

LOW-ODOR RESIN COMPOSITION

TECHNICAL FIELD

[0001]

5 The present invention relates to a low-odor resin composition. More specifically, the invention relates to a low-odor resin composition, which reduces odors to be generated when the thermoplastic resin composition is melted and kneaded and when molded products are heated at high temperatures. The invention also relates to IC trays produced by molding the
10 resin composition and having excellent appearance.

BACKGROUND ART

[0002]

 Since the thermoplastic resins have excellent mechanical strength,
15 moldability, lightweight properties and appearance, they are widely used in a wide field such as communication/information/OA equipments, precision instruments, and optical equipment, home electric appliances, automobile articles, medical applications, building materials, agricultural materials, miscellaneous daily goods, etc. However, in order to further enhance heat
20 resistance, weather resistance, flame retardancy, antistatic property, mold releasability, flowability, etc. in many thermoplastic resins, it is considered necessary to mix additives such as a heat stabilizer, an antioxidant, an ultraviolet absorber, a light stabilizer, a flame retardant, an antistatic agent, a mold releasing agent, a plasticizer, etc. at the time of melting/ kneading and

molding the thermoplastic resin.

Further, the thermoplastic resin is heated to high temperatures when melted/kneaded and when molded. For example, styrene-based resins are often molded at the high temperature range of 200°C to 280°C, and
5 polyphenylene ether-based resins and polycarbonate resins are often heated to the high temperature range of 260°C to 360°C.

[0003]

Further, when a molded product is, for example, an IC tray to be used in a step of producing an IC (integrated circuits) or a step of transferring an IC,
10 there is a baking step in which slight amounts of water, and non-volatile impurities such as alkaline ions, Br ions and Cl ions contained in IC assemblies are degassed by placing the IC chips, wafers or the like in the IC trays and heating them in an oven.

Thus, if such water and gaseous components remain in the ICs, they
15 cause fatal flaws in the precision of the ICs, so that the baking step is a very important step. In the baking step, the ICs are placed in the IC tray, and the water and the impurities are degassed and removed in the baking chamber set at a temperature of not less than 120°C. Recently, the baking temperatures tend to be increased to not less than 150°C for the purpose of enhancing the
20 reliability of the ICs.

[0004]

Consequently, the thermoplastic resins have problems such as odors of the resins themselves and odors in the pyrolysis of the resins as generated when the resins are heated at a high temperature in the case that the resins are

melted/ kneaded and molded and that molded products are used, as well as odors generated when the additives added in molding the thermoplastic resins are thermally decomposed or evaporated. Unfavorably, such odors unusually deteriorate the working environment and the surrounding environment
5 because of their bad odors.

[0005]

In order to cope with the above problems, for example, Patent Document 1 discloses a polyphenylene ether-based resin composition composed of 100 parts by weight of (A) a resin mixture consisting of 100 to 50wt% of a polyphenylene
10 ether resin and 0 to 50wt% of a styrene-based resin, 5 to 40 parts by weight of (B) carbon black and 0.1 to 10 parts by weight of (C) a synthesized zeolite having pore diameters of not less than 0.8nm and a moisture adsorbability of not less than 20wt% under the conditions of temperature 25°C/relative humidity 10%/ordinary pressure (Patent Document 1). However, Patent
15 Document 1 relates to the synthesized zeolite, and notes the moisture adsorbability only, without paying attention to the silica coefficient or an amount of crystal water of the zeolite. In actual, Examples of Patent Document 1 only describes examples that hydrophilic zeolites having low silica coefficients are used. In addition, when a synthesized zeolite having a
20 moisture adsorbability of not less than 20wt% is used, a silvering mark occurs on a surface of the molded product, so that only the molded products having inferior appearances are obtained.

[0006]

Meanwhile, Patent Document 2 discloses an additive for resins, which

additive contain an inorganic powder, as a main component, being capable of deodorizing and removing a bad odor generated in kneading and molding the resin composition. As the inorganic powder, aluminosilicic acid salt composed of silica, a metal oxide and alumina at specific proportions is used. However,
5 Patent Document 2 did not describe the appearance and the mechanical strength of molded products of resin compositions in which specifically disclosed resin additive was mixed. Inorganic powders in the specific examples had low silica coefficients.

[0007]

10 Patent Document 1: JP-A 07-138466

Patent Document 2: JP-A 11-293032

DISCLOSURE OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

15 [0008]

In order to solve the problems, the present invention is to provide a resin composition affording excellent appearance of molded products and reducing odors as generated when a thermoplastic resin is melted/kneaded and molded at high temperatures and when the resin molded products are heated at high
20 temperatures, without losing various intrinsic characteristics of the thermoplastic resin. The present invention is also to provide molded products (an IC tray and the like) using the resin composition.

MEASURES TO SOLVE THE PROBLEMS

[0009]

Having repeatedly made eager investigations, the present inventors discovered that the above problems can be solved by blending a zeolite of a highly hydrophobic silica alumina silicic acid salt having a high $\text{SiO}_2/\text{Al}_2\text{O}_3$ molar ratio into a resin composition. That is, the inventors discovered that it is possible for the following measure to provide a low-odor resin composition affording the extremely excellent appearance of molded products and remarkably reducing odors as generated when a thermoplastic resin is melted/kneaded and molded and when the resin molded products are heated at high temperatures, without various intrinsic characteristics of the thermoplastic resin being lost. The inventors reached the present invention based on the above discovery.

(1) A low-odor resin composition comprising 100 parts by weight of (A) a thermoplastic resin and 0.1 to 5.0 parts by weight of (B) a zeolite represented by the following formula (1):



wherein M represents an ion-exchangeable, univalent or bivalent metal; n represents an atomic valence of the metal represented by M; x, which is a silica coefficient as the molar ratio of SiO_2 to Al_2O_3 , is an integer of 10 to 500; and y, which is the number of crystal water, represents an integer of 0 to 7.

(2) The low-odor resin composition according to (1), wherein (A) the thermoplastic resin consists of (A-1) a polyphenylene ether and (A-2) a styrene resin, and 100 parts by weight of (A) the thermoplastic resin contains 20 to 90 parts by weight of (A-1) a polyphenylene ether and 10 to 80 parts by weight of

(A-2) a styrene resin (hereinafter referred as (AA) a thermoplastic resin in sometimes).

(3) The low-odor resin composition according to (1), comprising 3.0 to 30 parts by weight of (C) a carbon black based on 100 parts by weight of the low-odor
5 resin composition.

(4) The low-odor resin composition according to (2), comprising 3.0 to 30 parts by weight of (C) a carbon black based on 100 parts by weight of the low-odor resin composition.

(5) The low-odor resin composition according to any one of (1) to (4), comprising
10 1 to 25 parts by weight of (D) a styrene elastomer based on 100 parts by weight of (A) the thermoplastic resin.

(6) The low-odor resin composition according to any one of (1) to (5), wherein M in (B) the zeolite is natrium.

(7) The low-odor resin composition according to any one of (1) to (6), wherein x
15 in (B) the zeolite, which is a silica coefficient, is in the range of 20 to 60.

(8) The low-odor resin composition according to any one of (1) to (7), wherein (B) the zeolite is a MFI type.

(9) An article molded of a low-odor resin composition according to any one of (1) to (8).

20 (10) An IC tray molded of a low-odor resin composition according to any one of (3) to (8).

(11) The low-odor resin composition according to (1), wherein (A) the thermoplastic resin is (AA) a thermoplastic resin, M in (B) the zeolite is natrium, x in (B) the zeolite, which is a silica coefficient, is in the range of 20 to

60 and (B) the zeolite is a MFI type.

(12) The low-odor resin composition according to (1), wherein (A) the thermoplastic resin is (AA) a thermoplastic resin, said low-odor resin composition contains 1 to 25 parts by weight of (D) a styrene elastomer based
5 on 100 parts by weight of (AA) the thermoplastic resin, M in (B) the zeolite is natrium, x in (B) the zeolite, which is a silica coefficient, is in the range of 20 to 60 and (B) the zeolite is a MFI type.

(13) The low-odor resin composition according to (1) comprising 3.0 to 30 parts by weight of (C) a carbon black based on 100 parts by weight of the low-odor
10 resin composition, wherein (A) the thermoplastic resin is (AA) the thermoplastic resin and said low-odor resin composition contains 1 to 25 parts by weight of (D) a styrene elastomer based on 100 parts by weight of (AA) the thermoplastic resin.

(14) The low-odor resin composition according to (1) comprising 3.0 to 30 parts
15 by weight of (C) a carbon black based on 100 parts by weight of the low-odor resin composition, wherein (A) the thermoplastic resin is (AA) the thermoplastic resin, M in (B) the zeolite is natrium, x in (B) the zeolite, which is a silica coefficient, is in the range of 20 to 60 and (B) the zeolite is a MFI type.

(15) The low-odor resin composition according to (1) comprising 3.0 to 30 parts
20 by weight of (C) a carbon black based on 100 parts by weight of the low-odor resin composition, wherein (A) the thermoplastic resin is (AA) the thermoplastic resin, said low-odor resin composition contains 1 to 25 parts by weight of (D) a styrene elastomer based on 100 parts by weight of (AA) the thermoplastic resin, M in (B) the zeolite is natrium, x in (B) the zeolite, which is

a silica coefficient, is in the range of 20 to 60 and (B) the zeolite is a MFI type.

(16) An IC tray molded of a low-odor resin composition according to any one of (13) to (15).

(17) An IC tray molded of a low-odor resin composition according to (4).

5

Effects of the Invention

[0011]

The low-odor resin composition according to the present invention can produce molded products without the loss of the intrinsic characteristics of the thermoplastic resin (A). Further, when a molded product is to be produced by molding the low-odor resin composition according to the present invention, the generation of the odors is extremely low when the resin composition is melted/kneaded and molded at high temperatures. Therefore, a comfortable working environment and a surrounding environment can be maintained.

15

BEST MODE FOR CARRYING OUT THE INVENTION

[0012]

In the following, the present invention will be explained in detail. Note that the expression of "--- to ---" is used in the specification to mean that integers before and after "to" are included as lower and upper limits, respectively.

[0013]

(A) Thermoplastic resin

Although the thermoplastic resin (A) to be used in the present invention is

not particularly specified, mention may be made of polycarbonate resin; styrene-based resins such as a polystyrene resin, an acrylonitrile styrene (AS) resin, an acrylonitrile-butadiene-styrene (ABS) resin, and an acrylonitrile-ethylene-styrene (AES) resin, etc.; methacrylic resins such as a polymethyl methacrylate (PMMA) resin, etc.; a polyoxymethylene (polyacetal) resin; polyamide-based resin such as a polyamide 6, a polyamide 66, a polyamide MXD, etc.; a modified polyphenylene ether (modified PPE) resin; a polyphenylene sulfide resin; polyester-based resins such as a polyethylene terephthalate (PET) resin, a polybutylene terephthalate (PBT) resin, etc.; thermoplastic resins such as a liquid crystal polymer, and polymer alloys composed of at least two kinds of such thermoplastic resins. Among them, the polyamide-based resins, the modified polyphenylene ether resins, the polyester-based resins and polyoxymethylene (polyacetal) resins are preferable, because they give effects of largely reducing the odor (for example, amines or aldehydes generated from raw materials, a catalyst, additives, etc. in the production of the resin). Particularly when the resin composition is used for the IC trays, they are subjected to an annealing step before use and a baking treatment at a high temperature of not less than 120°C when the ICs are used. Thus, the odor-reducing effect is extremely effective for the thermoplastic resin (for example, the modified polyphenylene ether-based resin) as the raw material of the IC trays.

[0014]

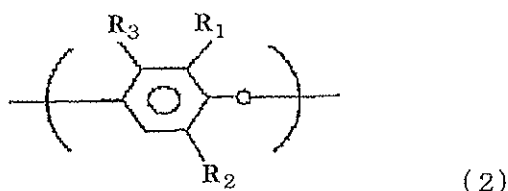
In the present invention, as the modified polyphenylene ether-based resin being the thermoplastic resin (A), a modified polyphenylene ether-based resin

composed of 20 to 90 parts by weight of a polyphenylene ether (A-1) and 10 to 80 parts by weight of a styrene-based resin (A-2) (a thermoplastic resin (AA)) is preferable. Particularly, a modified polyphenylene ether-based resin composed of 40 to 90 parts by weight of the polyphenylene ether (A-1) and 10 to 60 parts by weight of the styrene-based resin (A-2) is more preferable for use in the IC trays. Not less than 20 parts of the polyphenylene ether is preferable, because there are tendencies in this case that reduction in the deflection temperature under load and the mechanical strength can be further suppressed, whereas not more than 90 parts by weight can further suppress reduction in flowability and more simplify the molding step.

[0015]

The above polyphenylene ether (A-1) is preferably a polymer having structural units represented by the following formula (2) as a main chain.

[0016]



In the formula (2), R₁ represents a lower alkyl group having 1 to 3 carbon atoms, R₂ and R₃ independently represent a hydrogen atom or a lower alkyl group having 1 to 3 carbon atoms.

The polymer having the structural unit represented by the formula (2) as the main chain may be a homopolymer or a copolymer.

[0017]

As the polyphenylene ether (A-1), mention may be specifically made of

poly(2,6-dimethyl-1,4-phenylene)ether, poly(2,6-diethyl-1,4-phenylene)ether,
poly(2,6-dipropyl-1,4-phenylene)ether,
poly(2-methyl-6-ethyl-1,4-phenylene)ether,
poly(2-methyl-6-propyl-1,4-phenylene)ether, etc. Particularly, poly
5 (2,6-dimethyl-1,4-phenylene)ether and
2,6-dimethylphenol/2,3,6-trimethylphenol copolymer are preferable.

[0018]

Preferably, the polyphenylene ether (A-1) to be used in the present
invention has an intrinsic viscosity of 0.3 to 0.6dl/g at 30°C when measured in
10 chloroform. There is a tendency that when the intrinsic viscosity is set at not
less than 0.3dl/g, the mechanical strength of the resin composition increases,
and when it is set at not more than 0.6dl/g, decrease in the flowability can be
suppressed.

[0019]

15 As the styrene-based resin (A-2) to be used in the present invention,
polymers of styrene-based monomers, copolymers of the styrene-based
monomers and other copolymerizable monomers, and styrene-based graft
copolymers, etc. can be recited. As the copolymers between the styrene-based
monomers and other copolymerizable monomers, an AS resin, etc. can be
20 recited. As the styrene-based graft copolymers, a high impact polystyrene
(HIPS) resins, an ABS resin, an AES resin, an AAS resin, etc. can be recited.
As the method for producing the styrene-based copolymers, publicly known
methods such as an emulsion polymerization method, a solution
polymerization method, a suspension polymerization method, a mass

polymerization method, etc. can be recited.

[0020]

As the styrene-based monomers, styrene, α -methylstyrene, p-methylstyrene, etc. are recited, and preferably styrene is recited. As the
5 monomers copolymerizable with the styrene-based monomers, mention may be made of vinyl cyanide monomers such as acrylonitrile, methacrylonitrile, etc., alkyl (metha)acrylate esters such as methyl acrylate, ethyl acrylate, propyl acrylate, methyl methacrylate, ethyl methacrylate, etc., maleimide, N-phenyl maleimide, etc. can be recited. Preferably, vinyl cyanide monomer and alkyl
10 (metha)acrylate ester can be recited.

[0021]

(D) Styrene-based elastomer

In order to further enhance the impact strength, a styrene-based elastomer (D) is preferably mixed into the thermoplastic resin (A) in the present invention.
15 As the styrene-based elastomer (D) to be preferably mixed in the present invention, mention may be made of block copolymers in which a hard segment is constituted by a styrene polymer and a soft segment is constituted by at least one kind of polymers selected from the group consisting of polybutadiene, polyisoprene and water adducts thereof. Specifically, mention may be made of
20 SBS(styrene/butadiene/styrene block copolymer), SIS (styrene/isoprene/styrene block copolymer), SEBS (styrene/ethylene/butylene/styrene block copolymer: water adducts of SBS), SEPS (styrene/ethylene/propylene/styrene block copolymer: water adducts of SIS), etc. SEBS is particularly preferable.

The constituting ratio between the hard segments and the soft segments of

the styrene-based elastomer (D) can be ordinarily appropriately selected in a range of 10:90 to 90:10, preferably 10:90 to 50:50. The bonding form between the hard segment blocks and the soft segment blocks may be a diblock type or a triblock type.

5 [0022]

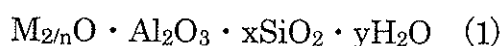
The mixing ratio of the styrene-based elastomer (D) is preferably 1 to 25 parts by weight, more preferably 3 to 20 parts by weight and further preferably 5 to 15 parts by weight with respect to 100 parts by weight of the thermoplastic resin (A). There is a tendency that when the mixing ratio of the styrene-based elastomer (D) is set at not less than 1 part by weight, the impact strength-improving effect is further enhanced. On the other hand, there is a tendency that when the mixing ratio of the styrene-based elastomer (D) is not less than 25 parts by weight, decrease in the rigidity and the deflection temperature under load of the resin composition can be suppressed.

15 [0023]

(B) Zeolite

Zeolite (B) to be used in the present invention is represented by the following formula (1). The zeolite (B) is aluminosilicate constituted by a three-dimensional skeleton structure.

20 [0024]



wherein M represents an ion-exchangeable, univalent or bivalent metal; n represents an atomic valence of the metal represented by M; x, which is a silica coefficient as the molar ratio of SiO₂ to Al₂O₃, is an integer of 10 to 500; and y,

which is the number of crystal water, represents an integer of 0 to 7.

[0025]

As the zeolites, there are natural zeolite and synthesized zeolites. As the synthesized zeolites, there are hydrophilic zeolites having low silica coefficients
5 (less than 10) (for example, A type zeolite, X type zeolite and Y type zeolite) and hydrophobic zeolites having high silica coefficients (not less than 10) (for example, MFI type zeolite).

Herein, the zeolites (B) to be used in the present invention are hydrophobic zeolites, and MFI type zeolite is preferably from the standpoint of availability
10 in the market. The hydrophobic MFI type zeolite possesses a three-dimensional network structure having inlets of fine pores formed by 10-membered oxygen rings and composed of linear fine pores and zigzag fine pores crossing them. For example, a MFI type zeolite having the fine pores of elliptical shapes with effective fine pore diameters of 5 to 6Å, a pore volume of
15 0.15 to 0.25mL/g and a specific surface area of 300 to 550m²/g is preferable, and one having the fine pores of elliptical shapes with effective fine pore diameters of 5 to 6Å, a pore volume of 0.15 to 0.25mL/g and a specific surface area of 300 to 450m²/g is more preferable.

The zeolite (B) to be used in the present invention needs to be one
20 represented by the above formula (1). As the ion-exchangeable univalent or bivalent metal represented by M, alkali metals or alkaline earth metals are preferable, and sodium is more preferable. A zeolite having a silica coefficient x of 20 to 100 and the number of crystal water, y, of 0 to 7 in the formula (1) is preferable. Further, a zeolite having moisture adsorbability of

less than 20wt% under the conditions of temperature 25°C/relative humidity 10%/ordinary pressure is preferable, and a zeolite having the moisture adsorbability of less than 15wt% is more preferable, and a zeolite having the moisture adsorbability of less than 10wt% is further more preferable.

5 Particularly, the zeolite represented by the above formula (1) and having a silica coefficient x of 20 to 60 and the moisture adsorbability of less than 10wt% under the conditions of temperature 25°C/relative humidity 10%/ordinary pressure has high heat resistance and hydrophobicity, and a molded product obtained from a low-odor resin composition mixed with this zeolite is featured
10 by no occurrence of a silvering phenomenon and an extremely excellent appearance.

 The average primary particle diameter of the zeolite (B) to be used in the present invention is preferably 0.1 to 20 μ m, more preferably 0.2 to 10 μ m, and further more preferably 0.5 to 5 μ m. There is a tendency that when the
15 average primary particle diameter is set at not less than 0.1 μ m, the melt viscosity of the resin composition does not become too high, whereas when it is set at not more than 20 μ m, a poor appearance of the molded product due to its rough surface, etc. can be more suppressed.

[0026]

20 The mixing ratio of the zeolite (B) to be used in the present invention is 0.1 to 5.0 parts by weight and more preferably 0.2 to 3.0 parts by weight to 100 parts by weight of the thermoplastic resin (A). If the mixing ratio of the zeolite (B) is less than 0.1 parts by weight, the odor-reducing effect is small. On the other hand, if it is mixed in an amount of more than 5.0 parts by weight,

there are problems that a further odor-reducing effect cannot be expected and the mechanical strength decreases.

[0027]

(C) Electroconductive agent

5 In order to afford an antistatic property and electroconductivity, an electroconductive agent may be mixed into the low-odor resin composition according to the present invention (preferably the resin composition containing the thermoplastic resin (A) and the zeolite (B), or the resin composition containing the thermoplastic resin (A), the zeolite (B) and the styrene-based
10 elastomer (D), particularly preferably the above resin compositions in which a modified polyethylene ether-based resin is contained as the thermoplastic resin (A)). As the electroconductive agent, an electroconductive organic material or an electroconductive inorganic material can be used. As examples of the electroconductive agent, mention can be made of ionic organic surfactants,
15 non-ionic organic surfactants, polymeric antistatic agents having polyethylene glycol units, polymeric antistatic agents having ionic functional groups, carbon black, carbon fibers, carbon whiskers, hollow carbon fibril, metal fibers, metal powders, metal oxides, etc. As the electroconductive materials, the electroconductive inorganic materials are preferable, since attachment of
20 volatile materials and production of volatile material through the decomposition of the polyphenylene ether-based resin are low. As the electroconductive inorganic material, carbon black (C-1), carbon fibers and hollow carbon fibrils, etc. can be preferably recited, and carbon blacks (C-1) are particularly preferable from the standpoint of the price. As the carbon blacks

(C-1), natural graphite, artificial graphite, carbon black, etc. can be recited, and among them artificial graphites, such as acetylene black and furnace black, in a powdery or a granular form, are preferably used. As the furnace black, Ketjenblack EC and Ketjenblack EC-600J (commercial names) manufactured
5 by Netherland Akzo Co., Ltd. and Asahi HS-500 manufactured by ASAHI CARBON Co., Ltd. are recited by way of example.

[0028]

The mixing ratio of the electroconductive agent (C) (particularly carbon black (C-1)) is preferably 3.0 to 30 parts by weight, more preferably 4.0 to 25
10 parts by weight, and further preferably 5.0 to 20 parts by weight based on 100 parts by weight of the low-odor resin composition (preferably, the low-odor resin composition containing the polyphenylene ether (A-1), the styrene-based resin (A-2) and the zeolite (B)). The reason why the mixing ratio of the electroconductive agent (C) is preferably not less than 3.0 parts by weight is
15 that the electroconductivity tends to be more exhibited in this case. Particularly, it is unfavorable to use the electroconductive resin composition for the IC tray, considering that dust and dirt are likely to be attached. Further, when the mixing amount of the electroconductive agent (C) is not more than 30 parts by weight, there is a tendency that reduction in dispersability of the
20 electroconductive agent (for example, carbon black) in the resin component can be suppressed. The above range is preferable, because the flowability of the resin composition as well as the strength and the appearance of the molded product tend to be improved in this case.

[0029]

(E) Other components

Besides the above components (A) to (D), the following can be added and mixed into the low-odor resin composition depending upon the necessity: a flame retardant such as a phosphoric acid ester, a condensed phosphoric acid ester, etc.; an ultraviolet absorber of such as a hindered amine type, a benzotriazol type, a benzophenone type, an epoxy type or the like; a heat stabilizer such as a hindered phenol-based compound, a phosphite-based compound, a phosphonite-based compound, zinc oxide or the like; an antioxidant, a pigment, a dye, a lubricant, a mold-releasing agent such as a saturated fatty acid ester, a polyolefin-based wax or the like; additives such as a plasticizer, an antistatic agent, a slidability-improving agent, a compatibilizing agent, etc.; a fluorine-based resin having a drip-preventing function on burning, such as a difluoroethylene polymer, a tetrafluoroethylene polymer, a tetrafluoroethylene-hexafluoropropylene copolymer, a copolymer between tetrafluoroethylene and an ethylene-based monomer containing no fluorine or the like; a reinforcing agent such as glass fibers, glass flakes, carbon fibers, metal fibers or the like; whiskers of such as potassium titanate, aluminum borate, calcium silicate or the like; an inorganic filler such as mica, talc, clay or the like. These additive can be appropriately added by a conventionally known method, which utilizes characteristics thereof.

[0030]

The low-odor resin composition according to the present invention is prepared, for example, by a method in which the thermoplastic resin (A) and the zeolite (B), and further the electroconductive agent (C) and/or the

styrene-based elastomer (D) and other additive (E) to be added depending upon the necessity are melted and kneaded in a lump by means of one of various kneader, for example, a uniaxial and multi-axial kneader, a banbury mixer, a rolling machine, a Brabender Plastogram or the like, or a part of the components is preliminarily kneaded and then combined and further kneaded with the other components (including a method using a master batch), or a solution-mixing method in which the additives (E) to be added depending upon the necessity are dissolved or suspended in an appropriate solvent, for example, a hydrocarbon such as hexane, heptane, benzene, toluene, xylene or the like or a derivative thereof, and the solution or the dispersion is mixed with the resin composition of the thermoplastic resin (A) and the zeolite (B), and further the electroconductive agent (C) and/or the styrene-based elastomer (D).

In the present invention, the melting/kneading method is preferable from the standpoint of the industrial cost, but the invention is not limited thereto. In the melting/kneading method, the uniaxial or biaxial extruder is preferably used.

[0031]

As a method for forming a molded product such as an IC tray or the like by using the low-odor resin composition according to the present invention, an injection molding is often used because of its good productivity. However, the method is not particularly limited, and a method generally used for the thermoplastic resins, for example, molding methods such as hollow molding, extrusion molding, heat molding with use of sheet-shaped molded product, rotary molding, etc. are applicable.

[0032]

When the molded product of the present invention is used as the IC tray, the modified polyphenylene ether resin (for example, the above thermoplastic resin (AA)) is preferably used as the thermoplastic resin (A).

5 Examples

[0033]

In the following, the present invention will be explained in more detail based on Examples, but the invention is not limited to the following Examples so long as there are no deviations from the gist of the present invention.

10 Low-odor resin compositions and molded products in Examples and Comparative Examples were evaluated as follows.

[0034]

(1) Odor A:

Five persons smelled an odor at a place away from a die of a biaxial extruder (screw diameter 30mm) by 50cm when extruding a low-odor resin composition, and gave scores according to the following criterion, and the total of the scores of all the persons was taken as an evaluation score.

Odor B:

An Izod impact test piece was placed in a ground glass stopper-type 300-ml Erlenmeyer flask, and the flask was heated at 140°C for 3 hours. Thereafter, five persons smelled an odor, and gave their scores according to the following criterion, and the total of the scores of all the persons was taken as an evaluation score.

Score	Evaluation criterion
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- | | | |
|---|---|------------------|
| | 1 | very slight odor |
| | 2 | slight odor |
| | 3 | easily felt odor |
| | 4 | strong odor |
| 5 | 5 | very strong odor |

[0035]

(2) Appearance of molded products:

Occurrences of a silvering mark, a flow mark, etc. were visually observed on a rectangular plate-like molded products of 50mm x 90mm x 3.2 mm in
10 thickness, and the molded products were evaluated by four grades ◎, ○, △ and × in the order of excellence of the appearance.

(3) Izod impact strength:

Izod impact strength of five unnotched specimens were measured in each of Examples and Comparative Examples at 23°C according to ASTM-D256, and
15 the average value for the five specimens was shown as the Izod impact strength (hereinafter abbreviated as IZ).

(4) Deflection temperature under load:

A deflection temperature under load (hereinafter abbreviated as DTUL) was measured under a condition of 1.82MP according to ASTM D648.

20 (5) Surface resistivity

A rectangular plate-like molded product of 50mm x 90mm x 3.2mm in thickness was used, and the surface resistivity was measured at arbitrary three points by using Lorester and Hirester (manufactured by Mitsubishi Chemical, Co., Ltd.). (With respect to the surface resistivity of not less than

10⁴Ω, Hirester was used, and with respect to less than 10⁴Ω, Lorester was used.)

[0036]

[Example 1]

5 A polyacetal resin (manufactured by Mitsubishi Engineering-Plastics Corporation, Commercial name: Iupital (registered trademark) F20-01, abbreviated as POM in Table 1) was mixed with an MFI type synthesized high silica zeolite at a mixing ratio shown in Table 1 (MFI type synthesized high silica zeolite: manufactured by Mizusawa Industrial Chemicals, Ltd.,
10 commercial name: Mizucasieves EX-122, silica coefficient $x = 33$, elliptical shapes with effective fine pore diameters of 5 to 6Å, a pore volume of 0.15 to 0.25 mL/g, a specific surface area of 300 to 450m²/g, the average primary particle diameter of 2.0μm, moisture adsorbability of 6wt% under the conditions of temperature 25°C/relative humidity 10%/ordinary pressure, metal
15 M is Na, the number of crystal water y is 0 to 7) (hereinafter abbreviated as MFI type zeolite). The above mixture was melted and kneaded at a preset resin temperature of 200°C and the screw revolutions per minutes of 100rpm by means of a 30mm-biaxial extruder, thereby obtaining pellets. After the thus obtained pellets were dried for 4 hours by using a hot air drier at a
20 temperature of 80°C, the resultant was injection molded at a cylinder preset temperature of 190°C and a mold temperature of 80°C by using an injection molding machine (SG125 manufactured by Sumitomo Heavy Industries, Ltd.) with a mold-clamping force of 125 tons. An appearance and an Izod impact strength of the molded product were evaluated, and evaluated results were

shown in Table 1.

[0037]

[Comparative Example 1]

Comparative Example 1 was conducted in the same manner as in
5 Example 1, except that in place of the MFI type zeolite, the A type zeolite was
mixed at a mixing ratio shown in Table 1 (A type zeolite: manufactured by
Nippon Chemical Industrial Co., Ltd., commercial name: Zeostar NX-110P,
silica coefficient $x = 2.6$, effective fine pore diameter of $9\text{\AA}$, the average
primary particle diameter of $3\mu\text{m}$, the moisture adsorbability of 25wt% under
10 the conditions of temperature $25\text{ }^{\circ}\text{C}$ /relative humidity 10%/ordinary pressure)
(hereinafter abbreviated as X type zeolite). Evaluation results were shown in
Table 1.

[0038]

[Comparative Example 2]

15 Comparative Example 2 was conducted in the same manner as in Example
1, except that no MFI type zeolite was added. Evaluation results were shown
in Table 1.

[0039]

[Table 1]

			Example 1	Comparative Example 1	Comparative Example 2
Composition	POM	Part by weight	100	100	100
	MFI type zeolite	Part by weight	1.5		
	X type zeolite	Part by weight		1.5	
Properties	Odor A		12	13	22
	Odor B		7	8	17
	Appearance of molded product		◎	△	◎
	Izod impact strength	J/m	750	690	760
	Deflection temperature under load	$^{\circ}\text{C}$	110	108	110

20

[0040]

[Example 2]

The materials given below were prepared.

(1) Poly(2, 6-dimethyl-1, 4-phenylene)ether resin (manufactured by Mitsubishi
5 Engineering-Plastics Corporation, commercial name: Iupiace (registered
trademark) PX100F, an intrinsic viscosity of 0.38dl/g as measured at 30°C in
chloroform, hereinafter abbreviated as PPE).

(2) Styrene-based resin: HIPS, weight average molecular weight (Mw)
200,000, melt flow rate (MFR) 3.2g/10min., manufactured by A & M Co., Ltd.,
10 HT478

(3) MFI type zeolite (used in Example 1)

(4) Electroconductive carbon black: manufactured by Netherlands Akzo Co.,
Ltd., Ketjenblack EC (hereinafter abbreviated as Ketjenblack EC)

(5) Styrene-based elastomer (SEBS): Manufactured by Shell Chemicals Ltd.,
15 Commercial name: Clayton G1652 (hereinafter abbreviated as SEBS, hard
segments: soft segments =29:71)

(6) Talc: Manufactured by Matsumura Sangyou Co., Ltd., talc K-5 treated with
a silane coupling agent (γ -methacryloxypropyltrimethoxy silane) (hereinafter
simply referred to as talc)

20 (7) Stabilizer: Zinc oxide as a first grade reagent (hereinafter simply
referred to zinc oxide)

A mixture obtained by mixing the above materials at a ratio shown in
Table 2 was melted and kneaded under conditions of a cylinder preset
temperature of 270 to 320°C and a screw rotation speed of 50rpm and extruded

by using a uniaxial extruder with a screw diameter of 40mm as manufactured by Tanabe Plastics Kikai Co., Ltd. Thereby, a pelleted electroconductive resin composition was produced.

After the thus pelleted electroconductive resin composition was dried for 4
5 hours by using a hot air drier at a temperature of 110°C, the dried resin composition was injection molded at a cylinder preset temperature of 290 to 330°C and a mold temperature of 120°C by using an 1S150 type injection molding machine manufactured by Toshiba Machine Co. Ltd. The appearance, an Izod impact strength, a deflection temperature under load and a surface
10 resistivity of the resulting molded product was evaluated, and evaluation results were shown in Table 2.

[0041]

[Comparative Example 3]

Comparative Example 3 was conducted in the same manner as in Example
15 2, except that in place of the MFI type zeolite in Example 2, the X type zeolite was mixed at a mixing ratio shown in Table 2 (X type zeolite: manufactured by Nippon Chemical Industrial Co., Ltd., commercial name: Zeostar NX-11OP, silica coefficient $x = 2.6$, effective fine pore diameter of 9Å, the average primary particle diameter of 3μm, the moisture adsorbability of 25wt% under the
20 conditions of temperature 25°C/relative humidity 10%/ordinary pressure, hereinafter abbreviated X type zeolite). Evaluation results are shown in Table 2.

[0042]

[Comparative Example 4]

Comparative Example 4 was conducted in the same manner as in Example 2 except that no MFI type zeolite was added. Evaluation results were shown in Table 2.

[0043]

5 [Table 2]

			Example 2	Comparative Example 3	Comparative Example 4
Composition	PPE	Part by weight	72	72	72
	HIPS	Part by weight	20	20	20
	MFI type zeolite	Part by weight	1.5		
	X type zeolite	Part by weight		1.5	
	Carbon black	Part by weight	10	10	10
	SEBS	Part by weight	8	8	8
	Talc	Part by weight	8	8	8
	Zinc oxide	Part by weight	0.3	0.3	0.3
Properties	Odor A		10	11	21
	Odor B		6	8	16
	Appearance of molded product		◎	△	◎
	Izod impact strength	J/m	290	260	300
	Deflection temperature under load	°C	165	163	166
	Surface resistivity	Ω	10 ⁵	10 ⁵	10 ⁵

[0044]

It is seen from Tables 1 and 2 that the odor was more suppressed in the low-odor resin compositions according to the present invention as compared with the resin compositions employing the X type zeolite generally used in the publicly known literatures. Further, it was recognized that the molded products having used said composition also had excellent appearance. Moreover, it was recognized from the results in Table 2 that in addition to the low-odor property and the excellent appearance, the molded products further had both good surface resistivity, mechanical strength and heat resistance, which are required for the resin composition, such as the resin composition directed to use in the IC trays, etc. necessitating the electroconductivity.

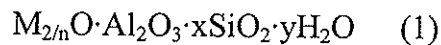
[Industrial Applicability]

[0045]

The low-odor resin composition according to the present invention is expected to be used for applications in a wide field including applications in
5 communication/information/OA devices and equipments, precision devices and equipments, home electric appliances, automobile parts, medical applications, building materials, agricultural materials, miscellaneous daily goods, etc. Particularly, it is expected that the resin composition is used for the IC trays.

What is claimed is:

1. A low-odor resin composition comprising 100 parts by weight of (AA) a thermoplastic resin which consists of 20 to 90 parts by weight of (A-1) a polyphenylene ether and 10 to 80 parts by weight of (A-2) a styrene resin, and 0.1 to 5.0 parts by weight of (B) a zeolite represented by the following formula (1):



wherein M represents an ion-exchangeable, univalent or bivalent metal; n represents an atomic valence of the metal represented by M; x, which is a silica coefficient as the molar ratio of SiO₂ to Al₂O₃, is an integer of 10 to 500; and y, which is the number of crystal water, represents an integer of 0 to 7.

2. The low-odor resin composition according to Claim 1, comprising 1 to 25 parts by weight of (D) a styrene elastomer based on 100 parts by weight of (AA) the thermoplastic resin.

3. The low-odor resin composition according to Claim 1, comprising 3.0 to 30 parts by weight of (C) a carbon black based on 100 parts by weight of the low-odor resin composition.

4. The low-odor resin composition according to Claim 1, wherein M in (B) the zeolite is sodium.

5. The low-odor resin composition according to Claim 1, wherein x in (B) the zeolite, which is a silica coefficient, is in the rage of 20 to 60.

5 6. The low-odor resin composition according to Claim 1, wherein (B) the zeolite is a MFI type.

7. An article molded of a low-odor resin composition according to any one of Claims 1 to 6.

8. An IC tray molded of a low-odor resin composition according to Claim
10 3.