame is 25 seconds or less, and no microparticle flame capable of igniting the absorbent cotton falls off of any of the samples.

V-II: Average flame retention time after removal of ignition flame is 5 seconds or less, and microparticle flame capable of igniting the absorbent cotton falls off the samples.

Moreover, UL-94 specifies that unless all of the test rods meet the requirements for a specified V class, they may not be assigned to said class. In cases where these conditions are not filled, the 5 test rods are assigned to the class of the test rod with the worst results. For example, in cases where one test rod is classified as V-II, the class for all 5 test rods is V-II.

UL94/5V (5VB) test (5-inch flame test)

According to Method A (bar test), the test pieces were brought into contact with a burner 5 times, and the following items were observed: (1) combustion time and glowing time, (2) length of the burned portion of the test piece, (3) the presence or absence of drips, and (4) deformation and physical strength. Moreover, the thickness

of the test piece was 2.5 mm. Evaluation criteria for passing 5VB: after 5 applications of the test flame, none of the test pieces may show a combustion time or glowing time exceeding 60 seconds. Moreover, none of the test pieces may show drips.

(4) Chemical resistance

- 5 A molded product measuring 1/8 inch in thickness was immobilized using a dedicated jig, a 1% strain was applied, liquid was applied to the surface (phenylresorcinol polyphosphate), the test piece was left standing for 48 hours, and the surface condition was then observed. The number of cracks or frays (small cracks) occurring in the 5 specimens was expressed (See Table 1).
- 10 The resin composition of the present invention shows an outstanding balance of properties such as fluidity, chemical resistance, thermal resistance, and impact resistance, and it also allows thin-wall molding. Moreover, by adding flame resistance agents, it is also possible to obtain a resin composition showing outstanding flame resistance. Accordingly, it can greatly contribute toward increasing miniaturization
- 15 and lighter weight of various machines and can be used in applications such as housings and cabinets for compact, lightweight equipment such as notebook computers and lap top computers.

Table 1

	Practical Example 1	Comparison Example 1	Comparison Example 2	Practical Example 2	Practical Example 3	Comparison Example 3	Practical Example 4	Practical Example 5	Comparison Example 4
Components (parts by weight)									
(A) PC(1) (Mv=20,000)	-	-	-	65.0	-	-	-	70.5	-
PC(2) (Mv=22,000)	65.0	65.0	-	-	70.5	70.5	70.5	-	-
PC(3) (Mv=18,000)	-	-	65.0	-	-	-	-	-	70.5
(B) SAN(1)(Mw=117,000)	-	20.0	20.0	-	-	12.0	-	-	-
SAN(2)(Mw= 63,000)	20.0	-	-	20.0	12.0	-	12.0	12.0	12.0
(C) ABS	15.0	15.0	15.0	15.0	7.5	7.5	5.0	7.5	7.5
(D) Methaprene S-2001	-	-	-	-	-	-	2.5	-	-
(E) CR733S	-	-	-	-	9.5	9.5	9.5	9.5	9.5
Teflon 30J	-	-	-	-	0.5	0.5	0.5	0.5	0.5
Evaluation tests									
(kg • cm/cm)	56	67	10	25	60	57	58	14	8
MV	2680	3080	2700	2470	1750	2280	1730	1550	1340
Izod impact strength									
UL94/V0, VI, VII	-	-	-	-	V-0	V-0	V-0	V-0	V-1
UL94/SVB	-	-	-	-	-	-	-	-	-
Flame resistance test	0/5	0/5	5/5	2/5	0/5	0/5	0/5	3/5	5/5

**CLAIMS****What is claimed is:**

1. A resin composition containing (A) 90-10 parts by weight of polycarbonate resin having a viscosity average molecular weight of 20,000 or above,

5 (B) 1-50 parts by weight of a copolymer containing (a) an aromatic vinyl monomer component and (b) a vinyl cyanide monomer component as its copolymer constituent and having a weight average molecular weight of 30,000-110,000, and

10 (C) 1-50 parts of a copolymer containing (a) an aromatic vinyl monomer component, (b) a vinyl cyanide monomer component, and (c) a rubber polymer as its copolymer constituent.

2. The resin composition of Claim 1, in which (A) the polycarbonate resin has a viscosity average molecular weight of 21,000 or above.

3. The resin composition of Claim 1, in which (B) the copolymer has a weight average molecular weight of 40,000-80,000.

15 4. The resin composition of Claim 3, in which (B) the copolymer is SAN resin.

5. The resin composition of Claim 4 in which (C) the copolymer is selected from among ABS resin, AES resin, ACS resin, and AAS resin.

20 6. The resin composition of Claim 5, wherein 0.5-40 parts by weight with respect to a total of 100 parts by weight of the aforementioned components (A)-(C) of a composite rubber graft copolymer is formed by grafting a vinyl monomer onto a composite rubber containing (D) polyorganosiloxane and polyalkyl(meth)acrylate.

25 7. The resin composition of Claim 6, further comprising 1-30 parts by weight of (E) a phosphoric ester compound with respect to a total of 100 parts of the aforementioned components (A)-(C).

This Sheet Has Been Replaced



THIS SHEET HAS BEEN
REPLACED