

RESIN COMPOSITION FOR CLEANING DIE

Technical Field

[0001] The present disclosure relates to a resin composition for cleaning a die.

Background Art

[0002] In the case of performing sealing molding using a sealing molding material containing a thermosetting resin composition, continuing a long-term sealing molding operation of an integrated circuit, a light emitting diode (LED) element, or the like tends to cause a stain originating from the sealing molding material and adhering to an internal surface of a molding die. Such a stain left in the die causes defects such as adhesion of the stain onto a surface of a sealing-molded product such as an integrated circuit or an LED element or failure in separation of a sealing-molded product from a molding die. Therefore, it is necessary to clean the molding die periodically for performing sealing molding. As a method for cleaning the molding die, it has been known a method which employs a resin composition for cleaning a die.

[0003] For example, International Patent Application No. 2002/030648 describes a resin composition for cleaning a die which contains a melamine-based resin and a fibrous inorganic compound of which an average fiber length, an average fiber diameter, and an aspect ratio each are within a specific range.

[0004] Japanese Patent Application Laid-Open (JP-A) No. H01-139649 describes a resin composition for cleaning a die which contains a melamine-based resin and a guanidine derivative.

SUMMARY OF INVENTION

[0005] In recent years, for environmental conservation, a sealing molding material which is called a green compound, which does not contain a halogen-containing flame retardant or the like, has become to be used. In a sealing and molding step using such a green compound, the internal surface of the molding die easily stainies, and the adhering stain to is hardly removed from the internal surface. Cleaning performance of conventional sealing molding materials is insufficient to address this problem. For this reason, there is a demand for developing a resin composition for cleaning a die having higher cleaning performance.

[0006] The present disclosure is made in view of the circumstances described above, and an object thereof is to provide a resin composition for cleaning a die which has favorable die cleaning performance.

[0007] Specific means for achieving the problems described above are as follows.

<1> A resin composition for cleaning a die, the resin composition comprising: a melamine-based resin; a zinc salt of a fatty acid; and an organic base other than a salt of a strong acid and a weak base, a content of the zinc salt of a fatty acid being 1 part by mass or more with respect to 100 parts by mass of a total solid content of the resin composition, and a ratio of a content of the organic base with respect to a content of the zinc salt of a fatty acid in the resin composition being from 1/100 to 1/2, on a mass basis.

<2> The resin composition for cleaning a die according to <1>, wherein the organic base comprises at least one compound selected from the group consisting of a guanidine compound and an amidine compound.

<3> The resin composition for cleaning a die according to <1> or <2>, wherein the zinc salt of a fatty acid comprises at least one selected from the group consisting of zinc myristate and zinc stearate.

<4> The resin composition for cleaning a die according to any one of <1> to <3>, wherein the melamine-based resin comprises a melamine-formaldehyde resin.

[0008] According to the present disclosure, a resin composition for cleaning a die which has favorable die cleaning performance may be provided.

DESCRIPTION OF EMBODIMENTS

[0009] Specific embodiments of the invention will be described in detail hereinafter. However, it should be noted that the invention is not restricted to the embodiments below but can be carried out with appropriate modification within the scope of the object of the invention.

[0010] A numerical value range indicated by using "from ... to ..." as used herein refers to a range including numerical values described before and after "to" as the minimum and maximum values, respectively. Further, when plural substances corresponding to each component are present in a composition, an amount of each component in the composition means a total amount of the plural substances present in the composition unless otherwise specified.

[0011] An "internal surface of a molding die" as used herein refers to a region at which the molding die contacts a material to be molded by the molding die.

[0012] [Resin Composition for Cleaning Die]

The resin composition for cleaning a die of the present disclosure contains a melamine-based resin, a zinc salt of a fatty acid, and an organic base other than a salt of a strong acid and a weak base (also simply referred to as an "organic base" hereinbelow) in which a content of the zinc salt of a fatty acid is 1 part by mass or more relative to 100 parts

by mass of the total solid content of the resin composition, and a content ratio of the organic base relative to the content of the zinc salt of a fatty acid is from 1/100 to 1/2, on a mass basis.

The resin composition for cleaning a die of the present disclosure may have an excellent cleaning performance compared to a resin composition for cleaning a die of conventional arts.

The reason for the resin composition for cleaning a die of the present disclosure to exhibit such effect remains unclear, however, it is believed by the authors of the present disclosure as follows.

[0013] A zinc salt of a fatty acid like zinc stearate and zinc myristate is generally contained in a resin composition for cleaning a die containing a melamine-based resin for the purpose of improving the molding die cleaning performance, the release property from a molding die after cleaning, tableting property, or the like. For example, in International Publication No. 2002/030648 and Japanese Patent Application Laid-Open (JP-A) No. H01-139649 that are described above, examples of a resin composition for cleaning a die containing zinc stearate are disclosed.

From the viewpoint of further enhancing the molding die cleaning performance, the release property from a molding die after cleaning, tableting property, or the like, it is preferable that a zinc salt of a fatty acid is contained as much as possible in the resin composition for cleaning a die containing a melamine-based resin.

However, a zinc salt of a fatty acid as an acid compound may also function as an acidic catalyst for a curing reaction of melamine-based resin. Therefore, when the resin composition for cleaning a die containing a melamine-based resin contains an excess amount of a zinc salt of a fatty acid, the curing reaction of a melamine-based resin is accelerated, and thus a tendency of having poorer molding die cleaning performance is exhibited.

[0014] The resin composition for cleaning a die of the present disclosure contains a melamine-based resin, a zinc salt of a fatty acid, and an organic base other than a salt of a strong acid and a weak base, and a ratio of a content of the organic base with respect to a content of the zinc salt of a fatty acid in the resin composition is from 1/100 to 1/2, on a mass basis. This configuration enables to have the curing reaction of a melamine-based resin caused by the zinc salt of a fatty acid be controlled at suitable rate by the organic base. Further, since the curing reaction of a melamine-based resin caused by the zinc salt of a fatty acid is controlled at suitable rate by the organic base, the resin composition for cleaning a die can contain a zinc salt of a fatty acid in an amount that is suitable for improving the molding die cleaning performance, that is, 1 part by mass or more with respect to 100 parts by mass of a total solid content of the resin composition for cleaning a die. It is considered that, as a

result thereof, the resin composition for cleaning a die of the present disclosure can exhibit an excellent cleaning performance.

[0015] Further, since the resin composition for cleaning a die of the present disclosure can contain a zinc salt of a fatty acid in an amount that is suitable for improving the release property from a molding die after cleaning as described above, that is, 1 part by mass or more relative to 100 parts by mass of a total solid content of the resin composition for cleaning a die, the working property at the time of removing a molded product of the resin composition for cleaning a die from a molding die after cleaning is also excellent.

[0016] [Melamine-based resin]

The resin composition for cleaning a die of the present disclosure includes a melamine-based resin.

The resin composition for cleaning a die of the present disclosure exhibits excellent cleaning performance for removing a stain on an internal surface of a molding die because of including the melamine-based resin.

It is considered that the excellent performance of the resin composition for cleaning a die including the melamine-based resin is exhibited since the melamine-based resin has a methylol group, that has a high polarity, can react with a stain that is generated in molding, adheres to an internal surface of a molding die, and originates from a sealing molding material (i.e., a stain originating from a sealing molding material containing a thermosetting resin composition such as an epoxy resin). It is also considered that excellent cleaning performance can be stably exerted at from around 160°C to 190°C, which is the temperature usually employed in cleaning of a die, since the melamine-based resin is thermally stable.

[0017] The melamine-based resin herein referred to means a melamine resin, a melamine-phenol co-condensate resin, or a melamine-urea co-condensate resin.

At least one of these may be contained in the resin composition of the present disclosure.

[0018] The melamine resin is a condensate of a triazine compound and an aldehyde compound.

Examples of the triazine compound include melamine, benzoguanamine, and acetoguanamine.

Examples of the aldehyde compound include formaldehyde, paraformaldehyde, and acetaldehyde.

A molar ratio of a repeating unit derived from the triazine compound to a repeating unit derived from the aldehyde compound in the melamine resin (triazine : aldehyde) is preferably from 1:1.2 to 1:4.

Hereinafter, a condensate of melamine and formaldehyde is referred to as a melamine-formaldehyde resin.

[0019] The melamine-phenol co-condensate resin is a co-condensate of a triazine compound, a phenol compound, and an aldehyde compound.

Examples of the phenol compound include phenol, cresol, xlenol, ethylphenol, and butylphenol.

A molar ratio of a repeating unit derived from the triazine compound to a repeating unit derived from the phenol compound and a repeating unit derived from the aldehyde compound in the melamine-phenol co-condensate resin (triazine : phenol : aldehyde) is preferably from 1:0.3:1 to 1:1:3.

[0020] The melamine-urea co-condensate resin is a co-condensate of a triazine compound, a urea compound, and an aldehyde compound.

Examples of the urea compound include urea, thiourea, and ethylene urea.

An amount of the triazine compound with respect to the total amount of the triazine compound and the phenol compound in a raw material for forming the melamine-phenol co-condensate resin and an amount of the triazine compound with respect to the total amount of the triazine compound and the urea compound in a raw material for forming the melamine-urea co-condensate resin may be respectively, for example, 30 % by mass or more, 40 % by mass or more, 50 % by mass or more, 60 % by mass or more, 70 % by mass or more, 80 % by mass or more, or 90 % by mass or more, but less than 100 % by mass.

Unless deteriorating the effect of the present disclosure, the resin composition for cleaning a die of the present disclosure may include, in addition to the melamine-based resin, another kind of resin such as one that includes at least one selected from the group consisting of an alkyd resin, a polyester resin, an acrylic resin, an epoxy resin, and a rubber.

[0021] The melamine-based resin of the present disclosure can be prepared by a known method.

For example, for preparing the melamine resin, melamine crystals and formaldehyde are stirred at conditions of a molar ratio of from 1 : 1.2 to 1 : 4, reaction temperature of from 80°C to 90°C, and from pH 7 to 7.5, and then reacted at 60°C for the time until 3% by mass-aqueous solution of a reaction product yields white cloudiness. Subsequently, by adding sodium hydroxide and cooling, a melamine resin can be obtained.

[0022] As for the melamine-based resin, a commercially available product may be used.

Examples of the commercially available product include NIKARESIN (registered trademark) S-166, S-176, S-260, S-305, or the like that are manufactured by NIPPON CARBIDE INDUSTRIES CO., INC.

[0023] The resin composition for cleaning a die of the present disclosure may contain only one kind of the melamine-based resin or two or more kinds of the melamine-based resins.

[0024] A content of the melamine-based resin in the resin composition for cleaning a die of the present disclosure is not particularly limited. For example, the content of the melamine-based resin in the resin composition for cleaning a die is preferably from 55 parts by mass to 85 parts by mass, more preferably from 60 parts by mass to 80 parts by mass, and even more preferably from 65 parts by mass to 75 parts by mass relative to 100 parts by mass with respect to a total solid content of the resin composition for cleaning a die.

[0025] [Zinc salt of a fatty acid]

The resin composition for cleaning a die of the present disclosure contains 1 part by mass or more of a zinc salt of a fatty acid with respect to 100 parts by mass of a total solid content of the resin composition.

In the resin composition for cleaning a die of the present disclosure, the zinc salt of a fatty acid contributes to improvement of the molding die cleaning performance, the release property from a molding die after cleaning, tableting property, or the like.

[0026] The zinc salt of a fatty acid is not particularly limited.

The fatty acid for constituting the zinc salt of a fatty acid can be any of a saturated fatty acid and an unsaturated fatty acid, and is preferably a saturated fatty acid.

The fatty acid for constituting the zinc salt of a fatty acid is preferably a saturated fatty acid with from 12 to 20 carbon atoms, and more preferably a saturated fatty acid with from 14 to 18 carbon atoms.

Specific examples of the saturated fatty acid with from 12 to 20 carbon atoms include lauric acid with 12 carbon atoms (IUPAC name: dodecanoic acid), myristic acid with 14 carbon atoms (IUPAC name: tetradecanoic acid), palmitic acid with 16 carbon atoms (IUPAC name: hexadecanoic acid), stearic acid with 18 carbon atoms (IUPAC name: octadecanoic acid), and arachidonic acid with 20 carbon atoms (IUPAC name: eicosanoic acid).

[0027] As for the zinc salt of a fatty acid, at least one selected from the group consisting of zinc myristate, which is formed of a saturated fatty acid having 14 carbon atoms and zinc, and zinc stearate, which is formed of a saturated fatty acid having 18 carbon atoms and zinc, is preferable, and zinc myristate is particularly preferable.

[0028] The resin composition for cleaning a die of the present disclosure may contain only 1 kind or 2 or more kinds of the zinc salt of a fatty acid.

[0029] A content of the zinc salt of a fatty acid in the resin composition for cleaning a die of the present disclosure is 1 part by mass or more, preferably 1.2 parts by mass or more, and more preferably 1.5 parts by mass or more, with respect to 100 parts by mass of a total solid

content of the resin composition for cleaning a die.

When the zinc salt of a fatty acid is 1 part by mass or more relative to 100 parts by mass of a total solid content of the resin composition for cleaning a die, an excellent cleaning performance is exhibited for stain on an internal surface of a molding die. Further, mold release of a resultant molded from the resin composition for cleaning a die after cleaning from an internal surface of a molding die becomes favorable so that the working property at the time of removing the resultant from a molding die is improved. Further, the tableting property at the time of shaping the resin composition for cleaning a die of the present disclosure into a tablet form is improved.

[0030] As described above, the zinc salt of a fatty acid contributes to not only the improvement of the molding die cleaning performance, but also the improvement of the release property from a molding die after cleaning, tableting property, or the like. However, when the resin composition for cleaning a die containing a melamine-based resin contains an excess amount of the zinc salt of a fatty acid, there is a case in which the tableting property is deteriorated or stain on a molding die due to the presence of an excess amount of the zinc salt of a fatty acid in a molding die is caused. On the other hand, since the release property from a molding die after cleaning does not change much even when the content of the zinc salt of a fatty acid in the resin composition for cleaning a die is more than a certain amount, it is considered that the merit of having an excess amount of the zinc salt of a fatty acid is insignificant.

An upper limit of the content of the zinc salt of a fatty acid in the resin composition for cleaning a die of the present disclosure is, although not particularly limited, preferably 5 parts by mass or less, and more preferably 4 parts by mass or less with respect to 100 parts by mass of a total solid content of the resin composition for cleaning a die from the viewpoint of preventing phenomena such as a deterioration of the tableting property and stain on a molding die.

[0031] [Organic Base]

The resin composition for cleaning a die of the present disclosure contains an organic base other than a salt of a strong acid and a weak base. A ratio of the content of the organic base with respect to a content of the zinc salt of a fatty acid in the resin composition for cleaning a die of the present disclosure is from 1/100 to 1/2, on a mass basis.

In the resin composition for cleaning a die of the present disclosure, the organic base contributes to control of the rate of a curing reaction of a melamine-based resin caused by the zinc salt of a fatty acid as described above.

[0032] The organic base is not particularly limited as long as it is other than salts of a strong

acid a weak base.

Examples of the organic base include a guanidine compound such as guanidine carbonate, aminoguanidine bicarbonate, guanidine phosphate, 1,1,3,3-tetramethyl guanidine, or phenylguanidine, and an amidine compound such as 1,8-diazabicyclo[5.4.0]-7-undecene or 1,5-diazabicyclo[4.3.0]-5-nonene.

Among them, from the viewpoint of, for example, suppressing effectively an increase in the rate of a curing reaction of a melamine-based resin caused by the zinc salt of a fatty acid described above, the organic base is preferably at least one compound selected from the group consisting of a guanidine compound and an amidine compound. The organic base is more preferably at least one compound selected from the group consisting of guanidine carbonate, aminoguanidine bicarbonate, and 1,8-diazabicyclo[5.4.0]-7-undecene, and guanidine carbonate is even more preferable.

Incidentally, the "salt of a strong acid and a weak base" herein means a salt of an acid with pKa of 2.0 or less at temperature of 25°C and a base with pKb of from 3.0 to 11.0 at temperature of 25°C. Herein, "Ka" represents a dissociation constant of an acid, "Kb" represents a dissociation constant of a base, pKa is $-\log K_a$, and pKb is $-\log K_b$.

Examples of the salt of a strong acid and a weak base include a salt of a strong acid, typical examples of which including hydrochloric acid, sulfuric acid, and nitric acid, and a weak base, typical examples of which including ammonia, diethanolamine, triethanolamine, and aniline.

[0033] The resin composition for cleaning a die of the present disclosure may contain only 1 kind or 2 or more kinds of the organic base.

[0034] A content of the organic base in the resin composition for cleaning a die of the present disclosure is preferably from 0.01 part by mass to 2.5 parts by mass, more preferably from 0.012 part by mass to 2.0 parts by mass, and even more preferably from 0.015 part by mass to 1.5 parts by mass, with respect to 100 parts by mass of a total solid content of the resin composition for cleaning a die.

[0035] A ratio of a content of the organic base with respect to a content of the zinc salt of a fatty acid in the resin composition for cleaning a die of the present disclosure is from 1/100 to 1/2, preferably from 1/80 to 1/3, and more preferably from 1/40 to 1/4, on a mass basis.

As the ratio of a content of the organic base with respect to a content of the zinc salt of a fatty acid in the resin composition for cleaning a die of the present disclosure is 1/100 or more on a mass basis, an increase in the rate of a curing reaction of a melamine-based resin caused by the zinc salt of a fatty acid can be controlled by an organic base so that the resin composition for cleaning a die can contain the zinc salt of a fatty acid in an amount that is

sufficient for improving the molding die cleaning performance, that is, 1 part by mass or more with respect to 100 parts by mass of a total solid content of the resin composition for cleaning a die. As a result, the resin composition for cleaning a die of the present disclosure can exhibit an excellent cleaning performance.

As the ratio of a content of the organic base with respect to a content of the zinc salt of a fatty acid is 1/2 or less on a mass basis, the zinc salt of a fatty acid can function as an acid catalyst for a melamine-based resin at an appropriate level so that a favorable molding property of the resin composition for cleaning a die can be obtained.

[0036] [Other Components]

If necessary, the resin composition for cleaning a die of the present disclosure may contain, in addition to the melamine-based resin, the zinc salt of a fatty acid, and the organic base other than a salt of a strong acid and a weak base, additives such as filler, lubricant, coloring agent, and/or anti-oxidant within a range in which the effect of the present disclosure is not negatively affected by them.

[0037] <Filler>

The resin composition for cleaning a die of the present disclosure preferably contains a filler.

When the resin composition for cleaning a die contains a filler, strength of the resin composition for cleaning a die is maintained at suitable level after molding. Therefore, the working property at the time of removing from a molding die a resultant molded from the resin composition for cleaning a die after cleaning becomes more favorable, and the performance for cleaning an internal surface of a molding die becomes more favorable.

The filler can be any one of an organic filler and an inorganic filler.

[0038] (Organic Filler)

Examples of the organic filler include pulp, wood powder, and synthetic fiber.

Among them, pulp is particularly preferable as the organic filler.

Examples of the pulp include wood pulp (softwood pulp, hardwood pulp, or the like) and non-wood pulp (straw, bamboo, bagasse, cotton, or the like). The pulp can be any one of chemical pulp and mechanical pulp.

[0039] A size of the pulp is not particularly limited, and is preferably from 5 μm to 1000 μm in terms of a fiber length, for example. The pulp size is more preferably from 10 μm to 200 μm . The fiber length of pulp can be measured by a method according to, for example, JIS P8226-2, which corresponds to ISO16065-2.

When the pulp size is within the above range, the fluidity of the resin composition for cleaning a die may become favorable, and thus a corner part of a cavity of a molding die can

be sufficiently cleaned. Further, when the pulp size is within the above range, the strength of the resin composition for cleaning a die is suitably maintained after molding, and thus the working property at the time of removing from a molding die a resultant formed from the resin composition for cleaning a die after cleaning becomes more favorable, and the performance for cleaning an internal surface of a molding becomes more favorable.

[0040] When the resin composition for cleaning a die of the present disclosure contains an organic filler, the resin composition for cleaning a die may contain only 1 kind or 2 or more kinds of the organic filler.

[0041] In a case in which the resin composition for cleaning a die of the present disclosure contains an organic filler, a content of the organic filler in the resin composition for cleaning a die is preferably from 3 parts by mass to 20 parts by mass with respect to 100 parts by mass of a total solid content of the resin composition for cleaning a die.

When the content of the organic filler is within the above range, more favorable fluidity of the resin composition for cleaning a die is obtained. Further, when the content of the organic filler is within the above range, strength of the resin composition for cleaning a die is maintained at suitable level after molding, and thus the working property at the time of removing from a molding die a resultant formed from the resin composition for cleaning a die after cleaning becomes more favorable, and the performance for cleaning an internal surface of a molding die becomes more favorable.

[0042] (Inorganic Filler)

Examples of the inorganic filler include silicon carbide, silicon oxide (silica), titanium carbide, titanium oxide, boron carbide, boron oxide, aluminum oxide, magnesium oxide, calcium oxide, and calcium carbonate.

Among them, from the viewpoint of having good mixing with a melamine-based resin at the time of preparing the resin composition for cleaning a die, the inorganic filler is preferably at least one selected from the group consisting of silicon carbide, silicon oxide (silica), titanium carbide, titanium oxide, boron carbide, boron oxide, aluminum oxide, magnesium oxide, and calcium oxide.

The inorganic filler is more preferably at least one selected from silicon oxide (silica) or titanium oxide, and is particularly preferably silicon oxide (silica).

Although it cannot be generally said due to a variation depending on a material and a state of a die, silicon oxide (silica) and titanium oxide have suitable hardness, can suppress an occurrence of wear and scratches on an internal surface and a gate part of a molding die, and are thermally stable near at from around 160°C to 190°C, which is a typical temperature for cleaning a molding die, and therefore desirable.

[0043] Incidentally, the hardness of the inorganic filler exemplified above (that is, new Mohs hardness) is as follows: 13 for silicon carbide, 8 for silicon oxide (silica), 9 for titanium carbide, 8 titanium oxide, 14 for boron carbide, 3 for boron oxide, 12 for aluminum oxide, 4 for magnesium oxide, and 3 for calcium oxide.

[0044] As for the inorganic filler, a commercially available product may be used.

Examples of the commercially available product include non-crystalline silica such as "S440-4", "HS-202", "HS-204", or "UF-320" (all product names) of Nippon Steel & Sumikin Materials Co., Ltd. Micron Co. and crystalline silica such as JUN-KEISEKIFUN (product name) of Seto Ceramic Raw Materials Co., Ltd.

[0045] When the resin composition for cleaning a die of the present disclosure contains an inorganic filler, the resin composition for cleaning a die may contain only 1 kind or 2 or more kinds of the inorganic filler.

[0046] In a case in which the resin composition for cleaning a die of the present disclosure contains an inorganic filler, a content of the inorganic filler in the resin composition for cleaning a die is preferably from 10 parts by mass to 30 parts by mass, and more preferably from 15 parts by mass to 25 parts by mass, with respect to 100 parts by mass of a total solid content of the resin composition for cleaning a die.

When the content of the inorganic filler is within the above range, strength of the resin composition for cleaning a die is maintained at suitable level after molding, so that the working property at the time of removing from a molding die a resultant formed from the resin composition for cleaning a die after cleaning becomes more favorable, and the performance for cleaning an internal surface of a molding die becomes more favorable.

[0047] <Lubricant>

It is preferable that the resin composition for cleaning a die of the present disclosure contains a lubricant.

In a case in which the resin composition for cleaning a die include a lubricant, dispersing property of each component at the time of preparing the resin composition for cleaning a die may be improved.

[0048] Examples of the lubricant include fatty acid amide lubricants, and specific examples thereof include saturated- and unsaturated- monoamide lubricants such as lauric acid amide, myristic acid amide, erucic acid amide, oleic acid amide, and stearic acid amide, and saturated- and unsaturated- bis amide lubricants such as methylenebis stearic acid amide, ethylenebis stearic acid amide, and ethylenebis oleic acid amide.

[0049] In a case in which the resin composition for cleaning a die include the lubricant, only one kind of lubricant or two or more of lubricants may be included in the resin composition.

[0050] In a case in which the resin composition for cleaning a die include the lubricant, a content of the lubricant in the resin composition in the resin composition is from 0.1 parts by mass to 0.6 parts by mass, and preferably from 0.12 parts by mass to 0.5 parts by mass, with respect to a total solid content of the resin composition.

[0051] [Method of Preparing Resin Composition]

The resin composition of the present disclosure is prepared by, for example, mixing the melamine-based resin, the zinc salt of a fatty acid, and the organic base other than a salt of a strong acid and a weak base (namely, a salt formed from a strong acid and a weak base is excluded from the scope of the organic base), and other additives that are described above and used if necessary.

A method of the mixing is not particularly limited, and examples thereof include a mixing method using a known mixer such as a kneader, a ribbon blender, a Nauta mixer, a Henschel Mixer, a ball mill, a roll kneader, a grinding machine, a tumbler, or the like.

[0052] [Application]

The resin composition of the present disclosure may be suitably used in removal of stain, which is derived from a sealing molding material containing a thermosetting resin composition represented by an epoxy resin, a silicone resin, a phenolic resin, and a polyimide resin, from an internal surface of a molding die.

The resin composition for cleaning a die of the present disclosure may be preferable as what is called a transfer-type resin composition for cleaning a die, which cleans an internal surface of a molding die by being subject to transfer molding.

[0053] [Mold Cleaning Method]

The resin composition of the present disclosure is usually formed into a tablet shape and used for the cleaning operation on an internal surface of a molding die. Specifically, in a cleaning operation, a lead frame is disposed on a molding die and then the tablet-shaped resin composition is inserted into a pot portion of the molding die. After mold clamping, the resin composition is extruded by a plunger. At this time, the resin composition flows from the pot portion into the inside of a die cavity through a runner portion and a gate portion of the molding die. After a predetermined molding time elapses, the die is opened and a resultant integrated with the lead frame, that is a resultant molded from the resin composition containing stain, is removed from the die. The cleaning operation is thus completed.

[0054]

EXAMPLES

Hereinafter, the present disclosure will be described in more detail by Examples.

However, the present disclosure is not limited to Examples described below as long as the gist of the present disclosure is not exceeded.

[0055] [Preparation of Pulp-Containing Melamine-Formaldehyde Resin]

[Preparation Example 1]

346 parts by mass of melamine and 522 parts by mass of formaldehyde (37% by mass aqueous solution) were subjected to a reaction under heating for 90 minutes at a condition with heating temperature of from 70°C to 100°C and pH of from 8 to 10 to obtain a melamine-formaldehyde resin. To the obtained melamine-formaldehyde resin, 95 parts by mass of hardwood pulp (product name: LDPT, Nippon Paper Industries Co., Ltd.) were added as organic filler. After kneading, drying under reduced pressure, and preparing in powder form, a pulp-containing melamine-formaldehyde resin with pulp content of 15% by mass was obtained.

[0056] [Preparation of Resin Composition for cleaning a die]

[Example 1]

30 parts by mass the pulp-containing melamine-formaldehyde resin obtained in the above and 50 parts by mass of NIKARESIN (registered trademark) S-166 (product name, melamine-formaldehyde resin, manufactured by Nippon Carbide Industries Co., Inc.) as a melamine-based resin, 20 parts by mass of silicon oxide (product name: JUN-KEISEKIFUN, crystalline silica, manufactured by Seto Ceramic Raw Materials Co., Ltd.) as an inorganic filler, 1 part by mass of zinc myristate (product name: POWDER BASE M, manufactured by NOF Corporation) as a zinc salt of a fatty acid, and 0.025 part by mass of guanidine carbonate (product name: GC, manufactured by Sanwa Chemical CO., LTD.) as an organic base were added to a ball mill followed by pulverization. Subsequently, 0.4 part by mass of ethylene bisstearic acid amide (product name: ALFLOW (registered trademark) H50T, manufactured by NOF Corporation) was added as a lubricant by using a Nauta mixer followed by stirring to obtain a resin composition for cleaning a die of Example 1.

[0057] [Examples 2 to 8]

Resin compositions for Examples 2 to 8 were respectively obtained in the same manner as in Example 1, except that formulations thereof were changed as shown in the formulations described in the following Table 1.

[0058] [Comparative examples 1 to 6]

Resin compositions for Comparative examples 1 to 6 were respectively obtained in the same manner as in Example 1, except that formulations thereof were changed as shown in the formulations described in the following Table 1.

[0059] Evaluation

Cleaning performance and molding property of the resin compositions of Examples 2 to 8 and Comparative examples 1 to 6 were evaluated by testing methods described below.

[0060] (1) Cleaning Performance

The resin compositions were respectively processed into a tablet form to be used as a test sample.

600 shots of quad flat packages (QFP) were formed by molding a commercial epoxy resin molding material (product name: CEL-9240HF10, manufactured by Hitachi Chemical Company, Ltd.), that is what is called a green compound, and a QFP molding die equipped with a gate portion (width: 800 μm , height: 300 μm) with an automatic transfer molding machine (die temperature: 175°C, transfer pressure: 9.5 MPa, transfer time: 10.5 seconds, curing time: 80 seconds), and then stain was caused to be generated on the internal surface of the molding die.

Die cleaning was performed by repeatedly molding the resin composition (test sample) of each of Examples or Comparative Examples under the same conditions as the molding conditions described above, using the molding die having stain on the internal surface thereof. At this time, the number of shots required until stain on the internal surface of the molding die was completely removed was counted. This number of shots was regarded as an index for evaluating the die cleaning performance of the resin composition. Whether or not stain can be completely removed from the molding die was determined by visual inspection.

In the evaluation of cleaning performance, the focus was particularly put on whether or not stain adhering to the gate portion or the corner portion in the cavity of the molding die can be completely removed. The smaller number of shots indicates the better die cleaning performance of the resin composition. The resin composition in which the number of shots is 1 was evaluated as satisfactory.

[0061] (2) Molding Property

The working property at the time of removing the resin composition for cleaning a die after first shot molding (that is, after cleaning) from a molding die in the above cleaning performance evaluation was used as an index for evaluating the molding property of the resin composition for cleaning a die.

The molding property of the resin composition for cleaning a die was evaluated "good" when the resin composition for cleaning a die after molding was sufficiently cured and thus a phenomenon in which a stain derived from the resin composition for cleaning a die as caused by poor curing are partially adhered on an internal surface of a molding die does not occur, and the resin composition for cleaning a die could be easily removed from the molding

die after cleaning. The molding property of the resin composition for cleaning a die was evaluated "poor" when the resin composition for cleaning a die after molding was not sufficiently cured, and a part of the composition is not molded and thus the resin composition for cleaning a die could not be easily removed from the molding die after cleaning to cause adhesion of the composition on an internal surface of the molding die or the like.

[0062] Composition and each evaluation result of the resin composition for cleaning a die of Examples 1 to 8 and Comparative examples 1 to 6 are shown in Table 1 and Table 2.

[0063] Table 1

		Example 1	Example 2	Example 3	Example 4	Example 5	Example 6	Example 7	Example 8
Composition (parts by mass)	Melamine-based resin	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
	Pulp-containing melamine-formaldehyde resin								
	Melamine-formaldehyde resin (NICARESIN S-166)	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
	Inorganic filler	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
	Zinc fatty acid	1.0	2.0	4.0	2.0	2.0	2.0	-	2.0
	Zinc stearate	-	-	-	-	-	-	2.0	-
	Lubricant	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
	Organic base	0.025	0.050	0.10	0.022	0.10	-	-	-
	Aminoguanidine bicarbonate	-	-	-	-	-	0.30	1.0	-
	1,8-Diazabicyclo[5.4.0]-7-undecene	-	-	-	-	-	-	-	0.050
	Sodium hydroxide	-	-	-	-	-	-	-	-
	Sodium carbonate	-	-	-	-	-	-	-	-
	Potassium stearate	-	-	-	-	-	-	-	-
Total		101.425	102.450	104.50	102.422	102.50	102.70	103.40	102.450
Content of zinc fatty acid with respect to 100 parts by mass of total solid content of the resin composition for die cleaning (unit: parts by mass)		1.0	2.0	3.8	2.0	2.0	1.9	1.9	2.0
Ratio of content of organic base with respect to content of zinc fatty acid (on mass basis)		1/40	1/40	1/40	1/91	1/20	1/7	1/2	1/40
[Content of organic base/Content of zinc fatty acid]									
Evaluation	Cleaning property [Number of shots required till to have complete removal of dirt]	1	1	1	1	1	1	1	1
	Molding property	Good	Good	Good	Good	Good	Good	Good	Good

[0064] Table 2

		Comparative example 1	Comparative example 2	Comparative example 3	Comparative example 4	Comparative example 5	Comparative example 6
Composition (parts by mass)	Melamine-based resin	30.0	30.0	30.0	30.0	30.0	30.0
	Pulp-containing melamine-formaldehyde resin						
	Melamine-formaldehyde resin (NICARESIN S-166)	50.0	50.0	50.0	50.0	50.0	50.0
	Inorganic filler	20.0	20.0	20.0	20.0	20.0	20.0
	Zinc fatty acid	0.5	2.0	2.0	2.0	2.0	2.0
	Zinc stearate	-	-	-	-	-	-
	Lubricant	0.40	0.40	0.40	0.40	0.40	0.40
	Ethylene bisstearic acid amide						
	Organic base	0.10	0.018	-	-	-	-
	Guanidine carbonate	-	-	2.0	-	-	-
	Aminoguanidine bicarbonate	-	-	-	0.50	-	-
	Sodium hydroxide	-	-	-	-	0.50	-
Content of zinc fatty acid with respect to 100 parts by mass of total solid content of the resin composition for die cleaning (unit: parts by mass)	Sodium carbonate	-	-	-	-	-	-
	Potassium stearate	-	-	-	-	-	0.50
	Total	101.00	102.418	104.40	102.90	102.90	102.90
	Ratio of content of organic base with respect to content of zinc fatty acid (on mass basis)	0.5	2.0	1.9	1.9	1.9	1.9
	[Content of organic base/Content of zinc fatty acid]	1/5	1/111	1/1	-	-	-
Evaluation	Cleaning property [Number of shots required till to have complete removal of dirt]	2	2	2	3	2	2
	Molding property	Poor	Good	Poor	Poor	Good	Good

[0065] In Tables 1 and 2, "-" means that the ingredient was not included in the composition. In Tables 1 and 2, details of zinc stearate and potassium stearate are as described below.

- Zinc stearate (product name: ZINC STEARATE GF200, manufactured by NOF Corporation)

- Potassium stearate (product name: NONSOUL (registered trademark) SK-1, manufactured by NOF Corporation)

[0066] From the results shown in Tables 1 and 2, it is evident that the resin compositions for cleaning a die of Examples 1 to 8 have a more excellent cleaning performance compared to the resin compositions for cleaning die of Comparative Examples 1 to 6. It is also evident that the resin compositions for cleaning a die of Examples 1 to 8 also have a good molding property. When the molding property of the resin composition for cleaning a die is good, the resin composition for cleaning a die can be easily removed from a molding die after cleaning, and thus a good working property is obtained.

[0067] Incidentally, it is also evident that the resin composition for cleaning a die of Comparative Example 1, in which a content of a zinc salt of a fatty acid is less than 1 part by mass relative to 100 parts by mass of a total solid content of the resin composition for cleaning a die, has a poor cleaning property. It is also evident that the resin composition for cleaning a die of Comparative Example 1 has a poor molding property.

[0068] It is also evident that the resin composition for cleaning a die of Comparative Example 2, in which the content ratio of the organic base relative to the content of a zinc salt of a fatty acid is less than 1/100, has a poor cleaning property.

[0069] It is also evident that the resin composition for cleaning a die of Comparative Example 3, in which the content ratio of the organic base relative to the content of a zinc salt of a fatty acid is more than 1/2, has a poor cleaning property. It is also evident that the resin composition for cleaning a die of Comparative Example 3 has a poor molding property.

[0070] It is evident that the resin composition for cleaning a die of Comparative Example 4 to Comparative Example 6, in which an inorganic base is contained instead of an organic base, has a poor cleaning property.

Among them, the resin composition for cleaning a die of Comparative Example 4, in which sodium hydroxide is contained as an inorganic base instead of an organic base, evidently has an even poorer cleaning property. Further, when cleaning of a molding die is carried out by using the resin composition for cleaning a die of Comparative Example 4, it is evidently found that, due to adhesion of stain originated from the resin composition for cleaning a die on a molding die caused by poor molding, the molding die gets stain adversely.

[0071] The disclosure of Japanese Patent Application No. 2016-055785 is incorporated herein by reference.

All publications, patent applications, and technical criteria mentioned in this specification are herein incorporated by reference to the same extent as if each individual publication, patent application, or technical standard was specifically and individually indicated to be incorporated by reference.

CLAIMS

1. A resin composition for cleaning a die, the resin composition comprising:
a melamine-based resin;
a zinc salt of a fatty acid; and
an organic base other than a salt of a strong acid and a weak base,
a content of the zinc salt of a fatty acid being 1 part by mass or more with respect to 100 parts by mass of a total solid content of the resin composition, and
a ratio of a content of the organic base with respect to a content of the zinc salt of a fatty acid in the resin composition being from 1/100 to 1/2, on a mass basis.
2. The resin composition for cleaning a die according to claim 1, wherein the organic base comprises at least one compound selected from the group consisting of a guanidine compound and an amidine compound.
3. The resin composition for cleaning a die according to claim 1 or claim 2, wherein the zinc salt of a fatty acid comprises at least one selected from the group consisting of zinc myristate and zinc stearate.
4. The resin composition for cleaning a die according to any one of claims 1 to 3, wherein the melamine-based resin comprises a melamine-formaldehyde resin.