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(54) **COMPOSITION DE POLYMERES DE STYRENE**
(54) **STYRENE POLYMER COMPOSITION**

(57) Disclosed is a styrene polymer composition comprising, in a specified proportion, (A) a styrene polymer having no functional group, and (B) either of polyphenylene ether having a polar group or a mixture of polyphenylene ether having a polar group and a styrene polymer having no functional group; or a styrene polymer composition comprising (C) polyamide, as well as above Components (A) and (B). These polymer compositions are excellent in impact resistance, water resistance, and mechanical properties, and are suitable for various purposes.

ABSTRACT OF THE DISCLOSURE

Disclosed is a styrene polymer composition comprising, in a specified proportion,

(A) a styrene polymer having no functional group, and

(B) either of polyphenylene ether having a polar group or a mixture of polyphenylene ether having a polar group and a styrene polymer having no functional group; or a styrene polymer composition comprising (C) polyamide, as well as above Components (A) and (B).

These polymer compositions are excellent in impact resistance, water resistance, and mechanical properties, and are suitable for various purposes.

STYRENE POLYMER COMPOSITION 73162-30

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a styrene polymer composition. More particularly, it is concerned with a styrene polymer composition which is suitable to be molded into industrial materials such as electric and electronic materials (e.g., connector, and printed substrates), construction materials for industrial use, parts of automobiles (e.g., connectors for the use on vehicles, wheel caps, cylinder head cover, etc.), parts of home electric appliances, and various machines.

2. Description of the Related Art

Heretofore, synthetic resins have been improved in their mechanical properties, particularly, rigidity and heat resistance, by compounding inorganic fillers including glass fiber with them. Styrene polymers, however, have not a sufficient adhesivity to inorganic filler so that additives to improve their adhesivity and surface-treating agents of inorganic fillers have been studied. As the result, various surface-treating agents which contain various kinds of aminosilane compounds with polyester type resins, urethane type resins, epoxy type resins, acrylic type resins, or vinyl acetate type resins, and also additives such as maleic anhydride/styrene copolymer and the like have been developed. Specifically, surface-treating agents such as silane-based coupling agents for glass fibers and the like, and a

composition containing an additive, such as a styrene/maleic anhydride-styrene/glass fiber composition (Japanese Patent Application Laid-Open No. 161836/1980, Japanese Patent Application Laid-Open No. 19097/1970) have been known. However, these had not sufficiently improved effects yet.

Japanese patent Application Laid-Open No. 257948/1987 and others proposed resin compositions which were excellent in heat resistance and mechanical properties, and which were obtained by adding an inorganic filler to a styrene polymer having a syndiotactic configuration, or adding a thermoplastic resin and/or a rubber and an inorganic filler to a styrene polymer having a syndiotactic configuration. Also in these compositions, however, the adhesivity between the styrene polymer having a syndiotactic configuration and the inorganic filler was insufficient, and had room for improvement.

To be more specifically, when the conventional inorganic fillers surface-treated with various surface-treating agents, and additives were added to the styrene polymer, the adhesivity with styrene polymer, especially a polystyrene having a syndiotactic configuration was insufficient, and the resulting compositions were poor in impact resistance, and none of them had a Izod impact strength (notched) of more than 6.0 kg cm/cm. Accordingly, a styrene polymer composition having an improved impact resistance has been desired.

On the other hand, polyamides have been used as the material to be molded into various products such as domestic

products, electric products and parts of machines or devices, since they are excellent in moldability and heat-resistance, and have a sufficient rigidity.

In spite of these excellent properties, however, polyamide has a disadvantage in that it is far from being sufficient in water resistance.

The group of the present inventor has attempted to remove the above disadvantage by blending, with polyamide, a styrene polymer having a high degree of syndiotacticity, but the effect of improving the properties by blending met a limitation, for the composition of such resins as polyamide and polystyrene that are substantially incompatible each other could not avoid a fall in mechanical properties due to the insufficient strength of interface between the phases.

Under the circumstances, the present inventor has repeated earnest studies to develop a styrene polymer composition excellent in all of impact resistance, heat resistance, and mechanical strength which has never seen before. Further, the study has proceeded, also in order to develop a composition greatly improved in heat resistance and water resistance, without lowering the mechanical properties of polyamide, by improving the compatibility between a styrene polymer having a syndiotactic configuration and a polyamide resin.

SUMMARY OF THE INVENTION

The present invention provides a styrene polymer composition (Composition I) comprising

(A) 99.9 to 20% by weight of a styrene polymer having no

functional group and having a syndiotactic configuration, and

(B) 0.1 to 80% by weight of polyphenylene ether having a polar group or a mixture of polyphenylene ether having a polar group and a styrene polymer having no functional group.

The present invention also provides a styrene polymer composition (Composition II) comprising:

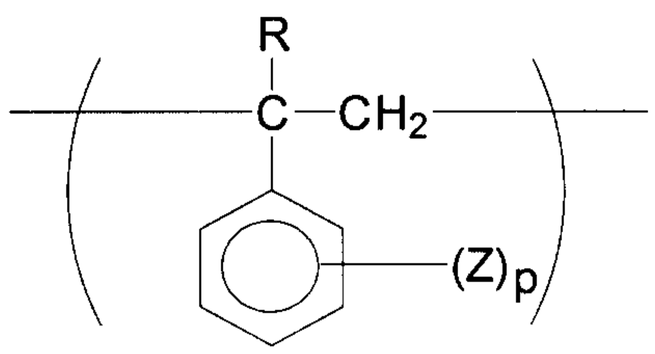
(A) 99 to 1% by weight of a styrene polymer having no functional group and having a syndiotactic configuration,

(B) 0.1 to 50% by weight of polyphenylene ether having a polar group or a mixture of polyphenylene ether having a polar group and a styrene polymer having no functional group, and

(C) 0.9 to 98.9% by weight of polyamide.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In Composition I and II of the present invention, the styrene polymer having a syndiotactic configuration and having no functional group, used as Component (A), may be any styrene polymers provided that they have a syndiotactic configuration and no functional group, and those which have at least 25% by weight of a repeating unit derived from a vinyl aromatic compound represented by the general formula:



(wherein R is a hydrogen or an alkyl group having 1 to 4 carbon atoms, Z is a hydrogen, a halogen atom, or an alkyl group having 1 to 4 carbon atoms, and p is an integer of 1 to 5) can be used.

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Examples of such styrene polymers are homopolymer of styrene or its derivatives; styrene polymer modified by natural or synthetic elastomer material such as polybutadiene, polyisoprene, isobutylene-isoprene rubber, EPDM, ethylene-propylene copolymer, natural rubber, epichlorohydrin; further, styrene-containing copolymers including styrene-methylstyrene copolymer, styrene-butadiene copolymer and the like. Among them, particularly preferred are styrene polymers having a syndiotactic configuration, selected from polystyrene, poly(α-methyl styrene), polybutadiene-modified styrene polymer, butadiene-styrene copolymer, isoprene-styrene copolymer, and high impact resistant polystyrene (HIPS).

Here, in the styrene polymer having a syndiotactic configuration, the syndiotactic configuration means that the stereostructure is a syndiotactic configuration, i.e., the stereostructure in which phenyl groups or substituted phenyl groups are located as side chains alternately in opposite directions relative to the main chain consisting of carbon-carbon bonds. The tacticity is quantitatively determined by the nuclear magnetic resonance method using a carbon isotope (^{13}C-NMR) methods. The tacticity as determined by the ^{13}C-NMR method can be indicated in terms of proportions of structural units continuously connected to each other, i.e., a diad in which two structural units are connected to each other, a triad in which three structural units are connected to each other, or pentad in which five structural units are connected to each other. Styrene polymers having the syndiotactic configuration of the present invention include

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polystyrene, poly(alkylstyrene), poly(halogenated styrene), poly(halogenated alkylstyrene), poly(vinyl benzoate), the hydrogenated polymers thereof and the mixtures thereof, and copolymers containing the above polymers as main components, having such a syndiotacticity that the proportion of racemic diad is at least 75%, preferably at least 85%, or the proportion of racemic pentad is at least 30%, preferably at least 50%. The poly(alkylstyrene) can include poly(methylstyrene), poly(ethylstyrene), poly(isopropylstyrene), poly(tert-butylstyrene), poly(phenylstyrene), poly(vinylnaphthalene), and poly(vinylstyrene), etc; the poly(halogenated styrene) include poly(chlorostyrene) poly(bromostyrene), poly(fluorostyrene), etc.

The most preferred styrene polymers are polystyrene, poly(p-methylstyrene), poly(m-methylstyrene), poly(p-tert-butylstyrene), poly(p-chlorostyrene), poly(m-chlorostyrene), poly(p-fluorostyrene), hydrogenated polystyrene, and a copolymer containing the structure units thereof.

The molecular weight of the styrene polymer used in the present invention is not critical, but is preferably at least 10,000, and more preferably at least 50,000 of a weight average molecular weight. If the weight average molecular weight is less than 10,000, the thermal properties and mechanical properties of the resulting composition or the molding is undesirably lowered.

The styrene polymers having a syndiotactic configuration can be produced by polymerizing styrene

monomers (corresponding to the above styrene polymers) using a catalyst comprising a titanium compound and a condensate of water and a trialkylaluminum in, for example, an inert hydrocarbon solvent, or in the absence of a solvent (Japanese Patent Application Laid-Open No. 187708/1987).

As Component (B) in Compositions I and II of the present invention, either of a polyphenylene ether having a polar group or a mixture of a polyphenylene ether having a polar group and a styrene polymer having no functional group, is used. Examples of the styrene polymer having no functional group include those styrene polymers mentioned above as Component (A) (except that atactic and isotactic styrene polymers may also be employed), a styrene polymer obtained by introducing at least one of acrylonitrile, methylmethacrylate, methacrylonitrile and the like to such a styrene polymer. The amount of the styrene polymer to be blended with polyphenylene ether is preferably not more than 80% by weight, and if it is in excess of this amount, the substantial amount of polyphenylene ether to the above-mentioned Component (A) is undesirably lowered.

Polyphenylene ether is known in itself. It is described in the specifications of U.S. Patent Nos. 3,306,874, 3,306,875, 3,257,357, and 3,257,358. Polyphenylene ether can be prepared usually by oxidization coupling reaction in which homopolymer or copolymer is produced in the presence of a copper amine complex and one or more of phenols substituted at two or three positions. Therein copper amine complexes derived from primary, secondary or tertiary amines can be used.

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Examples of preferred polyphenylene ethers are poly(2,3-dimethyl-6-ethylphenylene-1,4-ether), poly(2-methyl-6-chloromethyl-1,4-phenylene)ether, poly(2-methyl-6-hydroxydiethyl-1,4-phenylene)ether, poly(2-methyl-6-n-butyl-1,4-phenylene)ether, poly(2-ethyl-6-isopropyl-1,4-phenylene)ether, poly(2-ethyl-6-n-propyl-1,4-phenylene)ether, poly(2,3,6-trimethylphenylene-1,4-ether), poly[2-(4'-methylphenyl)phenylene-1,4-ether], poly(2-bromo-6-phenylphenylene-1,4-ether), poly(2-methyl-6-phenylphenylene-1,4-ether), poly(2-phenylphenylene-1,4-ether), poly(2-chlorophenylene-1,4-ether), poly(2-methylphenylene-1,4-ether), poly(2-chloro-6-ethylphenylene-1,4-ether), poly(2-chloro-6-bromophenylene-1,4-ether), poly(2-6-di-n-propylphenylene-1,4-ether), poly(2-methyl-6-isopropylphenylene-1,4-ether), poly(2-chloro-6-methylphenylene-1,4-ether), poly(2-methyl-6-ethylphenylene-1,4-ether), poly(2,6-dibromophenylene-1,4-ether), poly(2,6-dichlorophenylene-1,4-ether), poly(2,6-diethylphenylene-1,4-ether), and poly(2,6-dimethylphenylene-1,4-ether).

Also copolymers derived from two or more of phenyl compounds as used for the preparation of above-mentioned homopolymer are suitable. Further examples are graft copolymers and block copolymers of vinyl aromatic compounds

including polystyrene and the above-mentioned polyphenylene ether.

The polar groups contained in Component (B) include acid halide, a carbonyl group, acid anhydride, acid amide, carboxylate, acid azide, a sulfone group, a nitrile group, a cyano group, an isocyanic acid ester group, an amino group, a hydroxyl group, an imide group, a thiol group, an oxazoline group, and an epoxy group.

Particularly preferable polar group is acid anhydride, among which maleic anhydride is more preferable. The content of the polar group is preferably not less than 0.01% by weight of above polyphenylene ether, and if it is under 0.01% by weight, mechanical strength of resulting polymer cannot be expected to be improved.

In order to obtain the Component (B), a method to polymerize one or plural kinds of phenol compounds having these polar groups, a method to copolymerize one or plural kinds of phenol compounds having a polar group with phenol compounds having no polar group, and a method to react a compound containing both a polar group and an unsaturated group with polyphenylene ether can be used.

Above-mentioned compounds containing both a polar group and an unsaturated group are those which contain, in a molecular, both of an unsaturated group having carbon-carbon double bond or carbon-carbon triple bond; and a polar group such as carboxylic acid group, a group derived from carboxylic acid (for example, various salts, esters, acid amides, acid anyhydrides, imides, acid azides, and acid

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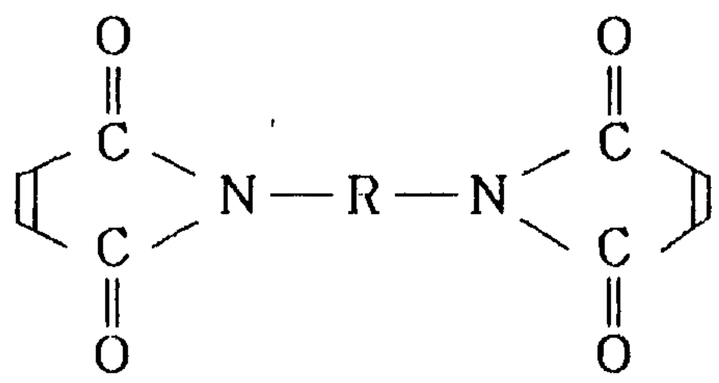
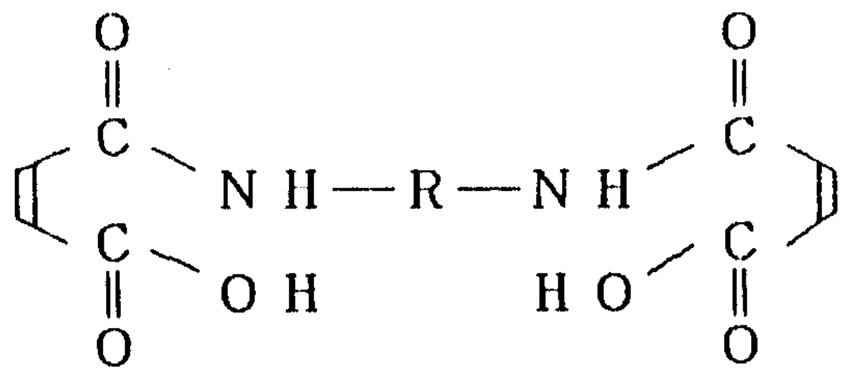
halides which result from substitution of hydrogen atoms or a hydroxyl group of carboxyl group), or oxazoline, nitrile, epoxy group, amino group, hydroxylic acid or isocyanate.

As the compound containing both of an unsaturated group and a polar group, unsaturated carboxylic acid, unsaturated carboxylic acid derivative, unsaturated epoxy compound, unsaturated alcohol, unsaturated amine, unsaturated isocyanate and the like are mainly used.

Specific examples of these compounds are maleic anhydride, maleic acid, fumaric acid, maleimide, maleic hydrazide, reaction products of maleic anhydride and diamine such as the compounds having the structure represented by:





(wherein R is an aliphatic group, or an aromatic group); anhydrous methyl, methyl nadic anhydride, dichloromaleic anhydride, maleic acid amide, itaconic acid, itaconic anhydride, acids of natural fats and oils such as soybean oil, tung oil, castor oil, linseed oil, hempseed oil, cotton seed oil, sesame oil, rapeseed oil, peanut oil, camellia oil, olive oil, coconut oil, and sardine oil; unsaturated

carboxylic acids such as acrylic acid, butenoic acid, crotonic acid, vinyl acetic acid, methacrylic acid, pentenoic acid, angelic acid, 2-pentenoic acid, 3-pentenoic acid, α-ethylacrylic acid, β-methylcrotonic acid, 4-pentenoic acid, 2-hexenoic acid, 2-methyl-2-pentenoic acid, 3-methyl-2-pentenoic acid, α-ethylcrotonic acid, 2-2-dimethyl-3-butenoic acid, 2-heptenoic acid, 2-octenoic acid, 4-decenoic acid, 9-undecenoic acid, 10-undecenoic acid, 4-dodecenoic acid, 5-dodecenoic acid, 4-tetradecenoic acid, 9-tetradecenoic acid, 9-hexadecenoic acid, 2-octadecenoic acid, 9-octadecenoic acid, eicosenoic acid, dococenoic acid, erucic acid, tetracosenoic acid, 2,4-pentadienoic acid, 2,4-hexadienoic acid, diallyl acetate, geraniumic acid, 2,4-decadienoic acid, 2,4-dodecadienoic acid, 9,12-hexadecadienoic acid, 9,12-octadecadienoic acid, hexadecatrienoic acid, linolic acid, linolenic acid, octadecatrienoic acid, eicosadienoic acid, eicosatrienoic acid, eicosatetraenoic acid, ricinolic acid, eleostearic acid, oleic acid, eicosapentaenoic acid, docosadienoic acid, docosatrienoic acid, docosatetraenoic acid, docosapentaenoic acid, tetracosenoic acid, hexacosenoic acid, hexacodienoic acid, octacosenoic acid, and esters, acid amides and anhydrides of these unsaturated carboxylic acids; unsaturated alcohols such as allyl alcohol, methylvinyl carbinol, allyl carbinol, methylpropenyl carbinol, 4-pentene-1-ol, 10-undecane-1-ol, propargyl alcohol, 1,4-pentadiene-3-ol, 1,4-hexadiene-3-ol,
3,5-hexadiene-2-ol, 2,4-hexadiene-1-ol, alcohols represented

by the general formulas: $C_nH_{2n-5}OH$, $C_nH_{2n-7}OH$, $C_nH_{2n-9}OH$ (n is a positive integer), 3-butene-1,2-diol, 2,5-dimethyl-3-hexene-2,5-diol, 1,5-hexadiene-3,4-diol, and 2,6-octadiene-4,5-diol, and unsaturated amines which result from substitution of NH_2 for OH group of these unsaturated alcohols; those result from addition of maleic anhydride or phenols to low polymers (e.g., polymers having an average molecular weight of 500 to 10000) or high-molecular polymers (e.g., those having an average molecular weight of 10000 or more) of butadiene or isoprene; those compounds to which amino group, carboxyl group, hydroxyl group, or expoxy group is introduced; and allyl isocyanate.

Examples of the vinyl compounds having epoxy group are glycidyl methacrylate, glycidyl acrylate, vinyl glycidyl ether, glycidyl ether of hydroxyalkyl(meth)acrylate, glycidyl ether of polyalkyleneglycol(meth)acrylate, and glycidylitaconate, among which glycidyl methacrylate is particularly preferred.

The compound having both of an unsaturated group and a polar group in the present invention also include, needless to say, compounds having two or more of unsaturated groups and two or more of polar groups (the same or different), and two or more of compounds having such groups.

Specified methods for preparing Component (B) include a method to melt and knead a polyphenylene ether and a compound having both a polar group and an unsaturated group at a temperature of 150°C to 350°C by the use of a roller mill, Banbury mixer, an extruder or the like, to react them, and a

method to heat and react a polyphenylene ether and a compound having both a polar group and an unsaturated group in the solvent such as benzene, toluene, xylene and the like. Further, in order to proceed with these reactions, it is effective to use a radical initiator, in the reaction system, such as organic peroxides including benzoyl peroxide, di-t-butyl-peroxide, dicumylperoxide, and t-butylperoxibenzoate, or azo compounds including azobisisobutylonitrile, azobisisobaleronitrile and the like.

A method to melt and knead a polyphenylene ether and a compound having both a polar group and an unsaturated group in the presence of radical initiator is more effective.

Component (B) can be produced also by melting and kneading the above-mentioned styrene polymer as a part of Component (B), a polyphenylene ether and a compound having both a polar group and an unsaturated group, in the presence of a radical initiator.

In Composition I of the present invention, the amount of Component (B) is 0.1 to 80% by weight, preferably 0.5 to 50% by weight, particularly preferably 1 to 25% by weight, of the total amount of Component (A) and Component (B). Particularly when styrene polymer having a syndiotactic configuration is used as Component (A), the amount of Component (B) is 0.1 to 50% by weight, preferably 0.5 to 30% by weight, and most preferably 1 to 25% by weight. Polyphenylene ether as Component (B) or as a part of Component (B) has a high compatibility with styrene polymer as Component (A), but if the amount of it is under 0.1% by

weight, the resulting composition cannot be improved in mechanical strength.

On the other hand, if it is added in excess of 80% by weight, the final composition becomes very near to Component (B) itself, which is poor in moldability. When a styrene polymer having a syndiotactic configuration is used, a very high compatibility with polyphenylene ether is obtained, but if it is added in excess of 50% by weight, heat resistance and moldability of the resulting composition are sometimes lowered.

In Composition II of the present invention, the amount of Component (A) to be blended is 1 to 99% by weight, preferably 10 to 95% by weight, and more preferably 20 to 95% by weight. Herein if the amount of Component (A) is under 1% by weight, the resulting Composition II cannot be improved in water resistance, while if it is in excess of 99% by weight, the mechanical strength of said composition becomes almost the same as that of the styrene polymer as Component (A).

In Composition II of the present invention, the amount of Component (B) is 0.1 to 50% by weight, preferably 0.5 to 40% by weight, and more preferably 1 to 30% by weight. Particularly, when a styrene polymer having a syndiotactic configuration is used as Component (A), said amount is preferably 0.5 to 30% by weight, and most preferably 1 to 25% by weight. Said polyphenylene ether as Component (B) or a part of it has a high compatibility with a styrene polymer as Component (A), but if its content is under 0.1% by weight, the resulting composition cannot be improved in mechanical

strength. If it is added in an amount of above 50% by weight, the resulting composition becomes lowered in heat resistance and moldability.

To produce Compositions I and II of the present invention, it is not necessary to prepare in advance said Component (B), but these compositions can be produced by mixing styrene polymer as Component (A) and a part of Component (B), a polyphenylene ether to be Component (B), a compound having both a polar group and an unsaturated group, and additives such as fillers, and subsequently by melting and kneading the mixture thereof at 150 to 350°C with the use of a roller mill, a Banbury mixer, an extruder and the like.

Composition I of the present invention basically comprises above Component (A) and Component (B).

On the other hand, in Composition II of the present invention, polyamide is blended further as Component (C). As said polyamide as Component (C), all the conventional thermoplastic polyamide can be used. Examples of preferred polyamides are polyamide-4; polyamide-6; polyamide-4,6; polyamide-6,6; polyamide-3,4; polyamide-12; polyamide-11, polyamide-6,10; polyamide purified from terephthalic acid and 4,4'-diaminocyclohexylmethane; polyamide purified from azelaic acid, adipic acid and 2,2-bis(p-aminocyclohexyl)-propane; polyamide purified from adipic acid and methaxylylene diamine; and polyamide purified from terephthalic acid and trimethylhexamethylene diamine.

Aromatic polyamide resin (hereinafter referred to as PA) is a polyamide containing an amide bond having an

aromatic nucleus, as a repeating unit, in its main chain. More specifically, the aromatic polyamide resin used in the present invention is appropriately selected from the polymers which are obtained by reacting, according to the conventional method, ω'-carboxylic compound having aromatic group with the polymer obtained by reacting an aromatic diamine component and a dicarboxylic acid component.

As the aromatic diamine components, diamine compounds having benzene ring, of which typical examples are 1,4-diaminobenzene; 1,3-diaminobenzene; 1,2-diaminobenzene; 2,4-diaminotoluene; 2,3-diaminotoluene; 2,5-diaminotoluene; 2,6-diaminotoluene; ortho-, meta-, and para-xylilene diamine; ortho-, meta-, and para-2,2'-diaminodiethyl benzene; 4,4'-diaminobiphenyl; 4,4'-diaminodiphenyl methane; 4,4'-diaminodiphenyl ether; 4,4'-diaminodiphenyl thioether; 4,4'-diaminodiphenyl ketone; and 4,4'-diaminodiphenyl sulfone, are used. The aromatic diamine component may be solely the diamine compound having the above benzene ring, or may be a mixture with other diamine compounds such as aliphatic diamines, as long as said diamine compound is contained in the amount of at least 50 mol%. Of course, two or more kinds of diamine compounds having benzene ring may be used in combination.

Next, examples of dicarboxylic acid components are aliphatic dicarboxylic compounds such as glutaric acid, adipic acid, pimelic acid, suberic acid, azelaic acid, and sebacic acid; aromatic dicarboxylic compounds such as phthalic acid, isophthalic acid, terephthalic acid,

naphthalene dicarboxylic acid and the like; and further, acid chlorides of these dicarboxylic compounds. These compounds can be used in combination.

Further, examples of ω-amino-ω'-carboxylic compounds having aromatic nucleus are 4-aminophenylcarboxyl methane, 1-(4-aminophenyl)-2-carboxyl ethane, 3-(4-aminophenyl)-1-carboxyl propane, para-(3-amino-3'-hydroxy)dipropyl benzene and the like. Preferred aromatic polyamide resins used in the present invention are polyamides derived from diamine compound having benzene ring and aliphatic dicarboxylic acid, and a more preferable example is a polyamide derived from xylylene diamine and adipic acid.

The most preferable example is a polyamide derived from meta-xylylene diamine and adipic acid.

The amount of said Component (C) blended is 0.9 to 98.9% by weight, preferably 5 to 90% by weight, more preferably 5 to 65% by weight. If the amount of it is under 0.9% by weight, no improvement in mechanical strength results. If it is in excess of 98.9% by weight, the water resistance of the resulting composition becomes very near to that of polyamide.

Composition II of the present invention comprises basically above Components (A), (B) and (C).

In Compositions I and II of the present invention, if necessary, a filler which is surface-treated with a coupling agent can be blended as Component (D). The filler used in the present invention may be in fibrous form, or in the form of granule or powder. Fillers in fibrous forms include glass

fiber, carbon fiber, organic synthetic fiber, whisker, ceramic fiber, metal fiber, natural vegetable fiber and the like.

Examples of specified organic synthetic fibers are those including all aromatic polyamide fibers, and polyimide fibers; whiskers of boron, alumina, silica, and silicon carbide; ceramic fibers of gypsum, potassium titanate, magnesium sulfate, and magnesium oxide; metal fibers of copper, aluminum, and steel; and particularly preferred are glass fibers and carbon fibers. The shape of fillers vary in cloth, mat, bundling cut form, short fiber, filament-form, and whisker. In bundling cut form, the length is preferably 0.05 to 50 mm, and the fiber diameter is preferably 5 to 20 μm. As carbon fiber, fibers of polyacrylonitrile (PAN) are preferred.

On the other hand, the particle or powder fillers include talc, carbon black, graphite, titanium dioxide, silica, mica, calcium carbonate, calcium sulfate, barium carbonate, magnesium carbonate, magnesium sulfate, barium sulfate, oxysulfate, tin oxide, alumina, kaolin, silicon carbide, metal powder, glass powder, glass flake, glass beads and the like. Talc, calcium carbonate, and mica are particularly preferred. A preferred average particle diameter of talc is 0.3 to 20 μm, more preferably 0.6 to 10 μm. A preferred average particle diameter of calcium carbonate is 0.1 to 20 μm, and preferred average particle diameter of mica is 40 to 250 μm, and more preferably 50 to 150 μm.

In the various fillers as above, particularly preferred are glass fillers such as glass powder, glass flake, glass beads, glass filament, glass fiber, glass roving, and glass mat. The coupling agent used for the surface treatment of above fillers is used for improving the adhesiveness between the filler and polyphenylene ether having a polar group, as Component (B). Therein any one of silane coupling agents and titanium coupling agents, which are conventionally known as coupling agents can be used.

Preferred examples of the silane coupling agents are specifically, triethoxysilane, vinyltris(β-methoxyethoxy)-silane, γ-methacryloxypropyltrimethoxysilane, γ-glycidoxypropyltrimethoxysilane, β-(1,1-epoxycyclohexyl)-ethyltrimethoxysilane, N-β-(aminoethyl)-γ-aminopropyl-trimethoxysilane, N-β-(aminoethyl)-γ-aminopropylmethyl-dimethoxysilane, γ-aminopropyltriethoxysilane, N-phenyl-γ-aminopropyltrimethoxysilane, γ-mercaptopropyltrimethoxy-silane, γ-chloropropyltrimethoxysilane, γ-aminopropyl-trimethoxysilane, γ-aminopropyl-tris(2-methoxy-ethoxy)silane, N-methyl-γ-aminopropyltrimethoxysilane, N-vinylbenzyl-γ-aminopropyltriethoxysilane, triaminopropyltrimethoxysilane, 3-ureidopropyltrimethoxysilane, 3-(4,5-dihydroimidazole)-propyltriethoxysilane, hexamethyldisilazane, N,O-(bistrimethylsilyl)amide, N,N-bis(trimethylsilyl)urea and the like. Among them, preferred are aminosilanes and epoxysilanes such as γ-aminopropyltriethoxysilane, N-β-(aminoethyl)-γ-aminopropyltrimethoxysilane, γ-glycidoxypropyltrimethoxysilane, β-(3,4-epoxycyclohexyl)-

ethyltrimethoxysilane. Particularly preferred are aminosilanes as described above.

Preferred examples of titanium coupling agents are specifically, isopropyltriisostearoyl titanate, isopropyltridodecylbenzenesulfonyl titanate, isopropyltris-(dioctylpyrophosphate)titanate, tetraisopropylbis(dioctyl-phosphate) titanate, tetraoctylbis(ditridecylphosphite) titanate, tetra(1,1-diallyloxymethyl-1-butyl)bis(ditridecyl)-phosphite titanate, bis(dioctylpyrophosphate)oxyacetate titanate, bis(dioctylpyrophosphate)ethylene titanate, isopropyltrioctanoyl titanate, isopropyldimethacryl-isostearoyl titanate, isopropylisostearoyldiacryl titanate, isopropyltri(dioctylphosphate)titanate, isopropyltricumylphenyl titanate, isopropyltri(N-amideethyl, aminoethyl) titanate, dicumylphenyloxyacetate titanate, and diisostearoylethylene titanate. Among them, preferred is isopropyltri(N-amideethyl, aminoethyl)titanate.

Surface treatment using these coupling agents can be carried out according to the conventional methods, without a particular limitation. More specifically, a sizing treatment in which the organic solvent solution or suspending solution of a coupling agent is applied as a sizing agent on the filler, drying and mixing with the use of Henschel mixer, a super mixer, or V-shape blender; the spray method, the integral blend method, or the dry concentrate method can be used appropriately depending on the form of fillers. Preferred are the sizing treatment, the dry mixing and the spray method.

With the above coupling agent, film-forming materials for glass can be used in combination. Said film-forming materials are not critical but include polyesters, urethane polymers, epoxy polymers, acryl polymers, isocyanate polymers, and vinyl acetate polymers.

In the present invention, the above surface-treated filler component can be blended. The proportion to be blended varies depending on the purposes and objects. In composition I, the surface-treated filler is blended in the proportion of 1 to 350 parts by weight, preferably 5 to 200 parts by weight based on 100 parts by weight of the above components (A) and (B). in composition II, the surface-treated filler is blended in the proportion of 1 to 350 parts by weight, preferably 5 to 200 parts by weight based on 100 parts by weight of the above components (A), (B) and (C).

If the proportion of the surface-treated filler to be blended is less than 1 part by weight, the sufficient effect of the blended filler cannot be obtained. On the other hand, if it exceeds 350 parts by weight, there occur defects that the dispersibility is poor and molding becomes difficult.

Further, in the present invention, by blending (A') a styrene polymer having a syndiotactic configuration as the above component (A), (B') either polyphenylene ether or a mixture of polyphenylene ether and a styrene polymer without any functional groups, having a maleic anhydride group, that is polyphenylene ether modified by maleic anhydride, as the component (B), and (D') a filler surface-treated by an amino silane coupling agent as the component (D) respectively, as

described above, the adhesiveness between a styrene polymer and a filler can be improved and a resin composition having more excellent properties can be obtained.

The resin composition of the present invention comprises each component described above, but if necessary, various additives, other thermoplastic resins or rubber-like elastomers can be blended, so long as the object of the present invention is not hindered. Examples of the above additives are an antioxidant such as phosphite and phosphate described in Japanese Patent Application Laid-Open No. 284244/1988, an UV absorbent, an aliphatic carboxylate- or paraffin-based external lubricant as described in Japanese Patent Application Laid-Open Nos. 201350/1989 and 22587/1989, a nuclear agent such as an organic acid metal salt and an organic phosphorus compound, a releasing agent, an antistatic agent, a colorant, a flame retardant and a flame retardant aid.

The above thermoplastic resins include polyphenylene ether without any polar groups, polyolefin such as polyethylene, polypropylene, polybutene and polypentene, polyester such as polyethylene terephthalate, polybutylene terepthalate and polyethylene naphthalate, polythioether such as polyamide and polyphenylene sulfide, polycarbonate, polyarylate, polysulfone, polyether ether ketone, polyether sulfone, polyimide, polyamide imide, polymethyl methacrylate, an ethylene-acrylic acid copolymer, an acrylonitrile-styrene copolymer, an acrylonitrile-chlorinated polyethylene-styrene copolymer, an ethylene-vinyl acetate copolymer, an ethylene-

vinyl alcohol copolymer, acrylonitrile-butadiene-styrene copolymer, a vinyl chloride resin, chlorinated polyethylene, fluorinated polyethylene, polyacetal, a thermoplastic polyurethane elastomer, 1,2-polybutadiene and styrene-maleic anhydride. The preferable thermoplastic resin is the one having affinity or reactivity with a polar group of polyphenylene ether having a polar group as Component (B). Examples are polyolefin such as polyethylene, polypropylene, polybutene and polypentene; polyphenylene sulfide; polyester such as polyethylene terephthalate, polybutylene terephthalate and polyethylene naphthalate; polycarbonate, polyarylate, polysulfone, polyether ether ketone, polyether sulfone, polyimide, polymethyl methacrylate, an ethylene-acrylate copolymer, an acrylonitrile-styrene copolymer, an acrylonitrile-chlorinated polyethylene-styrene copolymer, an ethylene-vinyl acetate copolymer, an ethylene-vinyl alcohol copolymer, an acrylonitrile-butadiene-styrene copolymer, polyacetal and a styrene-maleic anhydride copolymer, to which the compound having both a polar group and an unsaturated group, which is used for introduction of a polar group to polyphenylene ether having a polar group as Component (B), is introduced by melting reaction, solution reaction or polymerization. The most preferable thermoplastic resins include maleic anhydride-modified polyethylene, polypropylene, a styrene-maleic anhydride copolymer, polyarylate, polycarbonate, polyphenylene sulfide containing an epoxyl group and polyphenylene sulfide containing an amino group.

Various rubber-like elastomers can be used, and the most preferable one is a rubber-like copolymer containing a styrene-based compound as one component. Examples are styrene-butadiene copolymer rubber (SBR), a styrene-butadiene block copolymer (SB, SBS, BSB, etc.), a styrene-hydrogenated butadiene block copolymer (SEBS, SEB, etc.), a styrene-isoprene block copolymer (SI, SIS, ISI, etc.), a styrene-hydrogenated isoprene block copolymer (SEP, SEPS, etc.), or as described in Japanese Patent Application Laid-Open No. 292049/1989, a granular elastomer obtained by polymerizing a vinyl monomer in the presence of the polymer obtained by polymerizing one or at least two monomers selected from the group consisting of alkyl acrylate, alkyl methacrylate and a multi-functional monomer having a conjugated diene type double bond. Examples of the granular elastomer acrylonitrile-styrene grafted butadiene rubber (ABS), acrylonitrile-styrene grafted butadiene-butyl acrylate copolymer rubber (AABS), methyl methacrylate-styrene grafted butylacrylate rubber (MAS), styrene grafted butadiene rubber (SB), methyl methacrylate-styrene grafted butadiene rubber (MBS) and methyl methacrylate-styrene grafted butadiene-butyl acrylate copolymer rubber (MABS).

Further, examples are one or at least two block or graft copolymers selected from an A-B type block copolymer, an A-grafted B copolymer and a B-grafted A copolymer, wherein A is at least one styrene polymers or styrene copolymers selected from atactic polystyrene, acrylonitrile-styrene random copolymer, styrene-maleic anhydride random copolymer,

styrene-acrylonitrile-anhydrous maleimide random copolymer, styrene-methyl methacrylate random copolymer and styrene-methacrylic acid random copolymer, and B is at least one polymers selected from polybutadiene, polyisoprene, hydrogenated polybutadiene, hydrogenated polyisoprene and polycarbonate, and at least one polymers selected from polyamide, polymethyl methacrylate, polyethylene terephthalate and polybutylene terephthalate.

Further, the rubber-like elastomers include, in addition to the above, natural rubber, polybutadiene, polyisoprene, polyisobutyrene, neoprene, ethylene-propylene copolymer rubber, polysulfide rubber, thiokol rubber, acrylic rubber, urethane rubber, silicone rubber and epichlorohydrin rubber.

The rubber-like elastomer modified by reacting with the compound having a polar group and an unsaturated group used for introduction of the polar group to polyphenylene ether having a polar group, may be used.

Among various flame retardants, particularly halogen-based flame retardants and phosphorus-based flame retardants are preferable. The halogen-based flame retardants include, for example, tetrabromobisphenol A, tetrabromophthalic anhydride, hexabromobenzene, tribromophenylallyl ether, pentabromotoluene, pentabromophenol, tribromophenyl-2,3-dibromo propyl ether, tris(2,3-dibromopropyl)phosphate, tris(2-chloro-3-bromopropyl)phosphate, octabromodiphenyl ether, decabromodiphenyl ether, octabromobiphenyl, pentachloropentacyclodecane, hexabromocyclododecane,

hexachlorobenzene, pentachlorotoluene, hexabromobiphenyl, decabromobiphenyl, decabromobiphenyl oxide, tetrabromobutane, decabromodiphenyl ether, hexabromodiphenyl ether, ethylene-bis-(tetrabromophthalimide), tetrachlorobisphenol A, tetrabromobisphenol A, an oligomer of tetrachlorobisphenol A or tetrabromobisphenol A, a halogenated polycarbonate oligomer such as a brominated polycarbonate oligomer, a halogenated epoxy compound, polychlorostyrene, halogenated polystyrene such as polytribromostyrene, poly(dibromophenylene oxide) and bis(tribromophenoxy)ethane.

The phosphorus-based flame retardants include ammonium phosphate, tricresyl phosphate, triethyl phosphate, acidic phosphate and triphenylphosphene oxide.

Among them, the preferable flame retardants are particularly polytribromostyrene, poly(dibromophenylene oxide), decabromodiphenyl ether, bis(tribromophenoxy)ethane, ethylene-bis-(tetrabromophthalimide), tetrabromobisphenol A and a brominated polycarbonate oligomer.

The above flame retardant is blended in the proportion of 3 to 40 parts by weight, preferably 5 to 35 parts by weight based on 100 parts by weight of the total amount of the above components (A) and (B) in Composition I of the present invention (based on 100 parts by weight of the total amount of the above components (A), (B) and (C) in Composition II). If the proportion of the flame retarder to be blended is less than 3 parts by weight, less effect is obtained. On the other hand, if it exceeds 40 parts by weight, flame retardance is not improved according to the

amount added, but rather other mechanical properties are undesirably impaired.

And further, in the present invention, it is preferable to use a flame retardant aid with the above flame retardant. Various flame retardant aids can be used, for example, antimony flame retardant aids such as antimony trioxide, antimony pentaoxide, sodium antimonate, metal antimony, antimony trichloride, antimony pentachloride, antimony trisulfide and antimony pentasulfide. Also, in addition to the above, zinc borate, barium metaborate and zirconium oxide can be used. Among them, particularly antimony trioxide is preferable. Said flame retardant aid is blended in the proportion of 1 to 15 parts by weilght, preferably 2 to 10 parts by weight based on 100 parts by weight of the total amount of the above components (A) and (B) in Composition I of the present invention (based on 100 parts by weight of the total amount of the above components (A), (B) and (C) in Composition II). If the proportion of the flame retardant aid to be blended is less than 1 part by weight, the effect as a flame retardant aid is insufficient. On the other hand, if it exceeds 15 parts by weight, the effect as a flame retardant aid is not improved according to the amount added, but rather there exists possibility of impairing other properties undesirably.

Further, in the present invention, to prevent melt dropping, a tetrafluoroethylene polymer can be used. Specific examples of the tetrafluoroethylene polymer are, in addition to the tetrafluoroethylene homopolymer

(polytetrafluoroethylene), a copolymer of tetrafluoroethylene and hexafluoropropylene, and further a tetrafluoroethylene copolymer containing a few copolymerizable ethylenically unsaturated monomers. The tetrafluoroethylene polymer containing 65 to 76% by weight, preferably 70 to 76% by weight of fluorine is used. The above tetrafluoroethylene polymer is blended in the proportion of 0.003 to 10 parts by weight, preferably 0.02 to 2 parts by weight based on 100 parts by weight of the total amount of the above components (A) and (B) in Composition I of the present invention (based on 100 parts by weight of the total amount of the above components (A), (B) and (C) in Composition II).

As described above, the styrene polymer composition has excellent impact resistance, water resistance and mechanical property, and is expected to be utilized effectively for various purposes such as industrial materials including electric and electronic materials, industrial structural materials, automobile parts, domestic electric appliances and various machine parts.

The present invention is described in greater detail with reference to the following examples and comparative examples.

Reference Example 1

In a 500-milliliter glass reactor in which air had been replaced with argon, 17.8 g (71 mmol) of copper sulfate pentahydrate ($CuSO_4 \cdot 5H_2O$), 200 ml of toluene and 24 ml (250 mmol) of trimethylaluminum were placed and reacted at 40°C for 8 hours. And then, from the solution obtained by

removing the solid, the toluene was further distilled away under reduced pressure at room temperature to obtain 6.7 g of a contact product. The molecular weight of said product as determined by the freezing point depression method was 610.

Production Example 1

In a 2-liter reactor, 1 L (L=liter) of purified styrene, 7.5 mmol of the contact product obtained in the above Reference Example 1 as an aluminum atom, 7.5 mmol of triisobutyl alminum and 0.038 mmol of pentamethylcyclopentadienyl titanium trimethoxide were placed and polymerized at 90°C for 5 hours. After completion of the reaction, the resulting product was decomposed in a methanol solution of sodium hydroxide to remove the catalyst component, and then the residue was washed with methanol repeatedly and dried to obtain 466 g of a polymer.

The weight average molecular weight of said polymer as determined using 1,2,4-trichlorobenzene as a solvent at 130°C by the gel permeation chromatography was 290,000. Weight average molecular weight/number average molecular weight was 2.72. The melting point and ^{13}C-NMR measurements confirmed that said polymer was polystyrene having a syndiotactic configuration (SPS).

Production Example 2

In a 2-liter reactor, 1 L of purified styrene, 5 mmol as alminum atom of the contact product obtained in the above Reference Example 1, 5 mmol of triisobutyl aluminum and 0.025 mmol of pentamethylcyclopentadienyl titanium trimethoxide were placed and polymerized at 90°C for 5 hours. After

completion of the reaction, the resulting product was decomposed in a methanol solution of sodium hydroxide to remove the catalyst component, and then the residue was washed with methanol repeatedly and dried to obtain 308 g of a polymer.

The weight average molecular weight of said polymer as determined using 1,2,4-trichlorobenzene as a solvent at 130°C by the gel permeation chromatography was 389,000. Weight average molecular weight/number average molecular weight was 2.64. The melting point and ^{13}C-NMR measurements confirmed that said polymer was polystyrene having a syndiotactic configuration.

Production Example 3

In a 2-liter reactor, 1 L of purified styrene, 7.5 mmol as aluminum atom of the contact product obtained in the above Reference Example 1, 7.5 mmol of triisobutyl alminum and 0.038 mmol of pentamethylcyclopentadienyl titanium trimethoxide were placed and polymerized at 70°C for 3 hours. After completion of the reaction, the resulting product was decomposed in a methanol solution of sodium hydroxide to remove the catalyst component, and then the residue was washed with methanol repeatedly and dried to obtain 580 g of a polymer.

The weight average molecular weight of said polymer as determined using 1,2,4-trichlorobenzene as a solvent at 130°C by the gel permeation chromatography was 592,000. Weight average melecular weight/number average molecular weight was 2.81. The melting point and ^{13}C-NMR measurements confirmed

that said polymer was polystyrene having a syndiotactic configuration.

Production Example 4

With 100 parts by weight of poly(2,6-dimethyl-1,4-phenylene) ether (PPO)(catalogue No. 18178-1, produced by Aldorich Co.), 5 parts by weight of maleic anhydride (S Grade, produced by Wako Junyaku Co.) and 0.2 parts by weight of t-butylhydroxy peroxide (trade-mark: Perbutyl H, produced by Nippon Oil & Fats Co., Ltd.) as a peroxide were mixed by a Henschel mixer, and then the resulting mixture was kneaded by the twin-screw extruder at 300 to 320°C under heat melting to obtain maleic anhydride-modified PPO. The resulting modified PPO was dissolved in toluene, and then the resulting mixture was reprecipitated dropwise with methanol to be purified. The purified modified PPO was molded by compression. The peak due to a carbonyl group was observed by an infrared ray measurement to confirm that the PPO was modified by maleic anhydride.

Production Example 5

With 100 parts by weight of styrene grafted polyphenylene ether (PPE)(trade-mark: Iupiace CPX 100, produced by Mitsubishi Gas Chemical Company Inc.) having an intrinsic viscosity of 0.45 at 25°C in chloroform, 0.5 parts by weight of maleic anhydride (S Grade, produced by Wako Junyaku Co.) and 0.4 parts by weight of cumenehydro peroxide (trade-mark; Percumyl produced by Nippon Oil & Fats Co., Ltd.) as a peroxide were mixed by a Henschel mixer, and then the resulting mixture was kneaded by the twin-screw extruder

at 300 °C under heat melting to obtain maleic anhydride-modified PPE. It was confirmed that the resulting modified PPE was modified by maleic anhydride in the same manner as in Production Example 4.

Production Example 6

With 85 parts by weight of poly(2,6-dimethyl-1,4 phenylene) ether (PPO) (catalogue NO. 18178-1, produced by Aldorich Co.), 15 parts by weight of SPS obtained in the Production Example 1, 0.5 parts by weight of maleic anhydride (S Grade, produced by Wako Junyaku Co.) and 0.2 parts by weight of t-butylhydroxy peroxide (trade-mark: Perbutyl H*, produced by Nippon Oil & Fats Co.,) as a peroxide were mixed by a Henschel mixer, and then the resulting mixture was kneaded by the twin-screw extruder at 300 to 320°C under heat melting to obtain maleic anhydride-modified PPO. It was confirmed that the resulting modified PPO was modified by maleic anhydride in the same manner as in Production Example 4.

Production Example 7

With 85 parts by weight of poly(2,6-dimethyl-1,4 phenylene) ether (PPO) (catalogue NO. 18178-1, produced by Aldorich Co.), 15 parts by weight of Idemitsu Polystyrene HT-54 (HIPS), 5 parts by weight of maleic anhydride (S Grade, produced by Wako Junyaku Co.) and 0.2 parts by weight of t-butylhydroxy peroxide (trade name: Perbutyl H, produced by Nippon Oil & Fats Co., Ltd.) as a peroxide were mixed by a

* Trade-Mark

Henschel mixer, and then the resulting mixture was kneaded by the twin-screw extruder at 260 to 270°C under heat melting to

obtain maleic anhydride-modified PPO. It was confirmed that the resulting modified PPO was modified by maleic anhydride in the same manner as in Production Example 4.

Example 1

To 100 parts by weight of the total amount of 75% by weight of polystyrene having a syndiotactic configuration (SPS) obtained in Production Example 1 and 25% by weight of maleic anhydride-modified PPO obtained in Production Example 4, 0.7 parts by weight of (2,6-di-t-butyl-4-methylphenyl) pentaerythritol diphosphite (trade-mark: PEP-36, produced by Adeka Argus Co., Ltd.), 0.1 parts by weight of 2,6-di-t-butyl-4-phenol (trade-mark: Sumilizer BHT, produced by Sumitomo Chemical Co., Ltd.) and 1 part by weight of p-(t-butyl)benzoic acid as an antioxidant were added. The resulting mixture was dry blended by a Henschel mixer, and then kneaded under melting by a twin-screw extruder having a cylinder temperature of 300°C to be pelletized.

The resulting pellet was molded by injection to obtain test pieces for a bending test. The bending test was carried out. The results are shown in Table 1.

Comparative Example 1

To 100 parts by weight of polystyrene having a syndiotactic configuration (SPS) obtained in Production Example 1, 0.7 parts by weight of (2,6-di-t-butyl-4-methylphenyl) pentaerythritol diphosphite (trade-mark: PEP-36, produced by Adeka Argus Co., ltd.), 0.1 parts by weight of 2,6-di-t-butyl-4-phenol (trade-mark: Sumilizer BHT, produced by Sumitomo Chemical Co., Ltd.) and 1 part by weight

of p-(t-butyl)benzoic acid as an antioxidant were added. The resulting mixture was dry blended by a Henschel mixer, and then kneaded under melting by a twin-screw extruder cylindar temperature of 300°C to be pelletized.

The resulting pellet was molded by injection to obtain test pieces for a bending test. The bending test was carried out. The results are shown in Table 1.

Table 1

No.	Bending Strength (kg/cm^2)	Modulus of Bending Elasticity (kg/cm^2)
Example 1	1300	49000
Comparative Example 1	1000	39000

Example 2

To 100 parts by weight of the total amount of 95% by weight of polystyrene having a syndiotactic configuration (SPS) obtained in Production Exampel 1 and 5% by weight of modified PPO obtained in Production Example 4, 0.7 parts by weight of (2,6-di-t-butyl-4-methylphenyl) pentaerythritol diphosphite (trade-mark: PEP-36, produced by Adeka Arugus Co., Ltd.), 0.1 parts by weight of 2,6-di-t-butyl-4-phenol (trade-mark: Sumilizer BHT, produced by Sumitomo Chemical Co., Ltd.) and 1 part by weight of p-(t-butyl)aluminum benzoate (trade-mark: PTBBA-A1, produced by Dainippon Ink

Industry Co.) as an antioxidant were added. The resulting mixture was dry blended by a Henschel mixer, and then pelletized by a twin-screw extruder while side-feeding 43 parts by weight of glass fiber treated with amino silane (03T-488, 13 μm/3 mm, produced by Nippon Electric Glass Co., Ltd.) as a filler. The resulting pellet was molded by injection to obtain a bending test piece and an Izod impact test piece. Using the resulting test pieces, the bending test and Izod impact test were carried out. The heat distortion temperature was determined. The results are shown in Table 3.

Examples 3 to 23 and Comparative Examples 2 to 6

The procedure of Example 2 was repeated except that SPS obtained in the above Production Examples 1 to 3, atactic polystyrene (trade-mark: Idemitsu Polystyrene HH30E, produced by Idemitsu Petrochemical Co., Ltd.) or high impact polystyrene (trade-mark: Idemitsu Polystyrene HT-54, produced by Idemitsu Petrochemical Co., Ltd.) was used as a styrene polymer, and the product obtained in the above Production Examples 4 to 7 or poly(2,6-dimethyl-1,4-phenylene)ether (catalogue No. 18178-1, produced by Aldorich Co.) was used as polyphenylene ether, and further a filler and an additive were added according to the prescription shown in Table 2. These results are shown in Table 3.

However, in Example 12, with 100 parts by weight of the total amount of 95% by weight of syndiotactic polystyrene (SPS) obtained in the above Production Example 1 and 5% by weight of poly(2,6-dimethyl-1,4-phenylene)ether (catalogue

No. 18178-1, produced by Aldorich Co.), 0.5 parts by weight of maleic anhydride (S Grade, produced by Hiroshima Wako Junyaku Co.) and 0.2 parts by weilght of t-butyl-hydroxy peroxide (trade name: Perbutyl H, produced by Nippon Oil & Fats Co., Ltd.) as a peroxide were dry blended by a Henschel mixer, and then the resulting mixture was pelletized by a twin-screw extruder while side-feeding 43 parts by weight of glass fiber treated with amino silane (03T-488, 13 μm/3 mm, produced by Nippon Electric Glass Co., Ltd.) as a filler.

Table 2

No.	Base Composition (100 Parts)				Filler			
	Component (A)	wt %	Component (B)	wt %	Fibrous Filler	Part by Weight	Granular Filler	Part by Weight
Example 2	Product of Production Example 1	95	Product of Production Example 4	5	Chopped Strand*1	43	–	–
Example 3	Product of Production Example 1	97	Product of Production Example 4	3	Chopped Strand*1	43	–	–
Example 4	Product of Production Example 1	90	Product of Production Example 4	10	Chopped Strand*1	43	–	–
Example 5	Product of Production Example 1	70	Product of Production Example 4	30	Chopped Strand*1	43	–	–
Comparative Example 2	Product of Production Example 1	100	—	–	Chopped Strand*1	43	–	–
Comparative Example 3	Product of Production Example 1	70	PPO*2	30	Chopped Strand*1	43	–	–
Example 6	Product of Production Example 1	90	Product of Production Example 5	10	Chopped Strand*1	43	–	–
Example 7	Product of Production Example 1	90	Product of Production Example 6	10	Chopped Strand*1	43	–	–
Example 8	Product of Production Example 2	92.5	Product of Production Example 4	7.5	Chopped Strand*1	65	–	–
Example 9	Product of Production Example 3	92.5	Product of Production Example 4	7.5	Chopped Strand*1	100	–	–
Example 10	Product of Production Example 1	92.5	Product of Production Example 4	7.5	Chopped Strand*1	115	Talc*6	70
Example 11	Product of Production Example 1	40	Product of Production Example 4	60	Chopped Strand*1	43	–	–
Example 12	Product of Production Example 1	95	*7	5	Chopped Strand*1	43	–	–
Example 13	aPS*8	95	Product of Production Example 4	5	Chopped Strand*1	43	–	–
Example 14	HIPS*9	95	Product of Production Example 4	5	Chopped Strand*1	43	–	–
Example 15	Product of Production Example 1	95	Product of Production Example 7	5	Chopped Strand*1	43	–	–
Comparative Example 4	Product of Production Example 1	15	Product of Production Example 7	85	Chopped Strand*1	43	–	–

Table 2 (continued-1)

No.	Base Composition (100 Parts) Component (A)	wt %	Component (B)	wt %	Filler Fibrous Filler	Part by Weight	Granular Filler	Part by Weight
Comparative Example 5	Product of Production Example 1	97	PPO*2	3	Chopped Strand*1	43	–	–
Example 16	Product of Production Example 1	95	Product of Production Example 8	5	Chopped Strand*1	43	–	–
Example 17	Product of Production Example 1	99	Product of Production Example 9	1	Chopped Strand*1	43	–	–
Example 18	Product of Production Example 1	97	Product of Production Example 9	3	Chopped Strand*1	43	–	–
Example 19	Product of Production Example 1	90	Product of Production Example 9	10	Chopped Strand*1	43	–	–
Example 20	Product of Production Example 1	97	Product of Production Example 10	3	Chopped Strand*1	43	–	–
Example 21	Product of Production Example 1	95	Product of Production Example 11	5	Chopped Strand*1	43	–	–
Comparative Example 6	Product of Production Example 1	90	Product of Production Example 12	10	Chopped Strand*1	43	–	–
Example 22	Product of Production Example 1	97	Product of Production Example 4	3	Chopped Strand*10	30	–	–
Example 23	Product of Production Example 1	97	Product of Production Example 4	3	Chopped Strand*10	40	–	–

Table 2 (continued-2)

No.	Rubber-like Elastomer		Antioxidant		Antioxidant		Nuclear Agent	
	Kind	Part by Weight	Antioxidant (1)	Part by Weight	Antioxidant (2)	Part by Weight	Kind	Part by Weight
Example 2	—	—	PEP-36	0.7	BHT	0.1	PTBBA-A1	1
Example 3	—	—	PEP-36	0.7	BHT	0.1	PTBBA-A1	1
Example 4	—	—	PEP-36	0.7	BHT	0.1	PTBBA-A1	1
Example 5	—	—	PEP-36	0.7	BHT	0.1	PTBBA-A1	1
Comparative Example 2	—	—	PEP-36	0.7	BHT	0.1	PTBBA-A1	1
Comparative Example 3	—	—	PEP-36	0.7	BHT	0.1	PTBBA-A1	1
Example 6	—	—	PEP-36	0.5	MARK AO 60*3	0.1	PTBBA-A1	0.5
Example 7	—	—	P-EPQ*4	0.2	MARK AO 60*3	0.1	PTBBA-A1	0.2
Example 8	SB*5	10	P-EPQ*4	0.5	MARK AO 60*3	0.1	PTBBA-A1	0.5
Example 9	—	—	PEP-36	0.5	MARK AO 60*3	0.1	PTBBA-A1	0.5
Example 10	—	—	PEP-36	0.5	MARK AO 60*3	0.1	PTBBA-A1	0.5
Example 11	—	—	PEP-36	0.5	MARK AO 60*3	0.1	PTBBA-A1	0.5
Example 12	—	—	PEP-36	0.7	BHT	0.1	PTBBA-A1	0.5
Example 13	—	—	PEP-36	0.7	BHT	0.1	PTBBA-A1	0.5
Example 14	—	—	PEP-36	0.7	BHT	0.1	PTBBA-A1	0.5
Example 15	—	—	PEP-36	0.7	BHT	0.1	PTBBA-A1	0.5
Comparative Example 4	—	—	PEP-36	0.7	BHT	0.1	PTBBA-A1	0.5

Table 2 (continued-3)

No.	Rubber-like Elastomer		Antioxidant		Antioxidant		Nuclear Agent	
	Kind	Part by Weight	Antioxidant (1)	Part by Weight	Antioxidant (2)	Part by Weight	Kind	Part by Weight
Comparative Example 5	—	—	PEP-36	0.7	BHT	0.1	PTBBA-A1	1
Example 16	—	—	PEP-36	0.7	BHT	0.1	PTBBA-A1	1
Example 17	—	—	PEP-36	0.7	BHT	0.1	PTBBA-A1	1
Example 18	—	—	PEP-36	0.7	BHT	0.1	PTBBA-A1	1
Example 19	—	—	PEP-36	0.7	BHT	0.1	PTBBA-A1	1
Example 20	—	—	PEP-36	0.7	BHT	0.1	PTBBA-A1	1
Example 21	—	—	PEP-36	0.7	BHT	0.1	PTBBA-A1	1
Comparative Example 6	—	—	PEP-36	0.7	BHT	0.1	PTBBA-A1	1
Example 22	—	—	PEP-36	0.1	BHT	0.1	PTBBA-A1	1
Example 23	—	—	PEP-36	0.1	BHT	0.1	PTBBA-A1	1

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*1 Chopped strand treated with aminosilane, 13 μm/3 mm, 03T-488, produced by Nippon Electric Glass Co., Ltd.

*2 Poly(2,6-dimethyl-1,4 phenylene)ether

*3 Tetrakis[methylene-3-(3',5'-di-t-butyl-4'-hydroxyphenyl)] propionate (produced by Adeka Argus Co., Ltd.)

*4 Tetrakis(2,4-di-t-butylphenyl)-4-4'-biphenylene phosphite (produced by Ciba Geigy Co., Ltd.)

*5 Styrene-butadiene rubber (ZLS-01, produced by Nippon Zeon Co.)

*6 Talc treated by spraying a toluene/water suspension of γ-aminopropyl triethoxysilane.

*7 Refer to the description of Example 12.

*8 Atactic polystyrene (Polystyrene HH30E, produced by Idemitsu Petrochemical Co., Ltd.)

*9 High impact polystyrene (Polystyrene HT-54, produced by Idemitsu Petrochemical Co., Ltd.)

*10 Chopped strand treated with aminosilane and isocyanate, 14 μm/3mm, 03T-051 produced by Nippon Electric Glass Co., Ltd.

Table 3

No.	Bending Strength (kg/cm^2)	Izod Impact Strength (notched) ($kg \cdot cm/cm$)	Heat Distortion Temperature ($18.6\ kg/cm^2$) (°C)
Example 2	1750	8.2	251
Example 3	1650	7.6	252
Example 4	1830	8.5	250
Example 5	1860	8.7	220
Comparative Example 2	1200	4.6	250
Comparative Example 3	1480	5.0	215
Example 6	1760	8.1	250
Example 7	1780	8.3	251
Example 8	1980	7.5	254
Example 9	2150	8.0	260
Example 10	2000	7.6	265
Example 11	1850	8.8	190
Example 12	1760	8.4	250
Example 13	1740	8.0	—
Example 14	1650	8.1	—
Example 15	1790	8.3	252
Comparative Example 4	1750	8.2	163*1

*1 The resin of Comparative Example 4 was heat treated at 80°C. Its dimensional stability was good.

Table 3 (continued)

No.	Bending Strength (kg/cm^2)	Izod Impact Strength (notched) ($kg \cdot cm/cm$)	Heat Distortion Temperature ($18.6\ kg/cm^2$) (°C)
Comparative Example 5	1450	5.0	248
Example 16	1610	6.7	252
Example 17	1780	7.6	255
Example 18	1810	8.8	254
Example 19	1840	8.7	243
Example 20	1770	8.5	250
Example 21	1760	8.2	250
Comparative Example 6	1400	4.9	250
Example 22	1750	10.2	257
Example 23	2070	9.5	260

Example 24

To 100 parts by weight of the total amount of 85% by weight of polystyrene having a syndiotactic configuration (SPS) obtained in Production Example 1, 5% by weight of maleic anhydride-modified PPO obtained in Production Example 4, and 10% by weight of nylon-6,6 (trade name: Ube Nylon 2020B, produced by Ube Kosan Co., Ltd.), 0.7 parts by weight of (2,6-di-t-butyl-4-methylphenyl)pentaerythritol diphosphite (trade name: PEP-36, produced by Adeka Argus Co., Ltd.), 0.1 parts by weight of 2,6-di-t-butyl-4-phenol (trade name: Sumilizer BHT, produced by Sumitomo Chemical Co., Ltd.) and 1 part by weight of p-(t-butyl)aluminum benzoate as an antioxidant were added. The resulting mixture was dry blended by a Henschel mixer, and then kneaded under melting by twin-screw extruder at a cylinder temperature of 300°C to be pelletized.

The resulting pellet was molded by injection to obtain test pieces for a tensile test. The modulus of tensile elasticity, the water-absorptivity and the retention of the modulus of tensile elasticity after water-absorption were determined. The results are shown in Table 4.

Examples 25 to 29 and Comparative Examples 7 to 9

The procedure of Example 24 was repeated except that a styrene polymer, polyphenylene ether, polyamide and an additive were blended in the proportion shown in Table 4. The modulus of tensile elasticity, the water-absorptivity and the retention of the modulus of tensile elasticity after water-absorption were determined. The results are shown in

Table 4. In Example 24 Comparative Example 9, the blending strength was determined.

Example 30

To 100 parts by weight of the total amount of 85% by weight of polystyrene having a syndiotactic configuration (SPS) obtained in Production Example 1, 5% by weight of maleic anhydride-modified PPO obtained in Production Example 4, and 10% by weight of Nylon-6,6 (trade name: Ube Nylon 2020B, produced by Ube Kosan Co., Ltd.), 0.7 parts by weight of (2,6-di-t-butyl-4-methylphenyl)pentaerythritol diphosphite (trade name: PEP-36, produced by Adeka Argus Co., Ltd.), 0.1 parts by weight of tetrakis[methylene-3-(3',5'-di-t-butyl-4'-hydroxyphenyl)]propionate (trade name: MARK AO 60, produced by Adeka Argus Co., Ltd.) and 1 part by weight of p-(t-butyl)benzoic acid as an antioxidant were added. The resulting mixture was dry blended by a Henschel mixer, and then kneaded under melting by a twin-screw extruder at a cylinder temperature of 300°C while side-feeding 43 parts by weight of glass fiber (trade name: CS03MA416, produced by Asahi Glass Fiber Co., Ltd.) treated with amino silane as a filler to be pelletized.

The resulting pellet was molded by injection to obtain test pieces for a tensile test and a bending test. The modulus of tensile elasticity, the water-absorptivity, the retention of the modulus of tensile elasticity after water-absorption and the heat distortion temperature were determined. The results are shown in Table 5.

In Example 34, 41, 42 and Comparative Example 10, the

Izod impact strength was determined.

Table 4

No.	Base Composition (100 parts) Component (A)	wt %	Component (B)	wt %	Component (C)	wt %
Example 24	Product of Production Example 1	85	Product of Production Example 4	5	Nylon-6,6	10
Example 25	Product of Production Example 1	85	Product of Production Example 4	5	Nylon-6*1	10
Comparative Example 7	Product of Production Example 1	90	—	0	Nylon-6,6	10
Comparative Example 8	—	0	—	0	Nylon-6,6	100
Example 26	Product of Production Example 2	45	Product of Production Example 5	10	Nylon-6,6	45
Comparative Example 9	Product of Production Example 2	50	—	0	Nylon-6,6	50
Example 27	Product of Production Examfle 2	15	Product of Production Example 5	20	Nylon-6,6	65
Example 28	Product of Production Example 2	15	Product of Production Example 5	10	Nylon-6,6	75
Example 29	Product of Production Example 2	40	Product of Production Example 5	5	Nylon-4,6*6	55

Table 4 (continued-1)

No.	Antioxidant				Nuclear Agent	
	Kind	Part by Weight	Kind	Part by Weight	Kind	Part by Weight
Example 24	PEP-36	0.7	BHT	0.1	PTBBA-A1*3	1
Example 25	PEP-36	0.7	BHT	0.1	PTBBA-A1	1
Comparative Example 7	PEP-36	0.7	BHT	0.1	PTBBA-A1	1
Comparative Example 8	PEP-36	0.7	BHT	0.1	PTBBA-A1	1
Example 26	PEP-36	0.3	AO-60*2	0.1	PTBBA-A1	0.5
Comparative Example 9	PEP-36	0.3	AO-60	0.1	PTBBA-A1	0.5
Example 27	PEP-36	0.3	AO-60	0.1	PTBBA-A1	0.5
Example 28	PEP-36	0.3	AO-60	0.1	PTBBA-A1	0.5
Example 29	PEP-36	0.3	AO-60	0.1	PTBBA-A1	0.5

Table 4 (continued-2)

No.	Modulus of Tensile Elasticity (kg/cm^2)	Water Absorptivity*4 (%)	Change in Modulus of Tensile Elasticity by Absorption*5 (%)	Bending Strength (kg/cm^2)
Example 24	49000	0.15	0	—
Example 25	47000	0.15	0	—
Comparative Example 7	36000	0.15	0	—
Comparative Example 8	45000	1.30	-10.5	—
Example 26	48000	0.20	0	1200
Comparative Example 9	41000	0.23	0	900
Example 27	46000	0.52	-4.9	—
Example 28	44000	0.90	-8.5	—
Example 29	48000	0.32	-0.8	1500

*1 Ube Nylon 1013B, produced by Ube Kosan Co., Ltd.

*2 Tetrakis[methylene-3-(3',5'-di-t-butyl-4'-hydroxyphenyl)]propionate (produced by Adeka Argus Co., Ltd.)

*3 P-(t-butyl)aluminum benzoate

*4 $$\text{Absorptivity (\%)} = \frac{\text{Weight after Dipping - Weight before Dipping}}{\text{Weight before Dipping}} \times 100$$

*5 Change in Modulus of Tensile Elasticity (%) =

$$\frac{\text{Modulus of Elasticity after Dipping - Modulus of Elasticity before Dipping}}{\text{Modulus of Elasticity before Dipping}} \times 100$$

*6 Unichika Nylon 46 (F5000), produced by Unichika Co., Ltd.

Table 5

No.	Base Composition (100 parts)						Filler	
	Component (A)	wt %	Component (B)	wt %	Component (C)	wt %	Kind	Part by Weight
Example 30	Product of Production Example 3	90	Product of Production Example 6	5	Nylon-6,6	5	Chopped Strand*1	43
Example 31	Product of Production Example 3	80	Product of Production Example 6	10	Nylon-6,6	10	Chopped Strand	43
Example 32	Product of Production Example 3	60	Product of Production Example 6	10	Nylon-6,6	30	Chopped Strand	43
Example 33	Product of Production Example 3	25	Product of Production Example 6	10	Nylon-6,6	65	Chopped Strand	43
Example 34	Product of Production Example 3	45	Product of Production Example 6	10	Nylon-6,6	45	Chopped Strand	43
Comparative Example 10	Product of Production Example 3	50	—	-	Nylon-6,6	50	Chopped Strand	43
Example 35	Product of Production Example 3	65	Product of Production Example 6	20	Nylon-6,6	15	Chopped Strand	43
Example 36	aPS*3	80	Product of Production Example 6	10	Nylon-6,6	10	Chopped Strand	43
Example 37	HIPS*4	80	Product of Production Example 6	10	Nylon-6,6	10	Chopped Strand	100
Example 38	Product of Production Example 1	80	Product of Production Example 7	10	Nylon-6,6	10	Chopped Strand	115
Example 39	Product of Production Example 1	80	Product of Production Example 7	10	Nylon-6,6	10	Talc*5	70
Example 40	Product of Production Example 1	80	Product of Production Example 7	10	Nylon-6	10	Chopped Strand	43
Example 41	Product of Production Example 1	47	Product of Production Example 7	5	Nylon-6,6	48	Chopped Strand*7	43
Example 42	Product of Production Example 2	40	Product of Production Example 5	5	Nylon-4,6	55	Chopped Strand*7	43

Table 5 (continued-1)

No.	Rubber-like Elastomer		Antioxidant				Nuclear Agent	
	Kind	Part by Weight	Kind	Part by Weight	Kind	Part by Weight	Kind	Part by Weight
Example 30	—	—	PEP-36	0.2	AO-60	0.1	PTBBA-A1*2	0.5
Example 31	—	—	PEP-36	0.2	AO-60	0.1	PTBBA-A1	0.5
Example 32	—	—	PEP-36	0.2	AO-60	0.1	PTBBA-A1	0.5
Example 33	—	—	PEP-36	0.2	AO-60	0.1	PTBBA-A1	0.5
Example 34	—	—	PEP-36	0.2	AO-60	0.1	PTBBA-A1	0.5
Comparative Example 10	—	—	PEP-36	0.2	AO-60	0.1	PTBBA-A1	0.5
Example 35	—	—	PEP-36	0.2	AO-60	0.1	PTBBA-A1	0.5
Example 36	—	—	PEP-36	0.2	AO-60	0.1	PTBBA-A1	0.5
Example 37	—	—	PEP-36	0.2	AO-60	0.1	PTBBA-A1	0.5
Example 38	—	—	—	—	AO-60	0.1	PTBBA-A1	0.5
Example 39	—	—	PEP-36	0.2	AO-60	0.1	—	—
Example 40	SB*6	10	PEP-36	0.2	AO-60	0.1	PTBBA-A1	0.5
Example 41	—	—	PEP-36	0.1	AO-60	0.1	PTBBA-A1	1.0
Example 42	—	—	PEP-36	0.1	AO-60	0.1	PTBBA-A1	1.0

Table 5 (continued-2)

No.	Modulus of Tensile Elasticity (kg/cm^2)	Water Absorptivity (%)	Change in Modulus of Tensile Elasticity by Absorption (%)	Heat Distortion Temperature ($18.6\ kg/cm^2$) (°C)	Izod Impact Strength (notched) (kg·cm/cm)
Example 30	93000	0.15	0	250	—
Example 31	92500	0.14	0	250	—
Example 32	89000	0.21	0	250	—
Example 33	82000	0.51	-5	250	—
Example 34	84000	0.18	0	250	10.0
Comparative Example 10	80000	0.19	0	245	5.1
Example 35	88000	0.17	0	242	—
Example 36	91000	0.16	0	—	—
Example 37	86000	0.16	0	—	—
Example 38	114000	0.21	0	260	—
Example 39	125000	0.24	0	265	—
Example 40	84000	0.16	0	243	—
Example 41	103000	0.22	0	252	10.8
Example 42	110000	0.24	-1	270	10.3

*1 Chopped strand glass fiber treated with amino silane, 13 μm/3 mm.

*2 p-(t-butyl)aluminum benzoate

*3 Atactic polystyrene (trade name: Polystyrene HH30E, produced by Idemitsu Petrochemical Co., Ltd.)

*4 High impact polystyrene (trade name: Polystyrene HT-54, produced by Idemitsu Petrochemical Co., ltd.)

*5 Styrene-butadiene rubber (ZLS-01, produced by Nippon Zeon Co.)

*6 Talc treated by spraying a toluene/water suspension of γ-aminopropyl triethoxysilane.

*7 Chopped strand treated with aminosilane and isocyanate, 14 μm/3mm, 03T-051 produced by Nippon Electric Glass Co., Ltd.

CLAIMS:

1. A styrene polymer composition comprising

(A) 99.9 to 20% by weight of a styrene polymer having a syndiotactic configuration, and having no functional group, and

(B) 0.1 to 80% by weight of either of polyphenylene ether having a polar group or a mixture of polyphenylene ether having a polar group and a styrene polymer having no functional group.

2. A styrene polymer composition comprising

(A) 99.9 to 75% by weight of a styrene polymer having a syndiotactic configuration and having no functional group, and

(B) 0.1 to 25% by weight of either of polyphenylene ether having a polar group or a mixture of polyphenylene ether having a polar group and a styrene polymer having no functional group.

3. A styrene polymer composition according to Claim 1 or 2, wherein the polar group in Component (B) is an acid derivative.

4. A styrene polymer composition comprising 100 parts by weight of styrene polymer composition according to any one of Claims 1 to 3, and (D) 1 to 350 parts by weight of a filler surface-treated with a coupling agent.

5. A styrene polymer composition according to Claim 4, wherein the coupling agent used for the surface treatment of the filler as Component (D) is a silane coupling agent.

6. A styrene polymer composition comprising

(A') 99.9 to 20% by weight of a styrene polymer having a syndiotactic configuration and having no functional group,

(B′) 0.1 to 80% by weight of either of polyphenylene ether containing anhydrous maleic acid group or a mixture of polyphenylene ether containing maleic acid anhydride group and a styrene polymer having no functional group, and

(D′) a filler surface-treated with aminosilane coupling agent, in an amount of 1 to 350 parts by weight per 100 parts by weight of the total of above-mentioned Component (A′) and Component (B′).

7. A styrene polymer composition comprising

(A′) 99.9 to 75% by weight of a styrene polymer having a syndiotactic configuration and having no functional group,

(B′) 0.1 to 25% by weight of either of polyphenylene ether containing anhydrous maleic acid group or a mixture of polyphenylene ether containing maleic acid anhydride group and a styrene polymer having no functional group, and

(D′) a filler surface-treated with an aminosilane coupling agent, in an amount of 1 to 350 pats by weight per 100 parts by weight of the total of above-mentioned Component (A′) and Component (B′).

8. A styrene polymer composition comprising

(A) 99 to 1% by weight of a styrene polymer having a syndiotactic configuration and having no functional group,

(B) 0.1 to 50% by weight of either of polyphenylene ether having a polar group or a mixture of polyphenylene ether having a polar group and a styrene polymer having no functional group, and

(C) 0.9 to 98.9% by weight of polyamide.

B

9. A styrene polymer composition according to Claim 8, wherein the polar group in Component (B) is an acid derivative.

10. A styrene polymer composition comprising

100 parts by weight of the styrene polymer composition according to Claim 8 or 9, and

(D) 1 to 350 parts by weight of a filler surface-treated with a coupling agent.

11. A styrene polymer composition according to Claim 10, wherein the coupling agent used for surface treatment of the filler as Component (D) is a silane coupling agent.

12. A styrene polymer composition comprising

(A') 99 to 1% by weight of a styrene polymer having a syndiotactic configuration and having no functional group,

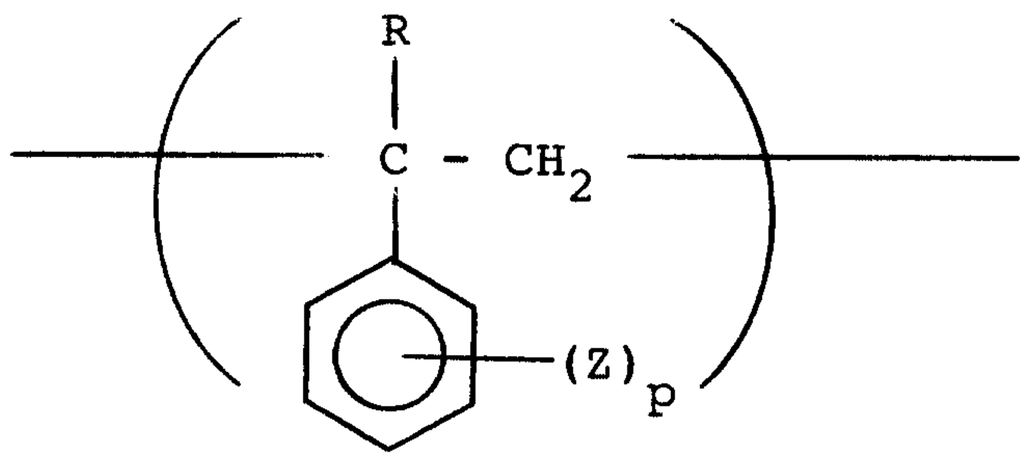
(B') 0.1 to 50% by weight of either of polyphenylene ether having anhydrous maleic acid group or a mixture of polyphenylene ether having maleic acid anhydride group and a styrene polymer having no functional group,

(C') 0.9 to 98.9% by weight of polyamide, and

(D') a filler surface-treated with an aminosilane coupling agent in an amount of 1 to 350 parts by weight per 100 parts by weight of the total of above-mentioned Components (A'), (B') and (C').

13. A styrene polymer composition prepared by admixing:

(A) 99.9 to 20% by weight of a styrene polymer having a weight-average molecular weight of at least 10,000 and no functional group and being represented by the following recurring unit:



(I)

[wherein R is hydrogen or an alkyl group having 1 to 4 carbon atoms;

Z is a hydrogen atom, a halogen atom, or an alkyl group having 1 to 4 carbon atoms; and

p is an integer of 1 to 5],

the said styrene polymer having such a syndiotacticity that a proportion of racemic pentad as determined by a ^{13}C-NMR method is at least 30%; and

(B) 0.1 to 80% by weight of (i) a polyphenylene ether having a polar group or a mixture of such a polyphenylene ether and (ii) a styrene polymer having no functional group, wherein the polar group in the polyphenylene ether is a member selected from the class consisting of acid halide, carbonyl, acid anhydride, acid amide, carboxylate, acid azide, sulfone, nitrile, cyano, isocyanic acid ester, amino, hydroxyl, imide, thiol, oxazoline and epoxy; and the styrene polymer having no functional group

(ii) is selected from the class consisting of an atactic, isotactic or syndiotactic homopolymer of a recurring unit of the formula (I) defined above, a styrene polymer of a recurring unit of the formula modified with a natural or synthetic elastomer material and a copolymer of a recurring unit of the formula (I) and butadiene or isoprene,

wherein the percentage is based on the total amount of the components (A) and (B).

14. A styrene polymer composition according to claim 13, wherein the content of the polar group in the polyphenylene ether is at least 0.01% by weight of the polyphenylene ether and the polyphenylene ether having a polar group is produced by reacting a polyphenylene ether having no such a polar group with a compound containing both an unsaturated group and the polar group.

15. A styrene polymer composition according to claim 14, wherein the compound containing both an unsaturated group and the polar group is an unsaturated carboxylic acid or anhydride thereof.

16. A styrene polymer composition according to claim 14, wherein the compound containing both an unsaturated group and the polar group is maleic anhydride.

17. A styrene polymer composition according to claim 14, wherein the polyphenylene ether having a polar group is poly (2,6-dimethyl-1,4-phenylene) ether or styrene-grafted poly(2,6-dimethyl-1,4-phenylene) ether, each modified with maleic

anhydride.

18. A styrene polymer composition according to any one of claims 13 through 17, wherein the component (B) is solely the polyphenylene ether having the polar group.

19. A styrene polymer composition according to any one of claims 13 through 17, wherein the component (B) is a mixture of the polyphenylene ether having the polar group and the styrene polymer having no functional group.

20. A styrene polymer composition according to claim 19, wherein the styrene polymer having no functional group is a member selected from the class consisting of atactic polystyrene, isotactic polystyrene, syndiotactic polystyrene, poly(α-methyl-styrene), polybutadiene-modified polystyrene, butadiene-styrene copolymer, isoprene-styrene copolymer and high impact resistant polystyrene.

21. A styrene polymer composition prepared by admixing:

(A) 99.5 to 50% by weight of polystyrene having a weight-average molecular weight of at least 10,000 and no functional group, the said polystyrene having such a syndiotacticity that a portion of racemic pentad as determined by a ^{13}C-NMR method is at least 50%; and

(B) 0.5 to 50% by weight of (i) solely a polyphenylene ether modified with 0.01% by weight (based on the polyphenylene ether) of an unsaturated carboxylic acid or anhydride thereof or (ii) a mixture thereof with a styrene polymer having no functional

group selected from the class consisting of atactic polystyrene, isotactic polystyrene, syndiotactic polystyrene, poly(α-methylstyrene), polybutadiene-modified polystyrene, butadiene-styrene copolymer, isoprene-styrene copolymer and high impact resistant polystyrene,

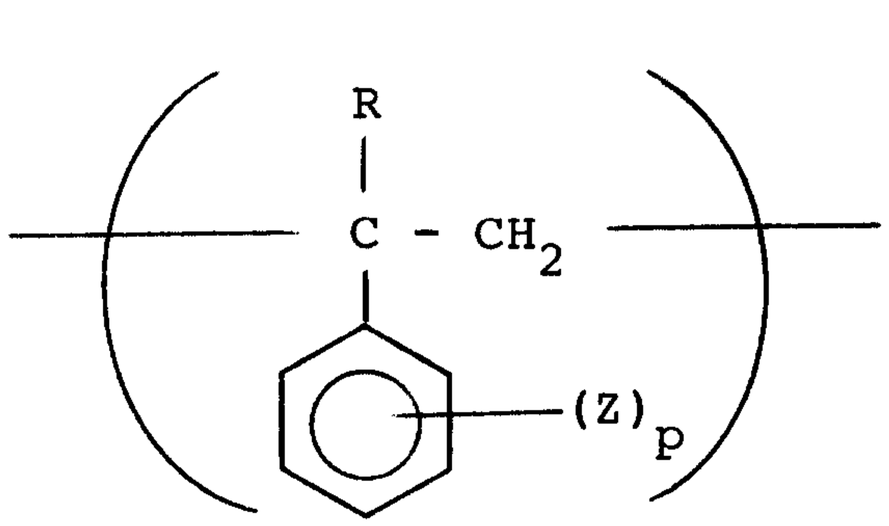
the percentage being based on the total amount of the components (A) and (B) and the amount of the polyphenylene ether in the mixture (ii) of the component (B) being at least 20% by weight based on the mixture.

22. A styrene polymer composition according to any one of claims 13 to 17 and 21, which is blended with a filler in an amount of 1 to 350 parts by weight per 100 parts by weight of the styrene polymer, wherein the filler is surface-treated with a coupling agent.

23. A styrene polymer composition according to claim 22, wherein the filler is a fibrous reinforcing filler.

24. A styrene polymer composition prepared by admixing:

(A) 99 to 1% by weight of a styrene polymer having a weight-average molecular weight of at least 10,000 and no functional group and being represented by the following recurring unit:



(I)

[wherein R is hydrogen or an alkyl group having 1 to 4 carbon atoms;

Z is a hydrogen atom, a halogen atom, or an alkyl group having 1 to 4 carbon atoms; and

p is an integer of 1 to 5],

the said styrene polymer having such a syndiotacticity that a proportion of racemic pentad as determined by a ^{13}C-NMR method is at least 30%;

(B) 0.1 to 50% by weight of (i) a polyphenylene ether having a polar group or a mixture of such a polyphenylene ether and (ii) a styrene polymer having no functional group, wherein the polar group in the polyphenylene ether is a member selected from the class consisting of acid halide, carbonyl, acid anhydride, acid amide, carboxylate, acid azide, sulfone, nitrile, cyano, isocyanic acid ester, amino, hydroxyl, imide, thiol, oxazoline and epoxy; and the styrene polymer having no functional group (ii) is selected from the class consisting of an atactic, isotactic or syndiotactic homopolymer of a recurring unit of the formula (I) defined above, a styrene polymer of a recurring unit of the formula modified with a natural or synthetic elastomer material and a copolymer of a recurring unit of the formula (I) and butadiene or isoprene; and

(C) 0.9 to 98.9% by weight of polyamide,

wherein the percentage is based on the total amount of the components (A), (B) and (C).

25. A styrene polymer composition according to claim 24,

wherein the content of the polar group in the polyphenylene ether is at least 0.01% by weight of the polyphenylene ether and the polyphenylene ether having a polar group is produced by reacting a polyphenylene ether having no such a polar group with a compound containing both an unsaturated group and the polar group.

26. A styrene polymer composition according to claim 25, wherein the compound containing both an unsaturated group and the polar group is an unsaturated carboxylic acid or anhydride thereof.

27. A styrene polymer composition according to claim 25, wherein the compound containing both an unsaturated group and the polar group is maleic anhydride.

28. A styrene polymer composition according to claim 25, wherein the polyphenylene ether having a polar group is poly(2,6-dimethyl-1,4-phenylene) ether or styrene-grafted poly(2,6-dimethyl-1,4-phenylene) ether, each modified with maleic anhydride.

29. A styrene polymer composition according to any one of claims 24 through 28, wherein the component (B) is solely the polyphenylene ether having the polar group.

30. A styrene polymer composition according to any one of claims 24 through 28, wherein the component (B) is a mixture of the polyphenylene ether having the polar group and the styrene polymer having no functional group.

31. A styrene polymer composition according to claim 30, wherein the styrene polymer having no functional group is a member selected from the class consisting of atactic polystyrene, isotactic polystyrene, syndiotactic polystyrene, poly(α-methyl-styrene), polybutadiene-modified polystyrene, butadiene-styrene copolymer, isoprene-styrene copolymer and high impact resistant polystyrene.

32. A styrene polymer composition according to any one of claims 24 through 28, wherein the polyamide (C) is an aromatic polyamide resin containing an amide bond and an aromatic nucleus in its main chain as repeating units.

33. A styrene polymer composition according to claim 29, wherein the polyamide (C) is an aromatic polyamide resin which has a repeating unit selected from the class consisting of (a) a diamine component that is at least 50 mol % aromatic and a di-carboxylic acid component that is aliphatic or aromatic and (b) an ω-amino-ω'-carboxyl compound component having an aromatic nucleus.

34. A styrene polymer composition according to claim 31, wherein the polyamide (C) is an aromatic polyamide resin which has a repeating unit selected from the class consisting of (a) a diamine component that is at least 50 mol % aromatic and a di-carboxylic acid component that is aliphatic or aromatic and (b) an ω-amino-ω'-carboxyl compound component having an aromatic nucleus.

35. A styrene polymer composition prepared by admixing:

(A) 95 to 20% by weight of polystyrene having a weight-average molecular weight of at least 10,000 and no functional group, the said polystyrene having such a syndiotacticity that a portion of racemic pentad as determined by a ^{13}C-NMR method is at least 50%; and

(B) 0.5 to 30% by weight of (i) solely a polyphenylene ether modified with 0.01% by weight (based on the polyphenylene ether) of an unsaturated carboxylic acid or anhydride thereof or (ii) a mixture thereof with a styrene polymer having no functional group selected from the class consisting of atactic polystyrene, isotactic polystyrene, syndiotactic polystyrene, poly(α-methyl-styrene), polybutadiene-modified polystyrene, butadiene-styrene copolymer, isoprene-styrene copolymer and high impact resistant polystyrene; and

(C) 5 to 65% by weight of an aromatic polyamide resin which has a repeating unit selected from the class consisting of (a) a diamine component that is at least 50 mol % aromatic and a dicarboxylic acid component that is aliphatic or aromatic and (b) an ω-amino-ω'-carboxyl compound component having an aromatic nucleus,

the percentage being based on the total amount of the components (A), (B) and (C) and the amount of the polyphenylene ether in the mixture (ii) of the component (B) being at least 20% by weight based on the mixture.

36. A styrene polymer composition according to any one of claims 24 through 28 and 35, which is blended with a filler in

an amount of 1 to 350 parts by weight per 100 parts by weight of the styrene polymer, wherein the filler is surface-treated with a coupling agent.

37. A styrene polymer composition according to claim 36, wherein the filler is a fibrous reinforcing filler.

38. A molded article made of the polymer composition as defined in any one of claims 1 to 3, 6 to 9 and 2.

39. A molded article made of the polymer composition as defined in any one of claims 13 to 17, 21, 23, 24 to 28, 35 and 37.

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