

AN ELECTROCONDUCTIVE RESIN COMPOSITION

The present invention relates to an electroconductive resin composition. Particularly, the present invention relates to an electroconductive resin composition having a specified range of surface resistance values and a remarkably small change (a fluctuating breadth) of the surface resistance value.

An electroconductive resin composition comprising a polyphenylene ether and/or an alkenyl aromatic resin and an electroconductive carbon black etc. is well-known and used for an IC tray to convey electronic components.

IC tray and the like to convey electronic components must be able to protect the electronic components from a breakage by an electric shock. Accordingly, as a resin composition used for IC tray and the like, a resin composition having an excellent insulating property as well as an excellent static charge eliminating property is desired. In more detail, there has been desired an electroconductive resin composition

having a surface resistance value within a range of 10^5 to $10^{12} \Omega$ at 10 V as well as at 500 V;

having a ratio of a surface resistance value at 10 V to a surface resistance value at 500 V of 10^6 or less; and

having no problem in granulating property and delamination.

However, conventional electroconductive resin

compositions does not satisfy the above-mentioned requirement for surface resistance values. Namely, conventional electroconductive resin compositions have a surface resistance value at 10 V of more than $10^{12} \Omega$ and/or a surface resistance value at 500 V of less than $10^5 \Omega$.

An object of the present invention is to provide an electroconductive resin composition having a surface resistance value at 10 V as well as at 500 V being within a range of 10^5 to $10^{12} \Omega$; having a ratio of a surface resistance value at 10 V to a surface resistance value at 500 V is 10^6 or less; and having no problem in granulating property and delamination.

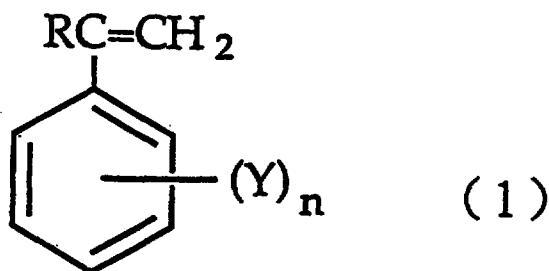
The present inventors have conducted intensive studies to develop such a desired electroconductive resin composition as mentioned above, and, as the result, have found out that, by using a specific copolymer of a specific alkenyl aromatic compound and a specific acrylate compound as one of the components of the electroconductive resin composition, the above-mentioned object can be attained. Thus, the present invention has been completed.

The present invention is an electroconductive resin composition, having surface resistance values both at 10 V and 500 V being within a range of 10^5 - $10^{12} \Omega$ and a ratio of a surface resistance value at 10 V to a surface resistance value at 500 V being 10^6 or less; and

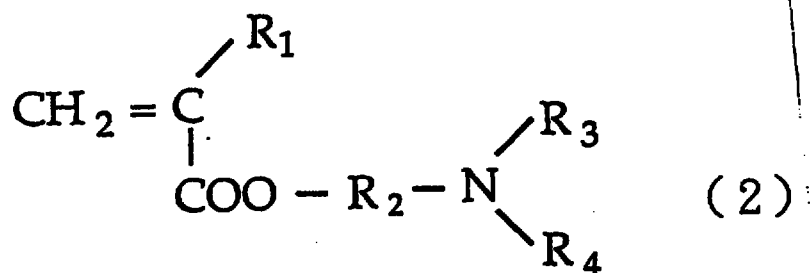
comprising

component (a), a polyphenylene ether and/or an alkenyl aromatic resin;

a component (b), a copolymer having an amine value of 170 or less of an alkenyl aromatic compound represented by the following formula(1):



wherein R is hydrogen, an alkyl group having 1 to 6 carbon atoms or halogen, Y is hydrogen, halogen, a vinyl group, an amino group, a hydroxy group or an alkyl group having 1 to 6 carbon atoms, and n is an integer of 0 to 5, and a N,N-dialkylaminoalkyl (metha)acrylate compound represented by the following formula(2):

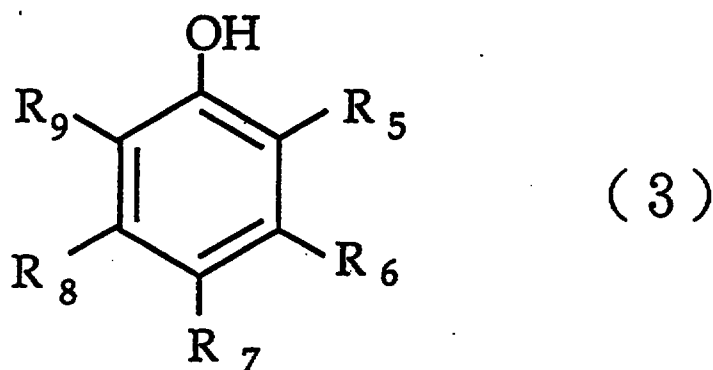


wherein R₁ is hydrogen or a methyl group, R₂ is an alkylene group having 1 to 6 carbon atoms, and R₃ and R₄, which are

same or different, are hydrogen or an alkyl group having 1 to 6 carbon atoms; and

a component (c), 2 to 45 parts by weight per 100 parts by weight of a total amount of a component (a) and a component (b) of a carbon black having a dibutylterephtharate oil absorption amount of 70 ml/100 or more.

The polyphenylene ether of the component (a), which is a well-known polymer, is a polymer obtained by an oxidative polymerization of one or more monovalent phenol compounds represented by the following formula (3):



wherein R_5 , R_6 , R_7 , R_8 and R_9 are a hydrogen atom, a halogen atom, a hydrocarbon group or a substituted hydrocarbon group, provided that at least one of them is a hydrogen atom by using oxygen or an oxygen-containing gas and an oxidative-coupling catalyst.

Examples of R_5 , R_6 , R_7 , R_8 and R_9 in the formula (3) include hydrogen, chlorine, bromine, fluorine, iodine, methyl, ethyl, n-propyl, iso-propyl, pri-butyl, sec-butyl, t-butyl,

chloroethyl, hydroxyethyl, phenylethyl, benzyl, hydroxymethyl, carboxyethyl, methoxycarbonyl, cyanoethyl, phenyl, chlorophenyl, methylphenyl, dimethylphenyl, ethylphenyl and allyl.

Examples of phenol compounds represented by the formula (3) include phenol, o-cresol, m-cresol, p-cresol, 2,6-dimethylphenol, 2,5-dimethylphenol, 2,4-dimethylphenol, 3,5-dimethylphenol, 2-methyl-6-phenylphenol, 2,6-diphenylphenol, 2,6-diethylphenol, 2-methyl-6-ethylphenol, 2,3,5-trimethylphenol, 2,3,6-trimethylphenol, 2,4,6-trimethylphenol, 3-methyl-6-t-butylphenol, thymol and 2-methyl-6-allylphenol.

The polyphenylene ether of component (a) also includes a copolymer of phenol compounds represented by the formula (3) with other phenol compounds, for example, polyvalent hydroxy aromatic compounds such as bisphenol A, tetrabromobisphenol-A, resorcin, hydroquinone and a novolack resin.

Examples of the polyphenylene ether of component (a) further include a copolymer obtained by grafting an alkenyl aromatic compound exemplified by styrene, methylstyrene such as α -methyl styrene, and p-methylstyrene, a halogenated styrene such as chlorostyrene to the above-mentioned polyphenylene ethers.

Preferable examples of the polyphenylene ether of component (a) include a homopolymer of 2,6-dimethylphenol or 2,6-diphenylphenol and a copolymer of a greater amount of

2,6-dimethylphenol with a smaller amount of 3-methyl-6-t-butylphenol or 2,3,6-trimethylphenol.

An oxidative coupling catalyst used for the oxidative polymerization of phenol compounds (3) is not restricted particularly and any catalysts capable of initiating polymerization can be used.

The preferable molecular weight range of the polyphenylene ether as the component (a) is within the range of 0.30 to 0.75dl/g, preferably 0.35 to 0.55dl/g, indicated in intrinsic viscosity measured in chloroform at 25°C. When the one having an intrinsic viscosity smaller than this range is used, an electroconductive resin composition having low mechanical strength is obtained, and when the one having an intrinsic viscosity more than this range is used, the electroconductive resin composition having insufficient granulating property and processability is obtained.

The alkenyl aromatic resin of the component (a) is a well-known homopolymer or a copolymer having at least 25mol% or more of a repeating unit derived from the alkenyl aromatic compound of the formula (1) and containing 51% by weight or more of the resin part.

Examples of the alkenyl aromatic resin of the component (a) include

a homopolymer of an alkenyl aromatic compound such as styrene and chlorostyrene;

a copolymer of said alkenyl aromatic compound with a

copolymerizable compound such as acrylonitrile, methyl methacrylate, and maleic anhydride, which includes, for example, a styrene-acrylonitrile copolymer, a styrene-methyl methacrylate copolymer and a styrene maleic anhydride copolymer;

a polymer obtained by a modification of the above-mentioned homopolymer of alkenyl aromatic compound or copolymer of alkenyl aromatic compound with a copolymerizable compound with a natural rubber or a synthetic rubber such as a polybutadiene rubber, a styrene-butadiene copolymer rubber, an urethane rubber, an ethylene- α -olefin copolymer rubber and an ethylene- α -olefin-non-conjugated diene copolymer rubber; and an admixture of them.

When the component (a) comprises both the polyphenylene ether and the alkenyl aromatic resin, an arbitrary blending ratio can be taken, as they have an excellent compatibility each other.

Examples of the alkenyl aromatic compound represented by the formula (1), as a repeating unit of the copolymer of component (b), include styrene, chlorostyrene and α -methyl styrene.

Examples of an N,N-dialkylaminoalkyl (metha)acrylate compound represented by the formula (2), as a repeating unit of the copolymer of component (b), include N, N-dimethylaminoethyl methacrylate and N, N-dimethylaminoethyl acrylate.

Examples of the copolymer of component (b) include a copolymer of styrene with N,N-dimethylaminoethyl methacrylate and a copolymer of styrene with N,N-dimethylaminoethyl acrylate. As a commercially obtainable example of the copolymer, LUNAPALE manufactured by Arakawa Chemical Industry Ltd. (Registered Trade Mark) can be mentioned.

As a repeating unit of the copolymer of component (b), in addition to the alkenyl aromatic compounds of formula (1) and N, N-dialkylaminoalkyl (metha)acrylate compound of the formula (2), one or more of other compounds copolymerizable with them such as acrylonitrile, methyl methacrylate and maleic anhydride, can be used as long as the effects of the present invention can be attained.

An amine value of the copolymer of component (b) measured by a method described in JIS K 7237 is 170 or less, preferably, 120 or less. When the amine value exceeds 170, a compatibility with the component (a) deteriorates and the component (a) and the component (b) cannot be kneaded enough.

The amount of component (b) to be blended to the electroconductive resin composition must be chosen so that both of surface resistance values at 10 V and 500 V of the electroconductive resin composition become within a range of 10^5 - $10^{12} \Omega$ and a ratio of a surface resistance value at 10 V to a surface resistance value at 500 V becomes 10^6 or less. The blending ratio is generally 1 to 18% by weight of the component (b) per 92 to 99% by weight of the component (a).

Generally, it is not preferred that the blending ratio of the component (b) exceeds 18% by weight, because a delamination in a injection-molded article of the electroconductive resin composition obtained is formed.

A carbon black used for a coloration, a rubber reinforcement, a bestowal of electroconductivity and the like, can be used as the component (c). The carbon black has a dibutylphthalate oil adsorption amount(hereinafter, named as 「DBP oil adsorption amount」) measured in accordance with a method described in ASTM D2414 of 70ml/100g or more. As a preferable example of the carbon black, an acetylene black obtained by the thermal cracking of acetylene gas, a Ketjen black produced by a furnace type incomplete combustion from a crude oil as a raw material and the like can be exemplified.

The blending ratio of the component (c) is 2 to 45 parts by weight per 100 parts by weight of a total amount of the component (a) and the component(b), preferably, 3 to 42 parts by weight. When the blending ratio of the component (c) is less than 2, an electroconductivity of the resin composition is not sufficient and when it exceeds more than 45 parts by weight, the component (c) cannot be kneaded enough with another component.

The electroconductive resin composition of the present invention may further comprise various kinds of arbitrary components in addition to the component (a), the component (b) and the component (c). These arbitrary components are

exemplified as follows.

Component (d) : Rubber-like substance

The component (d), rubber-like substance, is a natural and a synthetic polymer which are elastic at room temperature and can be blended to the electroconductive resin composition of the present invention in order to improve, for example, an impact strength of the composition. Preferable examples of the component (d) include, for example, a rubber of an ethylene- α -olefin copolymer, a rubber of an ethylene- α -olefin-non-conjugated diene copolymer, a rubber of polybutadiene, a rubber of a styrene-butadiene block copolymer, a rubber of a styrene-butadiene-styrene block copolymer, a rubber of a styrene-butadiene copolymer, a rubber of a partially-hydrogenated styrene-butadiene block copolymer, a rubber of a partially-hydrogenated styrene-butadiene-styrene block copolymer, a rubber of a styrene-isoprene block copolymer, a rubber of a styrene-isoprene-styrene block copolymer, a rubber of a partially hydrogenated styrene-isoprene block copolymer, a rubber of a partially hydrogenated styrene-isoprene-styrene block copolymer, a polyurethane rubber, a rubber of a styrene-grafted-ethylene-propylene-non-conjugated diene copolymer, which is a rubber obtained by grafting styrene with an ethylene-propylene-non-conjugated diene copolymer (Hereinafter, the term "grafted" is used in a similar

meaning.), a rubber of a styrene-grafted-ethylene-propylene copolymer, a rubber of a styrene/acrylonitrile-grafted-ethylene- α -olefin-non-conjugated diene copolymer, a rubber of a styrene/acrylonitrile-grafted-ethylene- α -olefin copolymer, a rubber of a styrene/methyl methacrylate-grafted-ethylene- α -olefin-non-conjugated diene copolymer, a rubber of a styrene/methyl methacrylate-grafted-ethylene- α -olefin copolymer and mixtures of these rubbers. Besides, a rubber-like substance wherein the above-mentioned rubber-like substance is modified with a functional monomer having an acid group such as acrylic acid or maleic anhydride or with a functional monomer having an epoxy group such as vinyl glycidyl ether is included in the component (d). The resin part in the component (d) is usually 50% by weight or less.

The blending ratio of the component (d) is 50 parts by weight or less per 100 parts by weight of the component (a) and preferably, within the range of 2 to 48 parts by weight. When the blending ratio of the component (d) exceeds 50 parts by weight, a thermal resistance and a processability of the obtained resin composition become insufficient.

Component (e) : Polyolefin

The component (e), polyolefin, can be blended in order to improve, for example, a processability of the electroconductive resin composition of the present invention.

Examples of the component (e), polyolefin, include a low

density polyethylene, a high density polyethylene, a linear low density polyethylene, a polypropylene and a poly-4-methylpentene-1. Preferable examples of the component (e) among these are a low density polyethylene and a linear low density polyethylene.

The blending ratio of the component (e) is 20 parts by weight or less per 100 parts by weight of the component (a) and preferably, 1 to 15 parts by weight. When the blending ratio of the component (e) exceeds 20 parts by weight, a delamination is tend to be caused at the vicinity of the gate of a fabricated article(a molded article), although the processability of the resin composition obtained is improved . Therefore, it is not preferred.

Component (f) : Non-electroconductive inorganic fillers

The component(f), non-electroconductive inorganic fillers, can be blended in order to improve, for example, a rigidity, a thermal resistance or a dimensional stability of the resin composition of the present invention. Examples of the component (f) include inorganic fillers such as glass fiber, silica, calcium carbonate, talc, mica, clay, kaolinite, magnesium sulfate, wollastonite, titanium oxide, zinc oxide, antimony oxide and alumina.

The blending ratio of the component (f) is 30 parts by weight or less and preferably within the range of 1 to 25 parts by weight per 100 part by weight of the component (a).

When the blending ratio of the component (f) exceeds 30 parts by weight, an impact strength of the obtained resin composition deteriorates to an undesirable level.

Component (g) : Electroconductive inorganic fillers

The component (g), the electroconductive inorganic fillers, can be blended, in order to improve, for example, an electroconductivity, an anti-static property and a rigidity of the electroconductive resin composition of the present invention.

Examples of the component (g) include a surface-treated potassium tetanode whisker, a carbon fiber, a stainless steel fiber, an aluminum flake and a graphite. As the component (g), one or more of the fillers may be blended.

The electroconductive resin compositions of the present invention may further comprise usual additives such as pigments, paints, flame retardants, plasticizer, anti-oxidants, weather proof agents and light stability agents in addition to the above-mentioned arbitrary components (d) to (g). The electroconductive resin compositions may also comprise a thermoplastic resin, other than the above-mentioned components (e), such as nylon and polycarbonate.

Preparing method of the electroconductive resin composition of the present invention is not restricted. For example, the electroconductive resin composition of the present invention can be prepared by melt-kneading a blended

article with usual melt-kneading equipments such as an extruder, a kneader, a roll mixer and a Banbury mixer after components used are compounded by a known method such as a dry-blending method. The compounding order of the components is not particularly restricted.

Examples

The Examples of the present invention are illustrated in comparison with the Comparative Examples as follows. The present invention is not restricted by these Examples. The following were used as the components.

Component (a)

Polyphenylene ether obtained by homopolymerizing 2,6-dimethylphenol and having an intrinsic viscosity measured in chloroform at 25°C of 0.41dl/100g (hereinafter, named as 「PPE-1」) and 0.5dl/100g (hereinafter, named as 「PPE-2」) were used.

As the alkenyl aromatic resin, Sumibright ST970 (Registered Trade Mark), a polystyrene resin manufactured by Sumitomo Chemical Company Ltd., (hereinafter, named as 「GPPS」) and Sumibright M584 (Registered Trade Mark), polystyrene resin reinforced with polybutadiene manufactured by Sumitomo Chemical Company Ltd., (hereinafter, named as 「HIPS」) were used.

Component (b)

LUNAPALE(Registered Trade Mark), a copolymer of styrene with N,N'-dimethylaminoethyl methacrylate manufactured by Arakawa Chemical Company Ltd.;

Grades 903(hereinafter, named as 「AA-1」),

Grades 900(hereinafter, named as 「AA-2」) and

Grades 912(hereinafter, named as 「AA-3」)

were used. Refer to Table 1.

Component (c)

Carbon blacks shown in Table 2 as CB-1 to CB-4 were used.

Component (d)

Rubber of the styrene-grafted-ethylene-propylene-non conjugated diene copolymer prepared in Reference Example 1 described afterward (hereinafter, named as 「SEPR」) and Rubber of the styrene/methyl methacrylate-grafted-ethylene-propylene-non conjugated diene copolymer prepared in Reference Example 2 described afterward (hereinafter, named as 「SMEPR」) were used.

Component (e)

Sumikathene (Registered Trade Mark) F210-6, a low density polyethylene manufactured by Sumitomo Chemical Company Ltd., (hereinafter named as 「PO」) was used.

Component (f)

Talc 5000S (Trade name), a talc manufactured by Hayashi Kasei Co., Ltd., (hereinafter, named as 「Talc」) and RepcoMica S-325 (Trade name), a mica manufactured by Canadamica Company Ltd., (hereinafter, named as 「Mica」) were used.

Reference Example-1 (Preparation of SEPR)

In a 5 l autoclave with a stirrer, 2200 ml of aqueous solution containing 6 g of a dispersing agent, PLURONIC F68 (Trade name) manufactured by ASAHI DENKA KOUGYOU Ltd., and 300g of Esprene (Registered Trade Mark) E502 of an ethylene-propylene-non conjugated diene copolymer manufactured by Sumitomo Chemical Company Ltd. which contained repeating units derived from propylene in an amount of 44 parts by weight, had an iodine value of 8.5 and Moony viscosity of 63 at 120 °C and were cut into 3 to 6mm cubes were charged. The resulting mixture were suspended under stirring.

Thereafter, 300g of styrene, 9 g of t-butylperoxy pivalate and 0.18 g of p-benzoquinone were added thereto, and then, the autoclave was immediately immersed in a oil bath heated at 30°C. It was heated until 110 °C at a temperature elevating rate of about 1°C/min. and the polymerization reaction was carried out by maintaining the autoclave at 110°C

for 30 minutes. The granular articles thus obtained were washed with water and, then, dried under vacuum at 95 °C to obtain SEPR.

Reference Example-2 (Preparation of SMEPR)

In a 5 l autoclave with a stirrer, 2200 ml of aqueous solution containing 6 g of a dispersing agent, PLURONIC F68 (Trade name) manufactured by ASAHI DENKA KOUGYOU Ltd., and 300g of Esprene (Registered Trade Mark) E502 of an ethylene-propylene-non conjugated diene copolymer manufactured by Sumitomo Chemical Company Ltd. which were cut into 3 to 6mm cubes were charged. The resulting mixture were suspended under stirring.

Thereafter, 101g of styrene , 19g of methyl methacrylate, 9 g of t-butylperoxy pivalate and 0.18 g of p-benzoquinone were added thereto, and then, the autoclave was immediately immersed in a oil bath heated at 30°C. It was heated until 110 °C at a temperature elevating rate of about 1°C/min. and the polymerization reaction was carried out by maintaining the autoclave at 110°C for 30 minutes. The granular articles thus obtained were washed with water and, then, dried under vacuum at 95 °C to obtain SEPR.

Examples 1 to 13 and Comparative Examples 1 to 11

In each of Examples and Comparative Examples, components were blended as composition illustrated in Tables 3 to 7 (the blending ratio is parts by weight); the resulting mixture were extruded by kneading with a twin-screw TEM 50 type extruder manufactured by Toshiba Machine Company Ltd. at a cylinder temperature of the extruder of 260°C in case of Examples 1 to 4 and Comparative Examples 1 to 6, and of 300 °C in other cases; and then granulated by a strand cutter after cooled in water tank to obtain pellets.

After the pellets thus obtained were dried for 3 hours by a hot-air at a temperature of 80°C in case of Examples 1 to 4 and Comparative Examples 1 to 4 and 6 and at a temperature of 130°C in other cases, plate-like test pieces of 54mm X 75mm were molded by an IS220EN type injection machine manufactured by Toshiba Machine Company in the conditions of a mold temperature of 80°C and at a cylinder temperature of the injection machine of 260 °C in case of Examples 1 to 4 and Comparative Examples 1 to 4 and 6 and of 330°C in other cases. The evaluations of these test pieces were conducted as described below. The evaluated result is shown in Tables 3 to 7.

Surface resistance value(hereinafter, named as 「SR」 .. The unit is Ω .)

A plate-like test piece of 54 mm $\times$ 75 mm was subjected to measurements of SR at a voltage of 10V(hereinafter, named as 「SR10V」) and SR at a voltage of 500V(hereinafter, named as 「SR500V」) by using HIRESTA IP (MCP-HT 260 type), a high resistance resistometer manufactured by YUKA DENSHI Co. Ltd.

Ratio of SR10V to SR500V (hereinafter, named as 「 Δ SR」)

Δ SR was calculated according to an equation of Δ SR = SR10V/SR500V from the measured value of SR10V and SR500V.

Granulating property

At the preparation of the resin composition as mentioned above, a case wherein kneading and granulating can be conducted continuously was represented as $\bigcirc$ and a case wherein they cannot be conducted was represented as $\times$.

Delamination

A case wherein a delamination was not recognized in the above-mentioned injection molding was represented as $\bigcirc$ and a case wherein it was recognized was represented as $\times$.

Table 1

	AA-1	AA-2	AA-3
Grade	903	900	912
Amine value	1.5	50	180
Amount containing a unit derived from styrene (% by weight)	95.8	84	49

Table 2

	CB-1	CB-2	CB-3	CB-4
Kind	Ketjen black	Acetylene black	Furnace black	Furnace black
Maker	Lion (Ltd.)	Denki Kagaku Kougyou(Ltd.)	Kyabot	Mitsubishi Chemical Industry (Ltd.)
Grade name	600JD	Denka Black	Vulcan C	Dia Black # 45
DBP oil adsorption amount (ml/100g)	495	212	100	55

Table 3

	Comparative Example 1	Comparative Example 2	Example 1	Example 2	Example 2
S	100	99.5	97	90	80
1		0.5	3	10	20
2	24	24	24	24	24
0V	$>10^{11}$	$>10^{11}$	2×10^9	1×10^9	8×10^8
00V	$<10^5$	$<10^5$	2×10^5	3×10^5	4×10^5
2	-	-	1×10^4	3×10^3	2×10^3
nulating perty	○	○	○	○	○
amination	○	○	○	○	×

Table 4

	Comparative Example 4	Example 3	Example 4	Comparative Example 5	Comparative Example 6
S	97	97	95	95	95
1	3	3	5	5	5
1	1	3			
3			40	50	
4					40
0V	$>10^{11}$	4×10^{11}	6×10^8	Impossible to	$>10^{11}$
00V	$<10^5$	2×10^8	2×10^5	be measured	$>10^{12}$
2	-	2×10^2	3×10^2	owing to the	-
				impossibility of	
nulating				granulation	
perty	O	O	O	X	O
amination	O	O	O	-	O

Table 5

	Comparative Example 7	Example 5	Example 6	Comparative Example 8	Comparative Example 9
-1	100	97	97	97	80
1		3			20
2			3		
3				3	
2	20	20	20	20	20
0V	$>10^{11}$	6×10^{11}	5×10^{11}	5×10^{11}	2×10^{11}
00V	1×10^8	3×10^8	3×10^8	3×10^8	2×10^8
3	-	2×10^3	2×10^3	2×10^3	1×10^3
nulating					
perty	O	O	O	O	O
amination	O	O	O	X	X

Table 6

	Example 7	Example 8	Example 9	Example 10
1-2	43	43	48	48
'S	50		44	
'S		50		44
2	7	7	8	8
2	20	20	22	22
R			10	
PR				10
0V	4×10^{11}	6×10^{11}	5×10^{11}	7×10^{11}
00V	8×10^8	8×10^8	9×10^8	8×10^8
R	5×10^2	8×10^2	6×10^2	9×10^2
mutating				
property	○	○	○	○
amination	○	○	○	○

Table 7

	Example 11	Example 12	Example 13
-2	46	46	46
S	46	46	46
2	8	8	8
2	23	23	23
PD	10	10	10
	3	3	3
c		10	
a			10
0V	5×10^{11}	3×10^{11}	2×10^{11}
00V	7×10^8	6×10^7	7×10^7
2	7×10^2	5×10^3	3×10^3
nulating			
perty	○	○	○
amination	○	○	○

Table 8

	Comparative Example 10	Comparative Example 11
HIPS	90	
PPE-1		97
AA-2	10	3
SR10V	$>10^{11}$	$>10^{11}$
SR500V	$>10^{12}$	$>10^{12}$
Δ SR	-	-
Granulating property	○	○
Delamination	○	○

According to the present invention, the electroconductive resin composition in which surface resistance values at 10 V as well as 500 V are within a range of 10^5 to 10^{12} Ω and a ratio of a surface resistance value at 10 V to a surface resistance value at 500 V is 10^6 or less and which has no problem in a granulating property and a delamination can be obtained.

As shown in Comparative Examples 1 and 7, a resin composition not containing the component (b), and, as shown in

Comparative Examples 2, a resin composition having the too little component (b), exhibit no effect relating to SR. As shown in Comparative Example 3, resin composition having the too much component (b), although exhibits an effect relating to SR, has a problem of a delamination.

Besides, as shown in Comparative Example 4, a resin composition having the too little component (c) exhibits no effect relating to SR. As shown in Comparative Example 5, a resin composition having the too much component (b) could not be granulated.

Furthermore, as shown in Comparative Example 6, a resin composition comprising a carbon black having a too small adsorption amount exhibit no effect relating to SR. As shown in Comparative Example 8, a resin composition comprising the component (b) having a too large amine value and, as shown in Comparative Example 9, a resin composition having a too much content of the component (b) have a problem of a delamination.

As shown in Comparative Examples 10 and 11, resin composition not comprising component (c) exhibits no effect relating to SR.

To the contrary, according to the present invention, as shown clearly by the Examples, the electroconductive resin composition having an excellent insulating property as well as an static eliminating property and having no problem in a granulating property and a delamination can be obtained. The electroconductive resin composition of the present invention

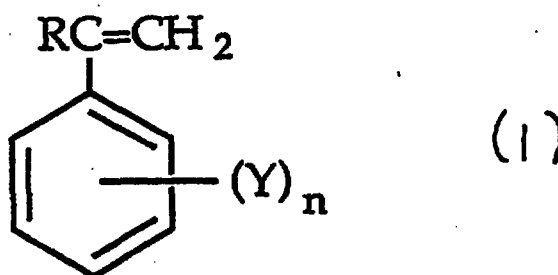
can be molded and used for IC tray and the like for conveying electronic components.

What we claim is:

1. An electroconductive resin composition, having surface resistance values both at 10 V and 500 V being within a range of 10^5 - 10^{12} Ω and a ratio of a surface resistance value at 10 V to a surface resistance value at 500 V being 10^6 or less; and comprising

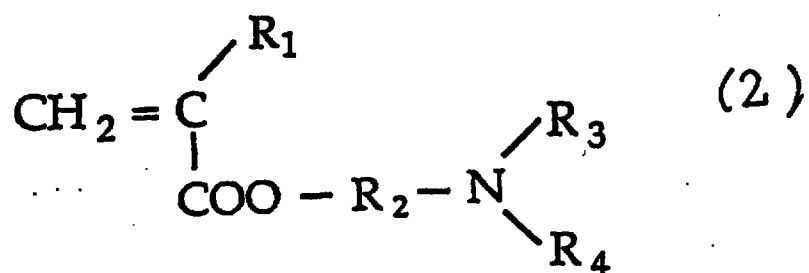
component (a), a polyphenylene ether and/or an alkenyl aromatic resin;

a component (b), a copolymer having an amine value of 170 or less of an alkenyl aromatic compound represented by the following formula(1):



wherein R is hydrogen, an alkyl group having 1 to 6 carbon atoms or halogen, Y is hydrogen, halogen, a vinyl group, an amino group, a hydroxy group or an alkyl group having 1 to 6 carbon atoms, and n is an integer of 0 to 5, and a N,N-dialkylaminoalkyl (metha)acrylate compound represented by the following formula(2):





wherein R₁ is hydrogen or a methyl group, R₂ is an alkylene group having 1 to 6 carbon atoms, and R₃ and R₄, which are same or different, are hydrogen or an alkyl group having 1 to 6 carbon atoms; and

a component (c), 2 to 45 parts by weight per 100 parts by weight of a total amount of a component (a) and a component (b) of a carbon black having a dibutylterephtharate oil absorption amount of 70 ml/100 or more.

