

DESCRIPTION

RESIN COMPOSITION FOR MOLD CLEANING

Technical Field

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

BACKGROUND ART

[0002] Sizes of the semiconductor have become increasingly smaller recently according to advances in features of mobile terminals such as smart phones. Further, due to the rapid spread of work robots and electrification of automobiles in conjunction with the shortage of manpower and cost reduction, the types and quantities of semiconductors used have been rapidly increasing, and the frequency of renewal of semiconductors has also been increasing. Along with such a situation, molds which are capable of coping with multiple picking design of package, complication of semiconductor patterns, and the like are spreading.

[0003] Along with the recent demand to improve the efficiency of molding operation of semiconductor sealing resins, the efficiency of the operation of the mold cleaning is also demanded for resin compositions for cleaning molds (so-called a resin composition for mold cleaning). In order to efficiently perform the operation of the mold cleaning, it is desirable that the resin composition for mold cleaning exhibits high fluidity so that the resin composition quickly spreads to all corners inside the mold. Several reports have been made on a method for controlling the fluidity of a resin composition for mold cleaning.

[0004] For example, a resin composition for mold cleaning which exhibits fluidity that is necessary for spreading to all corners of the inside of a mold even at a low temperature (so-called "proper fluidity") is realized by using a block carboxylic acid as a curing agent of a melamine-based resin in Japanese Patent Application Laid-Open (JP-A) No. 2019-126966.

Further, a resin composition for mold cleaning in which curing and fluidity are balanced is realized by using a plurality of curing catalysts in Japanese Patent Application Laid-Open (JP-A) No. 2017-177623.

Further, a resin composition for mold cleaning which exhibits good fluidity capable of spreading to all corners of voids inside of a mold is realized by using an inorganic filler having an average particle diameter, a standard deviation of a particle diameter, an average aspect ratio of the particle diameter, and a standard deviation of an aspect ratio of the particle diameter being in specific ranges in International Patent Application No. 2013/011876.

SUMMARY OF THE INVENTION

Technical Problem

[0005] As the progresses of the mold designing for multiple package picking, downsizing, and complexity of patterns in molds, it is becoming difficult to spread a resin composition for mold cleaning to all corners inside a mold by merely controlling the fluidity of the resin composition for mold cleaning. For this reason, measures have been taken to increase the speed, pressure, and the like of the plunger that pushes the mold cleaning resin composition into a mold. However, when such measures are taken, the resin composition for mold cleaning enters a gap between mating surface, rubbing surfaces and the like of a mold at the time of cleaning the mold so that burrs tend to be generated. When burrs are generated, problems such as deterioration of workability, contamination of molded articles, fluctuation in quality of molded articles, and the like occur upon molding a semiconductor sealing resin.

Therefore, it is required that a resin composition for mold cleaning has a property that hardly generate burrs, in addition to excellent cleaning performance.

[0006] In this regard, none of Japanese Patent Application Laid-Open (JP-A) No. 2019-126966, Japanese Patent Application Laid-Open (JP-A) No. 2017-177623, and International Patent Application No. 2013/011876 pays attention to the problem of the generation of burrs in relation to the resin composition for mold cleaning.

[0007] The problem which is aimed to be solved by one embodiment of the present disclosure is to provide a resin composition for mold cleaning which hardly generates burrs and which is excellent in cleaning performance.

[0008] [Means to Solve the Problem]

Specific means to solve the problem includes the following aspects.

<1> A resin composition for mold cleaning, comprising:

a melamine-based resin;

a filler;

an acidic compound; and

at least one selected from the group consisting of an imide compound having a molecular weight of 500 or less and a urea compound having a molecular weight of 500 or less,

the acidic compound being a compound that is different from the imide compound, and

a mass ratio of a total content of the imide compound and the urea compound with

respect to a content of the acidic compound being in a range of from 0.01 to 100.0.

<2> The resin composition for mold cleaning according to <1>, wherein a total content of the acidic compound, the imide compound, and the urea compound is in a range of from 0.1 parts by mass to 12.0 parts by mass with respect to 100 parts by mass of a sum of the melamine-based resin and the filler.

<3> The resin composition for mold cleaning according to <1> or <2>, wherein: the imide compound comprises at least one selected from the group consisting of phthalimide, succinimide, pyromellitic diimide, 1,2,3,6-tetrahydrophthalimide, and 1,2-cyclohexanedicarboximide, and

the urea compound comprises at least one selected from the group consisting of urea, 1-methylurea, 1-ethylurea, 1,1-dimethylurea, and 1,3-dimethylurea.

<4> The resin composition for mold cleaning according to any one of <1> to <3>, wherein the acidic compound has a carboxy group.

<5> The resin composition for mold cleaning according to any one of <1> to <3>, wherein the acidic compound comprises at least one selected from the group consisting of benzoic acid, tartaric acid, hydrochloric acid, sulfamic acid, and trimellitic acid.

<6> The resin composition for mold cleaning according to any one of <1> to <5>, wherein the content of the acidic compound is in a range of from 0.01 parts by mass to 5.0 parts by mass with respect to 100 parts by mass of a sum of the melamine-based resin and the filler.

<7> The resin composition for mold cleaning according to any one of <1> to <6>, further comprising a metal soap.

<8> The resin composition for mold cleaning according to any one of <1> to <7>, further comprising a lubricant.

[0009] [Effect of Invention]

According to one embodiment of the present disclosure, a resin composition for mold cleaning which hardly generates burrs and which is excellent in cleaning performance can be provided.

BRIEF DESCRIPTION OF DRAWINGS

[0010] Fig. 1A is a photograph showing an example of the evaluation result "A" of the suppression of generation of burrs in Examples.

Fig. 1B is a photograph showing an example of the evaluation result "D" of the suppression of generation of burrs in Examples.

DESCRIPTION OF EMBODIMENTS

[0011] Specific embodiments according to the present disclosure are described hereinbelow in detail. The present disclosure is by no means limited to the embodiments described below, and modifications may be applied, as appropriate, within the scope of the purpose of the present disclosure when practicing the embodiments.

[0012] In the present disclosure, any numerical range expressed using the expression of “(from) ... to ...” means a range including numerical values described before and after “to” as a lower limit value and an upper limit value.

For numerical value ranges described in a stepwise manner in the present specification, the upper limit value or the lower limit value of one numerical value range may be replaced with the upper limit value or the lower limit value of another numerical value range in the stepwise description. The upper limit value or the lower limit value of any numerical value range described in the present specification may also be replaced with a value described in Examples.

In the present disclosure, a combination of two or more preferable aspects or embodiments constitutes a more preferable aspect or embodiment.

In the present disclosure, the amount of each component in a composition means, when plural substances corresponding to the same component exist in the composition, a total amount of the plural substances present in the composition unless otherwise specified.

[0013] In the present disclosure, "inner surface of a(/the) mold" means an area of the mold at which the mold is to be in contact with an object to be molded thereby.

[0014] [Resin composition for mold cleaning]

The resin composition for mold cleaning of the present disclosure (hereinafter simply also referred to as a "resin composition") includes a melamine-based resin, a filler, an acidic compound, at least one compound selected from the group consisting of an imide compound having a molecular weight of 500 or less (hereinafter also referred to as a "specific imide compound") and a urea compound having a molecular weight of 500 or less (hereinafter also referred to as a "specific urea compound"), in which the acidic compound is a compound that is different from the specific imide compound, and a mass ratio of a total content of the specific imide compound and the specific urea compound to a content of the acidic compound is in a range of from 0.01 to 100.0.

Hereinafter, the specific imide compound and the specific urea compound may be generically referred to as a "specific compound".

[0015] The melamine-based resin and a curing catalyst contained in the resin composition for mold cleaning proceed a curing reaction as follows. First, the melamine-based resin contained in the resin composition for mold cleaning is melted by heating. Then, a curing catalyst acts on the melted melamine-based resin, and the resin composition for cleaning the mold is cured accordingly. Usually, the curing rate of the resin composition for mold cleaning is greatly affected by a content of the curing catalyst. When an amount of the curing catalyst contained in the resin composition for mold cleaning is large, the resin composition for mold cleaning has a higher curing rate and a lower fluidity. As the progresses of the mold designing for multiple package picking, downsizing, and complexity of patterns in molds, it is becoming difficult to control the fluidity of the resin composition for mold cleaning by merely controlling the fluidity of the resin composition for mold cleaning. Further, it is becoming difficult to spread a resin composition for mold cleaning to all corners inside a mold by merely controlling the fluidity of the resin composition for mold cleaning. For this reason, measures have been taken recently to increase the speed, pressure, and the like of the plunger that pushes the mold cleaning resin composition into a mold. However, when such measures are taken, the resin composition for mold cleaning enters a gap between mating surface, rubbing surfaces and the like of a mold at the time of cleaning the mold so that burrs tend to be generated. When burrs are generated, problems such as deterioration of workability, contamination of a molded article, fluctuation in quality of molded articles, and the like occur upon molding a semiconductor sealing resin.

[0016] In contrast thereto, since the resin composition for mold cleaning of the present disclosure contains an acidic compound as a curing catalyst and at least one of a specific imide compound or a specific urea compound in a specific range of a mass ratio, it hardly generates burrs and is excellent in cleaning performance at the time of cleaning a mold.

The reason why the resin composition for mold cleaning of the present disclosure can exhibit such an effect is not clear, but the present inventors speculate as follows. It should be understood that the following speculation does not restrictively interpret the resin composition for mold cleaning of the present disclosure, and will be described as an example.

[0017] It is considered that the acidic compound increases a curing rate while the specific imide compound and the specific urea compound delay the curing rate in the resin composition for mold cleaning of the present disclosure. Therefore, it is considered that, when the resin composition for mold cleaning of the present disclosure is heated, a cured product having a relatively large molecular weight (in other words, a long molecular chain)

and a cured product having a relatively small molecular weight (in other words, a short molecular chain) coexist at the curing stage. It is presumed that the cured products having different molecular weights are appropriately entangled with each other to suppress an excessive decrease in viscosity, whereby the fluidity of the mold cleaning resin composition becomes appropriate, and as a result, the penetration of the mold cleaning resin composition into a gap of the mold is suppressed, and the generation of burrs is suppressed accordingly. Further, it is considered that an excellent cleaning performance by a melamine-based resin is effectively exhibited since the fluidity of the resin composition for mold cleaning becomes appropriate so that the resin composition for mold cleaning spreads all over the inside of the mold.

Although a detailed mechanism is not known, according to the resin composition for mold cleaning of the present disclosure, it is possible to achieve an effect that an amount of formaldehyde which can be generated when molding is reduced.

[0018] <Melamine-based resin>

The resin composition of the present disclosure contains a melamine-based resin.

In the resin composition of the present disclosure, the melamine-based resin contributes to cleaning performance.

The melamine-based resin has a methylol group having a high polarity. It is considered that, in the resin composition containing a melamine-based resin, the methylol group having a high polarity in the melamine-based resin acts on a stain originated from a molding material for sealing containing a thermosetting resin such as an epoxy resin (hereinafter, also referred to as a "contaminant"), whereby the resin composition containing a melamine-based resin exhibits the cleaning performance effect.

[0019] In the present disclosure, the "melamine-based resin" means at least one selected from the group consisting of a melamine resin, a melamine-phenol co-condensate, and a melamine-urea co-condensate.

[0020] 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.

It is preferable that the melamine resin has a molar ratio of a repeating unit derived from a triazine compound to a repeating unit derived from an aldehyde compound (a

repeating unit derived from a triazine compound/a repeating unit derived from an aldehyde compound) of from 1/1.2 to 1/4.

[0021] The melamine-phenol co-condensate is a co-condensate of a triazine compound, a phenol compound, and an aldehyde compound.

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

It is preferable that the melamine-phenol co-condensate has a molar ratio of a repeating unit derived from a triazine compound to a repeating unit derived from a phenol compound (a repeating unit derived from a triazine compound/a repeating unit derived from a phenol compound) of from 1/0.3 to 1/1.

In addition, it is preferable that the melamine-phenol co-condensate has a molar ratio of a repeating unit derived from a triazine compound to a repeating unit derived from an aldehyde compound (a repeating unit derived from a triazine compound/a repeating unit derived from an aldehyde compound) of from 1/1 to 1/3.

[0022] The melamine-urea co-condensate 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.

[0023] The melamine-based resin can be produced by a known method.

For example, melamine crystals and formaldehyde are mixed by stirring under the conditions of a molar ratio (melamine crystals/formaldehyde) of from 1/1.2 to 1/4, a heating temperature of from 70 °C to 100 °C., and a pH of from 7 to 7.5, cooled, and subject to a reaction at 60 °C for a time (e.g., 1 hours) until an aqueous solution containing the reaction resultant at 3% by mass becomes white turbid. Then, sodium hydroxide is added to the reaction resultant until the pH becomes 8.0-9.0, followed by cooling, so that a melamine resins can be produced.

[0024] As the melamine-based resin, a commercially available product can be used.

Examples of the commercially available melamine-based resin product include NIKARESIN™ S-166, NIKARESIN™ S-176, NIKARESIN™ S-260, and NIKARESIN™ S-305, of Nippon Carbide Industries Co., Ltd.

[0025] The resin composition of the present disclosure may contain only one kind of the melamine-based resin, and may contain two or more kinds thereof.

[0026] The content of the melamine-based resin in the resin composition of the present disclosure is not particularly limited. For example, it is preferably in a range of from 10 parts to 90 parts by mass, more preferably in a range of from 15 parts by mass to 85 parts by

mass, still more preferably in a range of from 20 parts by mass to 80 parts by mass, and particularly preferably in a range of from 25 parts by mass to 75 parts by mass, with respect to 100 parts by mass of a total solid content of the resin composition.

In the present disclosure, the "total solid content of the resin composition" means a total mass of the resin composition when the resin composition does not contain a solvent (e.g., water, as hereinafter referred to), and means a mass of a residue obtained by removing a solvent from the resin composition when the resin composition contains the solvent.

[0027] <Filler>

The resin composition of the present disclosure contains a filler.

As the resin composition of the present disclosure contains a filler, the strength of a molded resultant of the resin composition can be appropriately maintained, thereby improving workability at removal of the molded resultant of the resin composition from a mold after cleaning.

The filler may be any of an organic filler and an inorganic filler.

[0028] (Organic filler)

Examples of the organic filler include pulp, wood flour, and synthetic fibers.

Of these, pulp is particularly preferable as the organic filler.

Examples of the pulp include wood pulp (softwood pulp, hardwood pulp, and the like), and non-wood pulp (straw, bamboo, bagasse, cotton, and the like). These pulps may be any of chemical pulp and mechanical pulp.

[0029] When the resin composition of the present disclosure contains pulp as the organic filler, the pulp is preferably used in a condition of a pulp which has been treated by impregnation with a melamine-based resin.

In the pulp treated by impregnation with a melamine-based resin, at least a part of the melamine-based resin have entered into gaps among fibers of the pulp, or at least a part of the melamine-based resin covers a part or all of surfaces of fibers of the pulp.

The pulp treated by impregnation with a melamine-based resin can be obtained by impregnating a pulp with an aqueous solution containing a melamine-based resin and then drying the pulp.

[0030] A size of the pulp is not particularly limited.

For example, the size of the pulp is preferably in a range of from 5 μ m to 1000 μ m, and more preferably in a range of from 10 μ m to 200 μ m, in terms of a fiber length.

When the size of the pulp is within the range described above, the strength of the molded resultant of the resin composition can be kept more appropriately, thereby further

improving workability at removal of a molded resultant of the resin composition from a mold after cleaning. Further, when the size of the pulp is within the range described above, the fluidity of the resin composition tends to be more appropriate.

The fiber length of the pulp is a value measured by a method according to JIS P8226-2 : 2011, which corresponds to ISO16065-2: 2007.

[0031] A commercially available product can be used as the pulp.

Examples of commercially available products of pulp include "NSPP1" (trade name, softwood pulp) and "LDPT" (trade name, hardwood pulp) of Nippon Paper Industries Co., Ltd.

[0032] When an organic filler is contained as a filler, the resin composition of the present disclosure may contain only one kind of the organic filler, and may contain two or more kinds thereof.

[0033] When the resin composition of the present disclosure contains the organic filler as the filler, a content of the organic filler is not particularly limited. For example, it may be preferably in a range of from 2 parts by mass to 50 parts by mass, more preferably in a range of from 2 parts by mass to 30 parts by mass, and still more preferably in a range of from 2 parts by mass to 15 parts by mass, with respect to 100 parts by mass of the total solid content of the resin composition.

When the content of the organic filler in the resin composition of the present disclosure is within the range described above with respect to 100 parts by mass of the total solid content of the resin composition, the strength of the molded resultant of the resin composition is kept more appropriately, so that the workability at the time of removing the molded resultant of the resin composition from a mold after cleaning can be further improved. In addition, when the content of the organic filler in the resin composition of the present disclosure is within the range described above with respect to 100 parts by mass of the total solid content of the resin composition, the fluidity of the resin composition tends to be more appropriate.

[0034] (Inorganic filler)

The inorganic filler may contribute not only to the improvement of the workability by maintaining the proper strength of the molded resultant of the resin composition, but also to the improvement of the cleaning performance by the physical abrasive action on an inner surface of a mold.

Examples of the inorganic filler include silicon carbide, silicon dioxide (so-called silica, as hereinafter referred to), titanium carbide, titanium oxide, boron carbide, boron

oxide, aluminum oxide, magnesium oxide, calcium oxide, and calcium carbonate.

Among these, as the inorganic filler, at least one kind selected from the group consisting of silicon carbide, silicon dioxide, titanium carbide, titanium oxide, boron carbide, boron oxide, aluminum oxide, magnesium oxide, and calcium oxide are preferable, and at least one kind selected from the group consisting of silicon dioxide and titanium oxide are more preferable, from the viewpoint that they can be well mixed with a melamine-based resin when preparing a resin composition.

Although not generally stated because it depends on the material and condition of a mold, silicon dioxide and titanium oxide are more preferable since these have suitable hardness and accordingly these may enable to suppress wearing and occurrence of scratches on an inner surface and a gate portion of a mold.

[0035] Regarding the hardness of the inorganic fillers exemplified above (so-called new Mohs hardness), silicon carbide has a value of 13, silicon dioxide has a value of 8, titanium carbide has a value of 9, titanium oxide has a value of 8, boron carbide has a value of 14, boron oxide has a value of 3, aluminum oxide has a value of 12, magnesium oxide has a value of 4, and calcium oxide has a value of 3.

[0036] A commercially available product can be used as the inorganic filler.

Examples of the commercially available product of the inorganic filler include: "S440-4", "HS-202", "HS-204", and "UF-320" (all trade names, amorphous silica) of Micron Company of Nippon Iron Chemical & Material Co., Ltd.; and PURE SILICA STONE POWDER (trade name, crystalline silica) of Seto Ceramic Raw Materials Co., Ltd.

[0037] When the inorganic filler is contained as the filler, the resin composition of the present disclosure may contain only one kind of the inorganic filler, and may contain two or more kinds thereof.

[0038] When the resin composition of the present disclosure contains the inorganic filler as the filler, the content of the inorganic filler is not particularly limited, but is preferably in a range of from 5 parts by mass to 30 parts by mass, and more preferably in a range of from 10 parts by mass to 25 parts by mass, for example, with respect to 100 parts by mass of the total solid content of the resin composition.

When the content of the inorganic filler in the resin composition of the present disclosure is within the range described above with respect to 100 parts by mass of the total solid content of the resin composition, the strength of the molded resultant of the resin composition is kept more appropriately, so that the workability at the time of removing the molded resultant of the resin composition from a mold after cleaning can be further

improved. In addition, when the content of the inorganic filler in the resin composition of the present disclosure is within the range described above with respect to 100 parts by mass of the total solid content of the resin composition, the fluidity of the resin composition tends to be more appropriate.

[0039] <Acidic compounds>

The resin composition of the present disclosure contains an acidic compound.

The acidic compound may function as a curing catalyst for a melamine-based resin in the resin composition of the present disclosure.

The acidic compound may be any substance as long as it cures the melamine-based resin, and typical examples thereof includes a Bronsted acid.

Further, the acidic compound is a compound which is different from the specific imide compound. In other words, a compound which corresponds to the specific imide compound is not encompassed by the acidic compound.

[0040] The acidic compound may be an organic acid and may be an inorganic acid.

Examples of the acidic compound which is an organic acid include benzoic acid, tartaric acid, sulfamic acid, trimellitic acid, trimesic acid, acetic acid, behenic acid, palmitic acid, salicylic acid, o-triyl acid, phthalic acid, isophthalic acid, terephthalic acid, adipic acid, oxalic acid, 2-phenylsuccinic acid, 1,2-cyclohexanedicarboxylic acid, and sebacic acid.

Examples of the acidic compound which is an inorganic acid include hydrochloric acid, sulfuric acid, and phosphoric acid.

[0041] At least one selected from the group consisting of benzoic acid, tartaric acid, hydrochloric acid, sulfamic acid, and trimellitic acid are preferable as the acidic compound, and at least one selected from the group consisting of benzoic acid, tartaric acid, sulfamic acid, and trimellitic acid are more preferable from the viewpoint of, for example, burr generation suppression and cleaning performance.

[0042] Further, the acidic compound is preferably a compound having a carboxy group.

When the acidic compound is a compound having a carboxy group, burrs comes to be more hardly generated as compared with a case where the acidic compound is a compound having no carboxy group, and an amount of formaldehyde which may be generated at the time that the resin composition is subject to molding tends to be further reduced, although the detailed mechanism thereof is unknown.

[0043] Among the above-mentioned acidic compounds, benzoic acid, tartaric acid, trimellitic acid, trimesic acid, acetic acid, behenic acid, palmitic acid, salicylic acid, o-toluic acid, phthalic acid, isophthalic acid, terephthalic acid, adipic acid, oxalic acid, 2-phenylsuccinic

acid, 1,2-cyclohexanedicarboxic acid, sebacic acid, and the like are applicable as the compound having a carboxy group.

[0044] The resin composition of the present disclosure may contain only one kind of an acidic compound, and may contain two or more kinds thereof.

[0045] A content of the acidic compound in the resin composition of the present disclosure is not particularly limited. For example, it is preferably in a range of from 0.01 parts by mass to 5.0 parts by mass, more preferably in a range of from 0.02 parts by mass to 3.0 parts by mass, still more preferably in a range of from 0.03 parts by mass to 2.0 parts by mass, and particularly preferably in a range of from 0.03 parts by mass to 1.0 parts by mass, with respect to 100 parts by mass of a sum of the melamine-based resin and the filler (that is, the organic filler and the inorganic filler)

When the content of the acidic compound in the resin composition of the present disclosure is within the range described above with respect to 100 parts by mass of the sum of the melamine-based resin and the filler (that is, the organic filler and the inorganic filler), burrs comes to be more hardly generated. In addition, when the content of the acidic compound in the resin composition of the present disclosure is within the range described above with respect to 100 parts by mass of the sum of the melamine-based resin and the filler (that is, the organic filler and the inorganic filler), the resin composition tends to exhibit more excellent cleaning performance.

[0046] <Specific compounds>

The resin composition of the present disclosure includes at least one compound (that is, the specific compound) selected from the group consisting of an imide compound having a molecular weight of 500 or less (that is, the specific imide compound) and a urea compound having a molecular weight of 500 or less (that is, the specific urea compound).

The specific compound contributes to adjusting a curing rate in the resin composition of the present disclosure.

[0047] As the specific compound, the resin composition of the present disclosure may contain only the specific imide compound, may contain only the specific urea compound, and may contain both the specific imide compound and the specific urea compound.

[0048] A molecular weight of the specific imide compound is 500 or less, preferably in a range of from 50 to 500, more preferably in a range of from 50 to 400, and still more preferably in a range of from 50 to 300.

The molecular weight of the specific imide compound is specified to 500 or less in view of excluding so-called high molecular compounds from the scope of the specific imide

compound. For example, an imide resin is outside the scope of the specific imide compound.

[0049] The specific imide compound is not particularly limited, and examples thereof include phthalimide (molecular weight: 147), succinimide (molecular weight: 99), pyromellitic diimide (molecular weight: 216), 1,2,3,6-tetrahydrophthalimide (molecular weight: 151), 1,2-cyclohexanedicarboximide (molecular weight: 153), maleimide (molecular weight: 97), 4-aminophthalimide (molecular weight: 162), 3,3-dimethylglutarimide (molecular weight: 141), and N-(cyclohexylthio)phthalimide (molecular weight: 261).

Note that there are two isomers of 1,2,3,6-tetrahydrophthalimide, namely, a cis form isomer and a trans form isomer. In the present disclosure, 1,2,3,6-tetrahydrophthalimide may be in any of a cis form and a trans form, and may be a mixture of these isomers.

[0050] Preferable examples the specific imide compound include at least one selected from the group consisting of phthalimide, succinimide, pyromellitic diimide, 1,2,3,6-tetrahydrophthalimide, and 1,2-cyclohexanedicarboximide. More preferable examples thereof include at least one selected from the group consisting of phthalimide, succinimide, 1,2,3,6-tetrahydrophthalimide, and 1,2-cyclohexanedicarboximide. Further preferable examples thereof include at least one selected from the group consisting of succinimide and 1,2,3,6-tetrahydrophthalimide. Particularly preferable example thereof is 1,2,3,6-tetrahydrophthalimide.

Note that, as the specific imide compound, at least one selected from the group consisting of phthalimide and succinimide is preferable from the viewpoint of, for example, further improving the suppression of generation of burrs.

Further, as the specific imide compound, at least one selected from the group consisting of succinimide, 1,2,3,6-tetrahydrophthalimide, and 1,2-cyclohexanedicarboximide is preferable from the viewpoint of, for example, further improving cleaning performance.

[0051] When the resin composition of the present disclosure contains the specific imide compound as the specific compound, the resin composition may contain only one kind of the specific imide compound, and may contain two or more kinds thereof.

[0052] A molecular weight of the specific urea compound is 500 or less, preferably in a range of from 50 to 500, and more preferably in a range of from 50 to 200.

The molecular weight of the specific urea compound is specified to 500 or less in view of excluding so-called high molecular compounds from the scope of the specific urea compound. For example, a urea formaldehyde resin is outside the scope of the specific urea compound.

[0053] The specific urea compound is not particularly limited, and examples thereof include urea (molecular weight : 60), 1-methylurea (molecular weight : 74), 1-ethylurea (molecular weight : 88), 1,1-dimethylurea (molecular weight : 88), 1,3-dimethylurea (molecular weight : 88), butyl urea (molecular weight : 116), 2,5-dithiobiurea (molecular weight : 150), and (4-ethoxyphenyl)urea (molecular weight : 180)

[0054] As a specific urea compound, for example, at least one selected from the group consisting of urea, 1-methylurea, 1-ethylurea, 1,1-dimethylurea, and 1,3-dimethylurea are preferable, and at least one selected from the group consisting of urea, 1,1-dimethylurea and 1,3-dimethylurea are more preferable, and at least one selected from the group consisting of urea and 1,3-dimethylurea are more preferable, and urea is particularly preferable.

As the specific urea compound, at least one selected from the group consisting of 1,1-dimethylurea and 1,3-dimethylurea are preferable from the viewpoint of, for example, further improving cleaning performance, and 1,3-dimethylurea is more preferable from the viewpoint of further improving the suppression of generation of burrs,.

[0055] When the specific urea compound is contained as the specific compound, the resin composition of the present disclosure may contain only one kind of the specific urea compound, and may contain two or more kinds thereof.

[0056] A content of the specific compound in the resin composition of the present disclosure (that is, a total content of the specific imide compound and the specific urea compound) is not particularly limited. For example, it is preferably in a range of from 0.01 parts by mass to 7.0 parts by mass, more preferably in a range of from 0.1 parts by mass to 5.0 parts by mass, still more preferably in a range of from 0.1 parts by mass to 4.0 parts by mass, and particularly preferably in a range of from 0.1 parts by mass to 3.0 parts by mass, with respect to 100 parts by mass of a sum of the melamine-based resin and the filler (that is, the organic filler and the inorganic filler)

When the content of the specific compound (that is, the total content of the specific imide compound and the specific urea compound) in the resin composition of the present disclosure is within the range described above with respect to 100 parts by mass of the sum of the melamine-based resin and the filler (that is, the organic filler and the inorganic filler), burrs come to be more hardly generated. In addition, when the content of the specific compound (that is, the total content of the specific imide compound and the specific urea compound) in the resin composition of the present disclosure is within the range described above with respect to 100 parts by mass of the sum of the melamine-based resin and the filler (that is, the organic filler and the inorganic filler), the resin composition tends to exhibit

more excellent cleaning performance.

[0057] A mass ratio of the content of the specific compound, which is the total content of the specific imide compound and the specific urea compound, with respect to the content of the acidic compound (namely, the content of the specific compound/the content of the acidic compound) in the resin composition of the present disclosure is in the range of 0.01 to 100.0 or less, preferably in a range of from 0.02 to 90.0, more preferably in a range of from 0.5 to 80.0, still more preferably in a range of from 1.5 to 70.0, and particularly preferably in a range of from 3.0 to 60.0.

When "the content of the specific compound/the content of the acidic compound" is within the range described above in the resin composition of the present disclosure, burrs come to be hardly generated. In addition, when "the content of the specific compound/the content of the acidic compound" is within the range described above, the resin composition of the present disclosure tends to exhibit excellent cleaning performance.

[0058] In the resin composition of the present disclosure, a total content of the acidic compound, the specific imide compound, and the specific urea compound is preferably in a range of from 0.1 parts by mass to 12.0 parts by mass, more preferably in a range of from 0.2 parts by mass to 7.0 parts by mass, still more preferably in a range of from 0.3 parts by mass to 6.0 parts by mass, and particularly preferably in a range of from 0.4 parts by mass to 5.0 parts by mass, with respect to 100 parts by mass of the sum of the melamine-based resin and the filler (that is, the organic filler and the inorganic filler)

When the total content of the acidic compound, the specific imide compound, and the specific urea compound is within the range described above with respect to 100 parts by mass of the sum of the melamine-based resin and the filler (that is, the organic filler and the inorganic filler) in the resin composition of the present disclosure, burrs come to be hardly generated. In addition, when the total content of the acidic compound, the specific imide compound, and the specific urea compound is within the range described above with respect to 100 parts by mass of the sum of the melamine-based resin and the filler (that is, the organic filler and the inorganic filler), the resin composition of the present disclosure tends to exhibit excellent cleaning performance.

[0059] <Metal Soap>

The resin composition of the present disclosure preferably contains a metal soap.

When the resin composition of the present disclosure contains a metal soap, the fluidity of the resin composition at the time of cleaning a mold is improved, and the melamine-based resin comes to easily act on stains which may be present on an inner surface

of a mold, so that the resin composition can exhibit more excellent cleaning performance. Further, when the resin composition of the present disclosure contains a metal soap, an affinity between the resin composition and stains which may be present on an inner surface of a mold increases, so that the resin composition can exhibit more excellent cleaning performance.

[0060] The metal soap is not particularly limited, and examples thereof include a fatty acid metal salt composed of a fatty acid and a metal.

The fatty acid which forms the fatty acid metal salt may be any of a saturated fatty acid and an unsaturated fatty acid, while it is preferably a saturated fatty acid.

A number of carbon atoms of the fatty acid which forms the fatty acid metal salt is not particularly limited, while it is preferably, for example, in a range of from 12 to 20, and more preferably in a range of from 14 to 18.

Specific examples of the fatty acid having a carbon number of 12-20 include lauric acid having a carbon number 12 (IUPAC name: dodecanoic acid), myristic acid having a carbon number 14 (IUPAC name: tetradecanoic acid), palmitic acid having a carbon number 16 (IUPAC name: hexadecanoic acid), stearic acid having a carbon number 18 (IUPAC name: octadecanoic acid), oleic acid having a carbon number 18 (IUPAC name: cis-9-octadecanoic acid), and arachidic acid having a carbon number 20 (IUPAC name: eicosanoic acid).

The metal which forms the fatty acid metal salt is not particularly limited, while it is preferably, for example, at least one selected from the group consisting of zinc, aluminum, magnesium, and calcium, and more preferably zinc.

[0061] Specific examples of the fatty acid metal salt include zinc stearate, zinc myristate, zinc laurate, zinc palmitate, aluminum stearate, magnesium oleate, magnesium stearate, calcium stearate, sodium 12-hydroxystearate, potassium montanate, and lithium laurate.

[0062] When the resin composition of the present disclosure contains the metal soap, the resin composition may contain only one kind of the metal soap, and may contain two or more kinds thereof.

[0063] When the resin composition of the present disclosure contains the metal soap, a content of the metal soap is not particularly limited, but is preferably, for example, in a range of from 0.1 parts by mass to 5.0 parts by mass, more preferably in a range of from 0.1 parts by mass to 4.0 parts by mass, and still more preferably in a range of from 0.1 parts by mass to 3.0 parts by mass, with respect to 100 parts by mass of the sum of the melamine-based resin and the filler (that is, the organic filler and the inorganic filler)

When the content of the metal soap in the resin composition of the present disclosure is 0.1 parts by mass or more with respect to 100 parts by mass of the total of the melamine-based resin and the filler (that is, the organic filler and the inorganic filler), the fluidity of the resin composition is further improved at the time of cleaning a mold, and the melamine-based resin comes to easily act to stains which may be present on an inner surface of a mold, so that the resin composition can exhibit more excellent cleaning performance. In addition, when the content of the metal soap in the resin composition of the present disclosure is 0.1 parts by mass or more with respect to 100 parts by mass of the total of the melamine-based resin and the filler (that is, the organic filler and the inorganic filler), an affinity between the resin composition and the stain which may be present on an inner surface of a mold is further increased, so that the resin composition can exhibit more excellent cleaning performance.

[0064] If the resin composition containing the melamine-based resin contains an excessive amount of a metal soap, an excess portion of the metal soap may remain in a mold and contaminate the mold.

When the content of the metal soap in the resin composition of the present disclosure is no more than 5.0 parts by mass with respect to 100 parts by mass of the total of the melamine-based resin and the filler (that is, the organic filler and the inorganic filler), contamination of a mold caused by an excessive amount of metal soap comes to hardly occur.

[0065] <Lubricant>

The resin composition of the present disclosure preferably contains a lubricant. Note that the lubricant is a component which is outside the scope of the above-mentioned metal soap.

In the resin composition of the present disclosure, the lubricant may contribute to an improvement in dispersibility of each component when preparing the resin composition and an improvement in fluidity of the resin composition at the time of cleaning a mold.

[0066] Examples of the lubricant include a fatty acid amide lubricant.

Examples of the fatty acid amide lubricant include: saturated- or unsaturated-monoamide lubricants such as lauramide, myristamide, erucamide, oleamide, and stearamide; and saturated- or unsaturated-bisamide lubricants such as methylenebistearamide, ethylenebistearamide, and ethylenebisoleamide.

[0067] When the resin composition of the present disclosure contains the lubricant, the resin composition may contain only one kind of the lubricant, and may contain two or more

kinds thereof.

[0068] When the resin composition of the present disclosure contains the lubricant, a content of the lubricant is not particularly limited. It is preferably, for example, in a range of from 0.1 parts by mass to 0.6 parts by mass, and more preferably in a range of from 0.2 parts by mass to 0.5 parts by mass, with respect to 100 parts by mass of the sum of the melamine-based resin and the filler (that is, the organic filler and the inorganic filler).

[0069] <Additional component>

The resin composition of the present disclosure may further contain a component in addition to the components described above (so-called an additional component) if necessary as long as the effect of the present disclosure is not impaired thereby.

Examples of the additional component include various additives such as colorants (e.g., dyes and pigments) and antioxidants.

[0070] When the resin composition of the present disclosure contains the additional component, a content of the additional other component in the resin composition can be appropriately set within a range in which the effect of the present disclosure is exhibited.

[0071] [Method for Preparing Resin Composition]

A method for preparing the resin composition of the present disclosure is not particularly limited.

The resin composition of the present disclosure can be prepared, for example, by mixing the melamine-based resin, the filler, the acidic compound, a specific amount of the specific compound (that is, at least one compound selected from the group consisting of the specific imide compound and the specific urea compound), and, if necessary, an optional component such as a metal soap or a lubricant.

The "specific amount" herein means an amount at which a mass ratio of a sum of the specific imide compound and the specific urea compound to the acidic compound to be blended (a sum of amounts of the specific imide compound and the specific urea compound to blended/an amount of the acidic compound to be blended, in terms of mass) is in the range of from 0.01 to 100.0 or less.

A mixing method employed therein is not particularly limited, and examples thereof include those using a known mixer such as a kneader, a ribbon blender, a Henschel mixer, a ball mill, a roll kneader, a mill, a tumbler, or the like.

[0072] [Application]

The resin composition of the present disclosure is suitably used for removing, from an inner surface of a mold, stains originated from a molding material for sealing, typical

examples of the molding material including thermosetting resins such as epoxy resins, silicone resins, melamine resins, urea formaldehyde resins, and phenolic resins.

The resin composition of the present disclosure is particularly suitable as a so-called transfer-type resin composition for mold cleaning, which cleans an inner surface of a mold by being subject to transfer molding.

[0073] [Mold cleaning method]

The resin composition of the present disclosure is usually processed into a tablet shape and is used in an operation to clean an inner surface of a mold.

Specifically, after a lead frame is disposed on a mold, the resin composition which is in a tablet-shape is inserted into a pot portion. After the mold is clamped, the resin composition is extruded with a plunger. At this time, the resin composition in the pot portion passes through a runner portion and a gate portion, and flows into an inside of a cavity. After a predetermined molding time elapses, the mold is opened and a resultant integrated with the lead frame, that is a resultant molded from the resin composition and including dirt, is removed from the mold. The operation of cleaning the inner surface of the mold is thus completed.

EXAMPLES

[0074] Hereinafter, the present disclosure is described more specifically by way of Examples. The present disclosure is not limited to the following examples, and modifications can be made without deviating from the spirit of the present disclosure.

[0075] [Preparation of Melamine-based resin]

(Production Example A: Pulp-containing Melamine-formaldehyde resin)

480 parts by mass of melamine and 522 parts by mass of formaldehyde (37% by mass aqueous solution) were stirred under conditions of a heating temperature of from 70 °C to 100 °C and a pH of from 7 to 7.5, and then cooled and reacted at 60 °C for 1 hours. An aqueous solution of sodium hydroxide was then added to the reaction resultant until the pH became to 8.0-9.0, followed by cooling to obtain an aqueous solution containing melamine-formaldehyde resin. To the thus-obtained aqueous solution containing the melamine-formaldehyde resin, 248 parts by mass of softwood pulp (trade name: NSPP1, Nippon Paper Industries Co., Ltd.) was added as an organic filler and kneaded, and then dried under reduced pressure and powdered to obtain a pulp-containing melamine-formaldehyde resin (pulp content: 28% by mass).

[0076] [Preparation of Resin Composition]

(Example 1)

30 parts by mass of the pulp-containing melamine-formaldehyde resin of Production Example A (21.6 parts by mass as a melamine-formaldehyde resin) and 50 parts by mass of a melamine-formaldehyde resin (trade name : NIKARESIN™ S-166, Nippon Carbide Industries Co., Ltd.) as the melamine-based resin, 20 parts by mass of silicon dioxide (trade name: PURE SILICA POWDER, crystalline silica, Seto Ceramic Raw Materials Co., Ltd.) as the inorganic filler, 0.12 parts by mass of benzoic acid (Fujifilm Wako Pure Chemical Corporation.) as the acidic compound, 1.00 parts by mass of phthalimide (Tokyo Chemical Industry Co., Ltd.) as the specific imide compound, and 1.13 parts by mass of zinc stearate (trade name: ZINC STEARATE GF200, NOF Corporation) as the metallic soap, were charged into a ball mill and ground. Then, the thus-obtained ground product and 0.36 parts by mass of ethylenebistearamide (trade name : ALFLOW™ H50T, NOF Corporation) as the lubricant were added to a Nauta mixer therewith and stirred to obtain a resin composition of Example 1.

[0077] (Examples 2-11)

Each of resin compositions of Examples 2 to 11 was obtained by performing operations in the similar manner to Example 1 except that the formulation of the resin composition was changed to that shown in the following Table 1.

[0078] (Examples 12-18)

Each of resin compositions of Examples 12 to 18 was obtained by performing operations in the similar manner to Example 1 except that the formulation of the resin composition was changed to that shown in the following Table 2.

[0079] (Examples 19-29)

Each of resin compositions of Examples 19 to 29 was obtained by performing operations in the similar manner to Example 1 except that the formulation of the resin composition was changed to that shown in the following Table 3.

[0080] (Examples 30-39)

Each of resin compositions of Examples 30 to 39 was obtained by performing operations in the similar manner to Example 1 except that the formulation of the resin composition was changed to that shown in the following Table 4.

[0081] (Examples 40-44)

Each of resin compositions of Examples 40 to 44 was obtained by performing operations in the similar manner to Example 1 except that the formulation of the resin composition was changed to that shown in the following Table 5.

[0082] (Examples 45-53)

Each of resin compositions of Examples 45 to 53 was obtained by performing operations in the similar manner to Example 1 except that the formulation of the resin composition was changed to that shown in the following Table 6.

[0083] (Comparative examples 1-7)

Each of resin compositions of Comparative examples 1 to 7 was obtained by performing operations in the similar manner to Example 1 except that the formulation of the resin composition was changed to that shown in the following Table 7.

[0084] Each of resin compositions obtained as described above was processed into a tablet shape having a diameter of 14mm. The thus-obtained tablet-shape resin compositions were used as resin compositions for evaluation in evaluations explained below.

[0085] [Evaluation]

1. Suppression of Burr generation

The ability to suppress the generation of burrs was evaluated by molding each resin composition under a condition in which a molding pressure of a mold was intentionally increased.

The resin composition for evaluation was molded using a transfer-type automated molding machine (trade name: GP-PRO sf40, Dai-ichi Seiko Co., Ltd.) and a mold (package size: 4.9mm×3.9mm, Dai-ichi Seiko Co., Ltd.) of a small outline integrated circuit (SOIC) under the conditions of a mold temperature of 175° C, holding time of 60 seconds, molding time of 180 seconds, stroke time of 2 seconds, and molding pressure of 10 torr (approximately 1.33kPa).

After the molding, ten squares engraved between packages adjoining runners (so-called resin-composition passages), i.e., the area A surrounded by a dotted line in Figure 1A, were visually observed to check whether or not burrs were generated and the degree of burrs. Based on the results of the observation, the ability to suppress the generation of burrs was evaluated according to the following evaluation criteria. 14 areas A were observed in this manner, and the result of the observation of the area which generated the largest number of burrs among the 14 areas A was adopted for the evaluation.

There is no problem in practical use in respect of the evaluation results of "A", "B" and "C". Note that a resin composition which is hardest to generate burrs is graded as "A" in the evaluation.

The results are shown in Tables 1 to 7.

[0086] For the purpose of reference, a photograph showing an example of the evaluation

result "A" is shown in FIG. 1A, and a photograph showing an example of the evaluation result "D" is shown in FIG. 1B. In the figures, the same reference numerals are used to denote the same components.

As shown in FIG. 1A, when the evaluation result is "A", no burr is generated in the area A in which ten squares 30 engraved between packages 20 adjoining runners 10 are present. On the other hand, when the evaluation result is "D", as shown in FIG. 1B, it is observed that burrs 40 are generated in the area A in which ten squares 30 engraved between packages 20 adjoining runners 10 are present, and the burrs 40 cover the squares 30.

[0087] (Evaluation Criteria)

A: The number of square completely covered with burrs among 10 squares was 0 or 1.

B: The number of square completely covered with burrs among 10 squares was 2 or 3.

C: The number of square completely covered with burrs among 10 squares was 4 or 5.

D: The number of square completely covered with burrs among 10 squares was from 6 to 10.

[0088] 2 .Cleaning performance

400 shots of QFD molding was performed using a transfer-type automatic molding machine [trade name: GP-PRO sf40, Dai-ichi Seiko Co., Ltd.] and a mold of a quad flat package (QFP) (package size: 28 mm × 28 mm, Dai-ichi Seiko Co., Ltd.) under the conditions of mold temperature of 175 °C, holding time of 0.5 seconds, molding time of 90 seconds, stroke time of 10 seconds, and molding pressure of 35 torr (approximately 4.67kPa) using an epoxy resin material for sealing semiconductors (trade name: CEL-9240 HF10, Hitachi Chemical Co., Ltd.), so that stains adhere to an inner surface of the mold.

Mold cleaning was performed by molding of the resin compositions of Examples and Comparative Examples repeatedly in the same conditions as the molding conditions of the epoxy resin material for sealing semiconductor (specifically, the conditions of the mold temperature, the holding time, the molding time, the stroke time, and the molding pressure) except that a mold employed therein was that onto which the stains have adhered and the molding time was changed to 180 seconds. A number of times of molding (hereinafter also referred to as "number of shots") required to completely remove stains adhering to the inner surface of the mold was measured, and the number of shots was used as an index for evaluating the cleaning performance of the resin composition. Whether or not the stain was

completely removed was visually observed for judgement.

The smaller the number of times of the repeated molding required to completely remove the stain adhered to the inner surface of the mold (i.e., the number of shots), the better the cleaning performance. There is no problem in practical use in respect of the number of shots of 3 or less. Incidentally, when the resin composition did not reach all corners inside the mold, namely, when the resin composition exhibited a so-called unfilled condition, the resin composition was evaluated as "NG", and judged that it has no cleaning performance.

The results are shown in Tables 1 to 7.

[0089] 3. Fluidity

Fluidity is an index indicating flowability of the resin composition, and can be measured by a value of a spiral flow length (flow length). In the present evaluation, the spiral flow length (in centimeter) of the resin composition was measured by a method which accords to ASTM D-3123. Specifically, the spiral flow length was measured when the resin composition for evaluation was injected into the flow path of the mold for the spiral flow measurement specified in ASTM D-3123 using a transfer-type molding machine (model: MF-O70, Techno Marushichi Co., Ltd.) under the conditions of a mold temperature of 175 °C, a clamping pressure of 17.5 Mpa, and a transfer pressure of 1.96 Mpa. Then, based on the measured value of the spiral flow length, the fluidity of the resin composition was evaluated according to the following evaluation criteria.

The larger the value of the spiral flow length, the higher the fluidity of the resin composition. When the spiral flow length is in a range of from 35cm to 75cm, there is no problem in practical use.

The results are shown in Table 1s to 7.

[0090] 4. Concentration of Free formaldehyde

Measurement of a concentration of free formaldehyde was performed by way of the sodium sulfite method. Specifically, the measurement was performed by the following method.

3 drops of a rosolic acid solution was added to 50 mL (50 milliliter) of an aqueous sodium sulfite solution of 0.5mol/L (liter, as hereinafter referred to) to obtain a reddish brown solution. Note that the reddish brown color is a color derived from rozolic acid. 0.1mol/L aqueous hydrochloric acid solution was then added dropwise to the resulting reddish brown solution using a burette to have the reddish brown color disappear. Then, 2 g of the resin composition for evaluation was added to the solution from which the reddish

brown color has disappeared, and then the resultant was stirred to obtain a pink-white turbid solution. Then, a 0.1mol/L aqueous hydrochloric acid solution was added dropwise to the obtained pink-white turbid solution using a burette, and the concentration of free formaldehyde was determined according to the following equality based on the amount of the aqueous hydrochloric acid solution dropped until the pink color of the solution disappeared (so-called titration amount).

The results are shown in Tables 1, 3, and 7.

[0091] Free formaldehyde concentration [unit: mass%] = $(H \times F \times C \times 30.03) / S$

H [unit: ml] Titration volume of 0.1mol/L aqueous hydrochloric acid solution

F: Titer of 0.1mol/L aqueous hydrochloric acid solution

C [units: mol/L]: Concentration of aqueous hydrochloric acid

S [unit: g]: Amount of resin composition for evaluation

30.03: Chemical formula weight of formaldehyde

[0092] Table 1

			Example 1	Example 2	Example 3	Example 4	Example 5	Example 6	Example 7	Example 8	Example 9	Example 10	Example 11
Formulation [mass]	Melamine-based resin or Melamine-based resin + organic filler	Pulp-containing Melamine-formaldehyde resin	30	30	30	30	30	30	30	30	30	30	30
		Melamine-formaldehyde resin (S-166)	50	50	50	50	50	50	50	50	50	50	50
		Melamine-formaldehyde resin (S-176)	—	—	—	—	—	—	—	—	—	—	—
	Inorganic filler	Silicon dioxide	20	20	20	20	20	20	20	20	20	20	20
	Content with respect to 100 parts by mass of Sum of Content of Melamine-based resin and Filler (organic filler + inorganic filler) [parts by mass]												
	Acidic compound	Benzoic acid	0.12	0.12	0.12	0.12	0.12	0.12	—	—	—	—	—
		Tartaric acid	—	—	—	—	—	—	0.12	0.12	—	—	—
		Hydrochloric acid	—	—	—	—	—	—	—	—	0.12	—	—
		Sulfamic acid	—	—	—	—	—	—	—	—	—	0.12	—
		Trimellitic acid	—	—	—	—	—	—	—	—	—	—	0.12
	Specific imide compound	Phthalimide	1.00	—	—	—	—	—	—	—	—	—	—
		Succinimide	—	1.00	—	—	—	0.50	0.50	0.50	0.50	0.50	0.50
		cis-1,2,3,6-tetrahydrophthalimide	—	—	1.00	—	—	—	—	—	—	—	—
		1,2,3,6-tetrahydrophthalimide	—	—	—	1.00	—	—	—	—	—	—	—
		1,2-cyclohexanedicarboximide	—	—	—	—	1.00	—	—	—	—	—	—
	Specific urea compound	Urea	—	—	—	—	—	—	—	—	—	—	—
		1-methylurea	—	—	—	—	—	—	—	—	—	—	—
		1-ethylurea	—	—	—	—	—	—	—	—	—	—	—
		1,1-dimethylurea	—	—	—	—	—	—	—	—	—	—	—
		1,3-dimethylurea	—	—	—	—	—	—	—	—	—	—	—
	Comparative compound	Urea formaldehyde resin (trade name: LEAD-LIGHT)	—	—	—	—	—	—	—	—	—	—	—
		Monoethanolamine	—	—	—	—	—	—	—	—	—	—	—
	Metal soap	Zinc stearate	1.13	1.13	1.13	1.13	1.13	1.13	1.13	—	1.13	1.13	1.13
		Zinc myristate	—	—	—	—	—	—	—	1.13	—	—	—
	Lubricant	Ethylenebistearamide	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36
	Total content of Acidic compound, Specific imide compound, and Specific urea compound with respect to 100 parts by mass of Sum of Melamine-based resin and Filler (organic filler + inorganic filler) [parts by mass]		1.12	1.12	1.12	1.12	1.12	0.62	0.62	0.62	0.62	0.62	0.62
	Mass ratio of Total of Content of Specific imide compound and Specific urea compound with respect to Content of Acidic compound		8.33	8.33	8.33	8.33	8.33	4.17	4.17	4.17	4.17	4.17	4.17
Evaluation	Suppression of Burr generation		A	A	B	B	B	A	A	A	B	A	A
	Cleaning performance		3	2	2	2	2	2	2	2	3	3	2
	Fluidity		55	58	56	57	56	53	54	53	48	53	52
	Concentration of Free formaldehyde [mass %]		0.09	0.07	0.07	0.07	0.08	—	—	—	—	—	—

[0093] Table 2

			Example 12	Example 13	Example 14	Example 15	Example 16	Example 17	Example 18
Formulation [mass]	Melamine-based resin or Melamine-based resin + organic filler	Pulp-containing Melamine-formaldehyde resin	30	30	30	30	30	30	30
		Melamine-formaldehyde resin (S-166)	50	50	50	50	50	50	50
		Melamine-formaldehyde resin (S-176)	—	—	—	—	—	—	—
	Inorganic filler	Silicon dioxide	20	20	20	20	20	20	20
	Content with respect to 100 parts by mass of Sum of Content of Melamine-based resin and Filler (organic filler + inorganic filler) [parts by mass]								
	Acidic compound	Benzoic acid	0.12	0.13	0.12	0.12	0.08	0.10	0.12
		Tartaric acid	—	—	—	—	—	0.10	—
		Hydrochloric acid	—	—	—	—	—	—	—
		Sulfamic acid	—	—	—	—	—	—	—
		Trimellitic acid	—	—	—	—	—	—	—
	Specific imide compound	Phthalimide	—	—	0.10	1.00	0.02	—	—
		Succinimide	5.88	6.40	—	1.00	—	0.02	0.50
		cis-1,2,3,6-tetrahydrophthalimide	—	—	—	—	—	—	—
		1,2,3,6-tetrahydrophthalimide	—	—	—	—	—	—	—
	Specific urea compound	1,2-cyclohexanedicarboximide	—	—	—	—	—	—	—
		Urea	—	—	—	—	—	—	0.50
		1-methylurea	—	—	—	—	—	—	—
		1-ethylurea	—	—	—	—	—	—	—
		1,1-dimethylurea	—	—	—	—	—	—	—
	Comparative compound	1,3-dimethylurea	—	—	—	—	—	—	—
		Urea formaldehyde resin (trade name: LEAD-LIGHT)	—	—	—	—	—	—	—
	Metal soap	Monooethanolamine	—	—	—	—	—	—	—
		Zinc stearate	1.13	1.13	1.13	1.13	1.13	1.13	1.13
	Lubricant	Zinc myristate	—	—	—	—	—	—	—
		Ethylenebisstearamide	0.36	0.36	0.36	0.36	0.36	0.36	0.36
	Total content of Acidic compound, Specific imide compound, and Specific urea compound with respect to 100 parts by mass of Sum of Melamine-based resin and Filler (organic filler + inorganic filler) [parts by mass]		6.00	6.53	0.22	2.12	0.10	0.22	1.12
	Mass ratio of Total of Content of Specific imide compound and Specific urea compound with respect to Content of Acidic compound		49.00	49.23	0.83	16.67	0.25	0.10	8.33
Evaluation	Suppression of Burr generation		C	C	B	B	C	C	A
	Cleaning performance		3	3	3	3	3	3	2
	Fluidity		66	68	53	56	44	40	58
	Concentration of Free formaldehyde [mass%]		—	—	—	—	—	—	—

[0094] Table 3

			Example 19	Example 20	Example 21	Example 22	Example 23	Example 24	Example 25	Example 26	Example 27	Example 28	Example 29
Formulation [mass]	Melamine-based resin or Melamine-based resin + organic filler	Pulp-containing Melamine-formaldehyde resin	30	30	30	30	30	30	30	30	30	30	30
		Melamine-formaldehyde resin (S-166)	50	50	50	50	50	50	50	50	50	50	50
		Melamine-formaldehyde resin (S-176)	—	—	—	—	—	—	—	—	—	—	—
	Inorganic filler	Silicon dioxide	20	20	20	20	20	20	20	20	20	20	20
	Content with respect to 100 parts by mass of Sum of Content of Melamine-based resin and Filler (organic filler + inorganic filler) [parts by mass]												
	Acidic compound	Benzoic acid	0.12	0.12	0.12	0.12	0.12	0.12	—	—	—	—	—
		Tartaric acid	—	—	—	—	—	—	0.12	0.12	—	—	—
		Hydrochloric acid	—	—	—	—	—	—	—	—	0.12	—	—
		Sulfamic acid	—	—	—	—	—	—	—	—	—	0.12	—
		Trimellitic acid	—	—	—	—	—	—	—	—	—	—	0.12
	Specific imide compound	Phthalimide	—	—	—	—	—	—	—	—	—	—	—
		Succinimide	—	—	—	—	—	—	—	—	—	—	—
		cis-1,2,3,6-tetrahydrophthalimide	—	—	—	—	—	—	—	—	—	—	—
		1,2,3,6-tetrahydrophthalimide	—	—	—	—	—	—	—	—	—	—	—
		1,2-cyclohexanedicarboximide	—	—	—	—	—	—	—	—	—	—	—
	Specific urea compound	Urea	2.00	—	—	—	—	—	—	—	—	—	—
		1-methyleurea	—	2.00	—	—	—	—	—	—	—	—	—
		1-ethyleurea	—	—	2.00	—	—	—	—	—	—	—	—
		1,1-dimethyleurea	—	—	—	2.00	—	—	—	—	—	—	—
		1,3-dimethyleurea	—	—	—	—	2.00	0.50	0.50	0.50	0.50	0.50	0.50
	Comparative compound	Urea formaldehyde resin (trade name: LEAD-LIGHT)	—	—	—	—	—	—	—	—	—	—	—
		Monoethanolamine	—	—	—	—	—	—	—	—	—	—	—
	Metal soap	Zinc stearate	1.13	1.13	1.13	1.13	1.13	1.13	1.13	—	1.13	1.13	1.13
		Zinc myristate	—	—	—	—	—	—	—	1.13	—	—	—
	Lubricant	Ethylenebistearamide	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36
	Total content of Acidic compound, Specific imide compound, and Specific urea compound with respect to 100 parts by mass of Sum of Melamine-based resin and Filler (organic filler + inorganic filler) [parts by mass]		2.12	2.12	2.12	2.12	2.12	0.62	0.62	0.62	0.62	0.62	0.62
	Mass ratio of Total of Content of Specific imide compound and Specific urea compound with respect to Content of Acidic compound		16.67	16.67	16.67	16.67	16.67	4.17	4.17	4.17	4.17	4.17	4.17
Evaluation	Suppression of Burr generation		B	B	B	B	A	A	A	A	B	A	A
	Cleaning performance		3	3	3	2	2	3	3	3	3	3	2
	Fluidity		59	62	61	61	62	56	54	54	55	55	55
	Concentration of Free formaldehyde [mass%]		0.05	0.06	0.06	0.05	0.05	—	—	—	—	—	—

[0095] Table 4

			Example 30	Example 31	Example 32	Example 33	Example 34	Example 35	Example 36	Example 37	Example 38	Example 39
Formulation [mass]	Melamine-based resin or Melamine-based resin + organic filler	Pulp-containing Melamine-formaldehyde resin	30	30	30	30	30	30	30	30	30	30
		Melamine-formaldehyde resin (S-166)	—	—	—	—	—	50	50	50	50	50
		Melamine-formaldehyde resin (S-176)	50	50	50	50	50	—	—	—	—	—
	Inorganic filler	Silicon dioxide	20	20	20	20	20	20	20	20	20	20
	Content with respect to 100 parts by mass of Sum of Content of Melamine-based resin and Filler (organic filler + inorganic filler) [parts by mass]											
	Acidic compound	Benzoic acid	—	—	—	—	—	0.12	0.13	0.08	0.12	0.20
		Tartaric acid	0.12	0.12	—	—	—	—	—	—	—	—
		Hydrochloric acid	—	—	0.12	—	—	—	—	—	—	—
		Sulfamic acid	—	—	—	0.12	—	—	—	—	—	—
		Trimellitic acid	—	—	—	—	0.12	—	—	—	—	—
	Specific imide compound	Phthalimide	—	—	—	—	—	—	—	—	—	—
		Succinimide	—	—	—	—	—	—	—	—	—	—
		cis-1,2,3,6-tetrahydrophthalimide	—	—	—	—	—	—	—	—	—	—
		1,2,3,6-tetrahydrophthalimide	—	—	—	—	—	—	—	—	—	—
		1,2-cyclohexanedicarboximide	—	—	—	—	—	—	—	—	—	—
	Specific urea compound	Urea	—	—	—	—	—	—	—	—	1.00	—
		1-methylurea	—	—	—	—	—	—	—	—	—	—
		1-ethylurea	—	—	—	—	—	—	—	—	—	—
		1,1-dimethylurea	—	—	—	—	—	—	—	—	—	—
		1,3-dimethylurea	0.50	0.50	0.50	0.50	0.50	5.58	6.40	0.02	1.00	0.02
	Comparative compound	Urea formaldehyde resin (trade name: LEAD-LIGHT)	—	—	—	—	—	—	—	—	—	—
		Monoethanolamine	—	—	—	—	—	—	—	—	—	—
	Metal soap	Zinc stearate	1.13	—	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13
		Zinc myristate	—	1.13	—	—	—	—	—	—	—	—
	Lubricant	Ethylenebisstearamide	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36
	Total content of Acidic compound, Specific imide compound, and Specific urea compound with respect to 100 parts by mass of Sum of Melamine-based resin and Filler (organic filler + inorganic filler) [parts by mass]		0.62	0.62	0.62	0.62	0.62	5.70	6.53	0.10	2.12	0.22
	Mass ratio of Total of Content of Specific imide compound and Specific urea compound with respect to Content of Acidic compound		4.17	4.17	4.17	4.17	4.17	46.50	49.23	0.25	16.67	0.10
Evaluation	Suppression of Burr generation		A	A	B	A	A	C	C	C	B	C
	Cleaning performance		3	3	3	3	2	3	3	3	3	3
	Fluidity		53	52	56	54	56	71	75	51	64	43
	Concentration of Free formaldehyde [mass %]		—	—	—	—	—	—	—	—	—	—

[0096] Table 5

			Example 4 0	Example 4 1	Example 4 2	Example 4 3	Example 4 4
Formulation [mass]	Melamine-based resin or Melamine-based resin + organic filler	Pulp-containing Melamine-formaldehyde resin	30	30	30	30	30
		Melamine-formaldehyde resin (S-166)	50	50	50	50	50
		Melamine-formaldehyde resin (S-176)	—	—	—	—	—
	Inorganic filler	Silicon dioxide	20	20	20	20	20
	Content with respect to 100 parts by mass of Sum of Content of Melamine-based resin and Filler (organic filler + inorganic filler) [parts by mass]						
	Acidic compound	Benzoic acid	0.12	0.13	0.08	0.12	0.20
		Tartaric acid	—	—	—	—	—
		Hydrochloric acid	—	—	—	—	—
		Sulfamic acid	—	—	—	—	—
		Trimellitic acid	—	—	—	—	—
	Specific imide compound	Phthalimide	—	—	—	—	—
		Succinimide	—	—	—	—	—
		cis-1,2,3,6-tetrahydrophthalimide	—	—	—	—	—
		1,2,3,6-tetrahydrophthalimide	—	—	—	—	—
	Specific urea compound	1,2-cyclohexanedicarboximide	—	—	—	—	—
		Urea	—	—	—	1.00	—
		1-methylurea	—	—	—	—	—
		1-ethylurea	—	—	—	—	—
		1,1-dimethylurea	—	—	—	—	—
	Comparative compound	1,3-dimethylurea	5.58	6.40	0.02	1.00	0.02
		Urea-formaldehyde resin (trade name: LEAD-LIGHT)	—	—	—	—	—
	Metal soap	Monoethanolamine	—	—	—	—	—
		Zinc stearate	1.13	1.13	1.13	1.13	1.13
	Lubricant	Zinc myristate	—	—	—	—	—
		Ethylenebisstearamide	0.36	0.36	0.36	0.36	0.36
	Total content of Acidic compound, Specific imide compound, and Specific urea compound with respect to 100 parts by mass of Sum of Melamine-based resin and Filler (organic filler + inorganic filler) [parts by mass]		5.70	6.53	0.10	2.12	0.22
	Mass ratio of Total of Content of Specific imide compound and Specific urea compound with respect to Content of Acidic compound		46.50	49.23	0.25	16.67	0.10
Evaluation	Suppression of Burr generation		C	C	C	B	C
	Cleaning performance		3	3	3	3	3
	Fluidity		71	75	51	64	43
	Concentration of Free formaldehyde [mass %]		—	—	—	—	—

[0097] Table 6

			Example 45	Example 46	Example 47	Example 48	Example 49	Example 50	Example 51	Example 52	Example 53
Formulation [mass]	Melamine-based resin or Melamine-based resin + organic filler	Pulp-containing Melamine-formaldehyde resin	30	30	30	30	30	30	30	30	30
		Melamine-formaldehyde resin (S-166)	50	50	50	50	50	50	50	50	50
		Melamine-formaldehyde resin (S-176)	—	—	—	—	—	—	—	—	—
		Inorganic filler	Silicon dioxide	20	20	20	20	20	20	20	20
	Content with respect to 100 parts by mass of Sum of Content of Melamine-based resin and Filler (organic filler + inorganic filler) [parts by mass]										
	Acidic compound	Benzoic acid	0.01	0.02	0.03	1.00	3.00	5.00	0.01	0.03	5.00
		Tartaric acid	—	—	—	—	—	—	—	—	—
		Hydrochloric acid	—	—	—	—	—	—	—	—	—
		Sulfamic acid	—	—	—	—	—	—	—	—	—
		Trimellitic acid	—	—	—	—	—	—	—	—	—
	Specific imide compound	Phthalimide	—	—	—	—	—	—	—	—	—
		Succinimide	1.00	1.50	2.00	4.00	4.00	7.00	—	—	—
		cis-1,2,3,6-tetrahydrophthalimide	—	—	—	—	—	—	—	—	—
		1,2,3,6-tetrahydrophthalimide	—	—	—	—	—	—	—	—	—
		1,2-cyclohexanedicarboximide	—	—	—	—	—	—	—	—	—
	Specific urea compound	Urea	—	—	—	—	—	—	—	—	—
		1-methylurea	—	—	—	—	—	—	—	—	—
		1-ethylurea	—	—	—	—	—	—	—	—	—
		1,1-dimethylurea	—	—	—	—	—	—	—	—	—
		1,3-dimethylurea	—	—	—	—	—	—	1.00	2.00	7.00
	Comparative compound	Urea formaldehyde resin (trade name: LEAD-LIGHT)	—	—	—	—	—	—	—	—	—
		Monoethanolamine	—	—	—	—	—	—	—	—	—
	Metal soap	Zinc stearate	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13
		Zinc myristate	—	—	—	—	—	—	—	—	—
	Lubricant	Ethylenebistearamide	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36
	Total content of Acidic compound, Specific imide compound, and Specific urea compound with respect to 100 parts by mass of Sum of Melamine-based resin and Filler (organic filler + inorganic filler) [parts by mass]		1.01	1.52	2.03	5.00	7.00	12.00	1.01	2.03	12.00
	Mass ratio of Total of Content of Specific imide compound and Specific urea compound with respect to Content of Acidic compound		100.00	75.00	66.67	4.00	1.33	1.40	100.00	66.67	1.40
Evaluation	Suppression of Burr generation		C	C	B	B	C	C	C	B	C
	Cleaning performance		3	2	2	2	3	3	2	2	3
	Fluidity		74	70	66	53	45	40	67	64	42
	Concentration of Free formaldehyde [mass %]		—	—	—	—	—	—	—	—	—

[0098] Table 7

			CE 1	CE 2	CE 3	CE 4	CE 5	CE 6	CE 7
Formulation [mass]	Melamine-based resin or Melamine-based resin + organic filler	Pulp-containing Melamine-formaldehyde resin	30	30	30	30	30	30	30
		Melamine-formaldehyde resin (S-166)	50	50	50	50	50	50	50
		Melamine-formaldehyde resin (S-176)	—	—	—	—	—	—	—
	Inorganic filler	Silicon dioxide	20	20	20	20	20	20	20
	Content with respect to 100 parts by mass of Sum of Content of Melamine-based resin and Filler (organic filler + inorganic filler) [parts by mass]								
	Acidic compound	Benzoic acid	0.12	0.12	0.12	0.12	15.00	0.10	0.10
		Tartaric acid	—	—	—	—	—	—	—
		Hydrochloric acid	—	—	—	—	—	—	—
		Sulfamic acid	—	—	—	—	—	—	—
		Trimellitic acid	—	—	—	—	—	—	—
	Specific imide compound	Phthalimide	—	—	—	—	—	—	—
		Succinimide	—	—	—	—	0.10	15.00	12.00
		cis-1,2,3,6-tetrahydrophthalimide	—	—	—	—	—	—	—
		1,2,3,6-tetrahydrophthalimide	—	—	—	—	—	—	—
		1,2-cyclohexanedicarboximide	—	—	—	—	—	—	—
	Specific urea compound	Urea	—	—	—	—	—	—	—
		1-methylurea	—	—	—	—	—	—	—
		1-ethylurea	—	—	—	—	—	—	—
		1,1-dimethylurea	—	—	—	—	—	—	—
		1,3-dimethylurea	—	—	—	—	—	—	—
	Comparative compound	Urea formaldehyde resin (trade name: LEAD-LIGHT)	—	—	2.00	—	—	—	—
		Monoethanolamine	—	1.00	—	2.00	—	—	—
	Metal soap	Zinc stearate	1.13	1.13	1.13	1.13	1.13	1.13	1.13
		Zinc myristate	—	—	—	—	—	—	—
	Lubricant	Ethylenebisstearamide	0.36	0.36	0.36	0.36	0.36	0.36	0.36
	Total content of Acidic compound, Specific imide compound, and Specific urea compound with respect to 100 parts by mass of Sum of Melamine-based resin and Filler (organic filler + inorganic filler) [parts by mass]		—	—	—	—	15.10	15.10	12.10
	Mass ratio of Total of Content of Specific imide compound and Specific urea compound with respect to Content of Acidic compound		—	—	—	—	0.007	150.00	120.00
Evaluation	Suppression of Burr generation		D	D	D	D	D	D	D
	Cleaning performance		4	5	5	5	NG	5	5
	Fluidity		39	65	39	74	10	94	91
	Concentration of Free formaldehyde [mass%]		0.15	—	—	—	—	—	—

CE: Comparative example

[0099] In Tables 1 to 7, each "-" shown in columns of formulation means that the component corresponding to the column is not included in the resin composition.

In Tables 1 to 7, each numerical value in columns of formulation of the acidic compound, the specific imide compound, the specific urea compound, the comparative compound, the metal soap, and the lubricant indicates an amount (parts by mass) of the component with respect to 100 parts by mass of the sum of the melamine-based resin and the filler (organic filler + inorganic filler).

In Table 7, each "-" shown in the columns of the "Total content of Acidic compound, Specific imide compound, and Specific urea compound with respect to 100 parts by mass of Sum of Melamine-based resin and Filler (organic filler + inorganic filler)" and the columns of "Mass ratio of Total of Content of Specific imide compound and Specific urea compound with respect to Content of Acidic compound" means that the value was not calculated because the acidic compound, which is an essential component of the resin composition of the present disclosure, was absent.

In Tables 1 to 7, each "-" in columns of the evaluation means that the evaluation corresponding to that column is not performed.

[0100] Details of each component described in Tables 1 to 7 are as shown below.

<Melamine-based resin + organic filler>

Pulp-containing melamine-formaldehyde resin: Production Example A

<Melamine-based resin>

Melamine-formaldehyde resin (S-166): NIKARESIN™ S-166 (trade name, Nippon Carbide Industries Co., Ltd.)

Melamine-formaldehyde resin (S-176): NIKARESIN™ S-176 (trade name, Nippon Carbide Industries Co., Ltd.)

<Inorganic filler>

Silicon dioxide (trade name: PURE SILICA POWDER, crystalline silica, Seto Ceramic Raw Materials Co., Ltd.)

[0101] <Acidic compound>

Benzoic acid (Fujifilm Wako Pure Chemical Corporation: monocarboxylic acid)

Tartaric acid (Fujifilm Wako Pure Chemical Corporation: dicarboxylic acid)

Hydrochloric acid (Fujifilm Wako Pure Chemical Corporation)

Sulfamic acid (Fujifilm Wako Pure Chemical Corporation)

Trimellitic acid (Fujifilm Wako Pure Chemical Corporation: tricarboxylic acid)

[0102] <Specific imide compound>

Phthalimide (molecular weight: 147, Tokyo Chemical Industries Co., Ltd.)
 Succinimide (molecular weight: 99, Tokyo Chemical Industries Co., Ltd.)
 cis-1,2,3,6-tetrahydrophthalimide (molecular weight: 151, cis-form, Tokyo Chemical Industries Co., Ltd.)
 1,2,3,6-tetrahydrophthalimide (molecular weight: 151, a mixture of cis and trans forms, Fujifilm Wako Pure Chemical Corporation)
 1,2-cyclohexanedicarboximide (molecular weight: 153, Tokyo Chemical Co., Ltd.)
 <Specific urea compound>
 Urea (molecular weight: 60, Tokyo Chemical Industries Co., Ltd.)
 1-methylurea (molecular weight: 74, Tokyo Chemical Industries Co., Ltd.)
 1-ethylurea (molecular weight: 88, Tokyo Chemical Industries Co., Ltd.)
 1,1-dimethylurea (molecular weight: 88, Tokyo Chemical Industries Co., Ltd.)
 1,3-dimethylurea (molecular weight: 88, Tokyo Chemical Industries Co., Ltd.)
 <Comparative compound>
 Urea formaldehyde resin (trade name: LEAD-LIGHT, weight average molecular weight: 800, Daiwa Co., Ltd.)
 Monoethanolamine (Fujifilm Wako Pure Chemical Corporation)

[0103] <Metal Soap>
 Zinc stearate (trade name: ZINC STEARATE GF200, NOF Corporation)
 Zinc myristate (trade name: POWDER BASE M, NOF Corporation)

<Lubricant>

Ethylenebistearamide (trade name: ALFLOW™ H50T, NOF Corporation)

[0104] As shown in Tables 1 to 6, the resin compositions of Examples 1 to 53 hardly generate burrs and were excellent in cleaning performance. Further, the resin compositions of Examples 1 to 53 exhibited proper fluidity. Further, from the comparison with the resin composition of Comparative example 1, it was clarified that the amount of formaldehyde generated is reduced in the resin compositions of Examples 1 to 5 and Examples 19 to 23.

[0105] On the other hand, as shown in Table 7, the resin compositions of Comparative examples 1 to 4, which lack the specific imide compound and the specific urea compound, easily generated burrs and were inferior in cleaning performance as compared with the resin compositions of Examples. Further, the resin composition of Comparative example 5, in which the ratio of the total content of the specific imide compound and the specific urea compound to the content of the acidic compound was less than 0.01, and the resin compositions of Comparative examples 6 and 7, in which the ratio of the total content of the

specific imide compound and the specific urea compound to the content of the acidic compound was more than 100.0, were more likely to generate burrs and inferior in cleaning performance as compared with the resin compositions of Examples.

According to the resin composition of Comparative example 3, which contains a urea formaldehyde resin instead of the specific urea compound, burrs were remarkably generated, and the cleaning performance was remarkably inferior as compared with the resin compositions of Examples, which contain the specific urea compound. The reason thereof is presumed that, when the resin composition contains a urea formaldehyde resin, a condensation reaction between the urea formaldehyde resin and the melamine-based resin occurs preferentially, and the urea formaldehyde resin is incorporated into a crosslinked structure, so that the resin composition cannot become one that has an appropriate viscosity in contrast to the case in which the resin composition contains the specific urea compound. [0106] The disclosure of Japanese Patent Application No. 2020-006344, filed January 17, 2020, is incorporated herein by reference in its entirety.

All documents, patent applications, and technical standards described herein are incorporated by reference herein to the same extent as if the individual documents, patent applications, and technical standards were specifically and individually noted to be incorporated by reference.

CLAIMS

1. A resin composition for mold cleaning, comprising:
a melamine-based resin;
a filler;
an acidic compound; and
at least one selected from the group consisting of an imide compound having a molecular weight of 500 or less and a urea compound having a molecular weight of 500 or less,
the acidic compound being a compound that is different from the imide compound,
and
a mass ratio of a total content of the imide compound and the urea compound with respect to a content of the acidic compound being in a range of from 0.01 to 100.0.
2. The resin composition for mold cleaning according to claim 1, wherein a total content of the acidic compound, the imide compound, and the urea compound is in a range of from 0.1 parts by mass to 12.0 parts by mass with respect to 100 parts by mass of a sum of the melamine-based resin and the filler.
3. The resin composition for mold cleaning according to claim 1 or 2,
wherein:
the imide compound comprises at least one selected from the group consisting of phthalimide, succinimide, pyromellitic diimide, 1,2,3,6-tetrahydrophthalimide, and 1,2-cyclohexanedicarboximide, and
the urea compound comprises at least one selected from the group consisting of urea, 1-methylurea, 1-ethylurea, 1,1-dimethylurea, and 1,3-dimethylurea.
4. The resin composition for mold cleaning according to any one of claims 1 to 3, wherein the acidic compound has a carboxy group.
5. The resin composition for mold cleaning according to any one of claims 1 to 3, wherein the acidic compound comprises at least one selected from the group consisting of benzoic acid, tartaric acid, hydrochloric acid, sulfamic acid, and trimellitic acid.

6. The resin composition for mold cleaning according to any one of claims 1 to 5, wherein the content of the acidic compound is in a range of from 0.01 parts by mass to 5.0 parts by mass with respect to 100 parts by mass of a sum of the melamine-based resin and the filler.

7. The resin composition for mold cleaning according to any one of claims 1 to 6, further comprising a metal soap.

8. The resin composition for mold cleaning according to any one of claims 1 to 7, further comprising a lubricant.