

SHEET FOR REGENERATING MOLD

FIELD OF THE INVENTION

[0001]

The present invention relates to a sheet for regenerating a mold for use in cleaning the surface of the mold.

BACKGROUND OF THE INVENTION

[0002]

In a process for encapsulating a semiconductor device with a resin through a transfer molding, a resin molding using a mold is generally continuously conducted. As the number of repetition (shot number) of such resin molding increases, contamination such as components effused from the resin, burr and dust accumulates on a surface of the mold, particularly, on a cavity surface. Such contamination degrades releasability for taking out a molded product from the mold, and forms a rough surface on the molded product. Thus, the surface of the mold (cavity surface) is cleaned at an interval of a predetermined number of molding repetition (shot number).

[0003]

To perform cleaning in the above-mentioned manner, there is proposed a method using a mold cleaning material formed into a sheet (see, for example, Patent Document 1). This method includes coupling an upper mold with a lower mold with the mold cleaning material interposed therebetween so that the mold cleaning material is filled into a cavity; carrying out a heat molding in such a condition to allow the contamination to be attached to the mold cleaning material; and releasing the mold cleaning material to remove the contamination from the surface of the mold (cavity surface) together with the mold cleaning material.

[0004]

In addition, the applicant of the present invention suggests a sheet for regenerating a mold having an improved cleaning property (see, for example, Patent Documents 2 and 3). This sheet for regenerating a mold is formed with a paper sheet or a cloth sheet in which a mold cleaning material is provided on at least one surface thereof so as to project in a predetermined pattern having an air vent gap. By using the sheet for regenerating a mold, air in the cavity can be vented easily from the air vent gap. Thus, no air is retained in the cavity and the mold cleaning material can be filled throughout the entire portions of the cavity. As a result, cleaning can be conducted throughout the entire portions of the cavity, thereby improving cleaning property.

[0005]

Patent Document 1: JP-A-2004-130819

Patent Document 2: JP-A-2007-196586

Patent Document 3: JP-A-2008-132759

SUMMARY OF THE INVENTION

[0006]

However, even when the sheet for regenerating a mold having an improved cleaning property is used, there are some cases where contamination is not removed sufficiently. Therefore, the inventors of the present invention have studied on reasons for such a problem, and realized that a composition for a mold cleaning material is mixed non-homogeneously, leading to degradation in filling of the molding cleaning material in a cavity.

[0007]

The present invention has been made in view of the above, and an object of the present invention is to provide a sheet for regenerating a mold that has high cleaning

property and allows identification of a mixing state of a composition for a mold cleaning material.

[0008]

In order to attain the object above, the present invention relates to the following items (1) to (11).

(1) A sheet for regenerating a mold, including:

a paper sheet or a cloth sheet; and

a mold cleaning material including an unvulcanized rubber-based composition or a thermosetting resin-based composition and being formed on at least one surface of the paper sheet or the cloth sheet so as to project in a predetermined pattern having an air vent gap,

in which a thin film including the composition is formed on a surface portion of the paper sheet or the cloth sheet positioned at a portion of the air vent gap, so that a mixing state of the composition forming the pattern is identifiable from a formation state of the thin film.

(2) The sheet for regenerating a mold according to (1), in which the thin film has a thickness of 500 μm or less.

(3) The sheet for regenerating a mold according to (1) or (2), in which the pattern has a non-flat top part.

(4) The sheet for regenerating a mold according to (3), in which the non-flat top part is formed of a convex part having a curvature radius within a range of 0.2 to 3.0 mm.

(5) The sheet for regenerating a mold according to any one of (1) to (4), in which the pattern is formed of a plurality of belts or a plurality of dots.

(6) The sheet for regenerating a mold according to (5), in which the belts or dots have a width and a thickness each within a range of 1 to 5 mm, and a distance between the adjacent belts or dots is set within a range of 1 to 5 mm.

(7) The sheet for regenerating a mold according to (5), in which a distance between the adjacent belts or dots is set to be 0.5 to 2.0 times a width of the belts or dots.

(8) The sheet for regenerating a mold according to (5), in which a width of the belts or dots is set to be 0.8 to 1.2 times a thickness of the belts or dots.

(9) The sheet for regenerating a mold according to any one of (1) to (8), in which the cloth sheet is a nonwoven fabric.

(10) The sheet for regenerating a mold according to (9), in which the nonwoven fabric is a spunbond nonwoven fabric.

(11) The sheet for regenerating a mold according to any one of (1) to (10), in which the cloth sheet is subjected to an embossing treatment.

[0009]

The inventors of the present invention have made the mixing state of the mold cleaning material identifiable by utilizing the high cleaning property of the sheet for regenerating a mold where a predetermined pattern having an air vent gap is projected as suggested by the applicant of the present invention, and repeated the studies. As a result, the inventors have found out that when forming a thin film including the mold cleaning material on a portion of the surface of the paper sheet or the cloth sheet positioned at the air vent gap portion, it is possible to identify the mixing state of the mold cleaning material from a formation state of the thin film. The present invention is based on this finding.

[0010]

More particularly, while the mold cleaning material includes an unvulcanized rubber-based composition or a thermosetting resin-based composition, the composition also includes an inorganic filler, such as silica powder or titanium dioxide, which is dispersed therein in an undissolved state. As mentioned above, when the inorganic filler is dispersed non-homogeneously, the mold cleaning material is filled insufficiently in a cavity, resulting in degradation of cleaning property. The reason why the inorganic filler is dispersed non-homogeneously is that the mold cleaning material, which is thick at the projecting pattern, makes the inorganic filler impossible to be identified. However, when forming a thin film with the composition, homogeneous dispersion of the inorganic filler provides the thin film with a uniform color tone and a smooth surface. When the inorganic filler is not dispersed homogeneously, the thin film shows a non-uniform color tone. In addition, when the inorganic filler is not dispersed but form agglomerates, the agglomerates appear on the thin film surface as convex parts. Such different states of the thin film formation can be identified by checking with the naked eye.

[0011]

When identifying the thin film by color tones as described above, the inorganic filler may have an outstanding color as compared with the color of a main ingredient (base material) of the composition of the thin film (mold cleaning material). For example, when the main ingredient of the composition is colorless and transparent, a colored (e.g. white colored) inorganic filler may be used. When the main ingredient of the composition is light colored (e.g. white colored), a dark colored (e.g. black colored) inorganic filler may be used. When the main ingredient of the composition is dark colored (e.g. brown or gray colored), a light colored (e.g. white colored) inorganic filler may be used. In other words, the color of the main ingredient of the composition and

that of the inorganic filler may be opposite to each other or show a clear contrast between light and shade in view of easy identification.

[0012]

The sheet for regenerating a mold according to the present invention is formed with a paper sheet or a cloth sheet in which a mold cleaning material including an unvulcanized rubber-based composition or a thermosetting resin-based composition is formed on at least one surface thereof to be projected in a predetermined pattern having an air vent gap. Therefore, when cleaning a mold using the sheet for regenerating a mold according to the present invention, the mold cleaning material can be filled in a cavity while air present in the cavity is vented through the air vent gap. As a result, no air is retained in the cavity and filling property of the mold cleaning material in the cavity is improved, so that cleaning can be conducted throughout the entire area of the cavity. Further, the sheet for regenerating a mold according to the present invention is provided with a thin film including the composition on a surface portion of the paper sheet or the cloth sheet positioned at the air vent gap portion. Since the color tone or surface condition of the thin film represents the mixing state of the composition, the state of thin film formation allows identification of the mixing state of the composition forming the pattern. As a result, when a composition is in a non-homogeneous mixing state, the composition is regarded as unsuitable for mold cleaning and may not be used in practice. In other words, the thin film can be used in quality control of the sheet for regenerating a mold according to the present invention.

[0013]

Particularly, when the thin film has a thickness of 500 μm or less, the mixing state of the composition can be displayed easily on the thin film. Thus, it is possible to identify the mixing state of the composition more readily.

[0014]

In addition, when the pattern has a top portion formed to be non-flat, air present in the cavity can be vented easily even if an opening of the cavity is small. This is because the top portion of the mold cleaning material blocks the opening partially. As a result, filling property of the molding cleaning material is further improved along with the improvement of cleaning property in the cavity.

[0015]

In particular, when the non-flat top part of the pattern has convex parts having a curvature radius within a range of 0.2 to 3.0 mm, filling property of the mold cleaning material and cleaning property in the cavity are further improved.

[0016]

Additionally, when the pattern is formed as a plurality of belts or a plurality of dots, it is easy to set the shapes and dimensions of the pattern and the air vent gap. It is also easy to set the mold cleaning material into an appropriate pattern for filling into the cavity.

[0017]

Particularly, when the belts or dots are set to have a width and a thickness each within a range of 1 to 5 mm, and a distance between the adjacent belts or dots is set to be within a range of 1 to 5 mm, it is possible to obtain appropriate dimensions for cleaning of a mold for transfer molding which is used in encapsulating a semiconductor device with a resin. Therefore, a mold for transfer molding can be cleaned adequately.

[0018]

Further, when a distance between the adjacent belts or dots is set to be 0.5 to 2.0 times the width of the belts or dots, a suitable balance is made between the volume of the air vent gap and the amount of the mold cleaning material. In this manner, it is possible to perform ventilation of air in the cavity and fill the mold cleaning material more reasonably.

[0019]

Meanwhile, the pattern has a width of the belts or dots set to be 0.8 to 1.2 times the thickness thereof to have an excellent shape stability, resulting in a significant improvement of filling property of the mold cleaning material.

[0020]

When the cloth sheet is formed of a nonwoven fabric, the cloth sheet has a rough surface, and thus an anchor effect of the mold cleaning material improves, thereby increasing adhesion between the cloth sheet and the mold cleaning material.

[0021]

More particularly, when the nonwoven fabric is a spunbond nonwoven fabric, there is relatively no directional property in tensile strength, and stress applied during heat molding is absorbed and relaxed easily. Thus, the sheet hardly tears during heat molding. Moreover, since the sheet does not tear even during peeling-off (demolding) from a mold, it is easy to perform a peeling (demolding) operation.

[0022]

Further, when the cloth sheet is subjected to an embossing treatment, since the sheet has a rough surface, an anchor effect of the mold cleaning material is improved and adhesion between the cloth sheet and the mold cleaning material is increased.

BRIEF DESCRIPTION OF THE DRAWING

[0023]

FIG. 1 is a perspective view illustrating a first embodiment of a sheet for regenerating a mold of the present invention.

FIG. 2 is a perspective view illustrating a second embodiment of a sheet for regenerating a mold of the present invention.

FIG. 3 is a perspective view illustrating a third embodiment of a sheet for regenerating a mold of the present invention.

FIGs. 4 (a) to (g) are sectional views each illustrating a modified example of projected lines of the sheet for regenerating a mold of the present invention.

FIG. 5 is a perspective view illustrating a fourth embodiment of a sheet for regenerating a mold of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0024]

Next, embodiments of the present invention will be described more specifically based on drawings.

[0025]

FIG. 1 shows a first embodiment of a sheet for regenerating a mold of the present invention. The sheet for regenerating a mold according to this embodiment includes a substrate sheet 1 formed of a paper sheet or a cloth sheet, and a mold cleaning material including an unvulcanized rubber-based composition or a thermosetting resin-based composition is formed on both sides of the substrate sheet 1 in a belt-like pattern. That is, the projected lines (belts) 2A, which are constitutional components of the belt-like pattern, are arranged in parallel to each other with a gap therebetween, and each gap serves as an air vent gap while a mold is subjected to a cleaning process. In addition, a thin film 3 including the composition is formed integrally with the projected lines 2A at a surface portion of the substrate sheet 1 positioned at the air vent gap portion. Through a color tone or surface condition of the thin film 3, it is possible to identify a mixing state of the composition. As described above, one of the main aspects of the present invention is directed to the formation of

the thin film 3 that allows identification of a mixing state of the composition of the mold cleaning material.

[0026]

Particularly, the composition (unvulcanized rubber-based composition or thermosetting resin-based composition) of the mold cleaning material and the thin film 3 includes an unvulcanized rubber or a thermosetting resin (main ingredient) mixed with an inorganic filler, such as silica powder or titanium dioxide. Although the inorganic filler is dispersed in a non-dissolved state, the thin film 3 shows a uniform color tone and a smooth surface when the inorganic filler is dispersed homogeneously. However, when the inorganic filler is dispersed non-homogeneously, the thin film 3 shows a non-uniform color tone. Moreover, when the inorganic filler is not dispersed but forms agglomerates, the agglomerate portions appear on the surface of the thin film 3 as convex parts. For example, in the case of a thermosetting resin-based composition, the thermosetting resin (main ingredient) is generally colorless and transparent or translucent. When the thermosetting resin is mixed with the inorganic filler, the resultant mixture becomes white colored and opaque. However, when the inorganic filler is in a non-uniformly dispersed (mixed) state, a transparent or translucent portion of the main ingredient can be seen on the thin film 3. Such a state of formation of the thin film 3 can be identified by the naked eye.

[0027]

Then, when the composition is identified as being mixed homogeneously from the state of formation of the thin film 3, the mold cleaning material of the projected lines 2A can be filled throughout the cavity. Thus, it is possible to perform cleaning throughout the entire area of the cavity. On the other hand, when the composition is identified as being mixed non-homogeneously, it is not suitable for mold cleaning, and thus is not used for mold cleaning.

[0028]

More particularly, the thin film 3 may have a thickness of 500 μm or less in view of easy identification of the mixing state of the composition appearing on the thin film 3, and in particular have a thickness within a range of 20 to 150 μm . If the thin film thickness is less than 20 μm , the thin film is too thin to allow identification of the mixing state of the composition.

[0029]

As mentioned above, the composition includes an unvulcanized rubber or a thermosetting resin mixed with an inorganic filler, such as silica powder or titanium dioxide, or the like. Particularly, about 40 to 50 parts by weight of silica powder or about 5 parts by weight of titanium dioxide is preferably combined with 100 parts by weight of the unvulcanized rubber or thermosetting resin. If necessary, other ingredients may further be added.

[0030]

Particular examples of the unvulcanized rubber include natural rubber (NR), chloroprene rubber (CR), butadiene rubber (BR), nitrile rubber (NBR), ethylene propylene diene rubber (EPDM), ethylene propylene rubber (EPM), styrene butadiene rubber (SBR), polyisoprene rubber (IR), isobutylene isoprene rubber (IIR), silicone rubber (Q), and fluorine rubber (FKM).

[0031]

Particular examples of the thermosetting resin include melamine resins.

[0032]

A method for producing the sheet for regenerating a mold includes, for example, kneading the composition with a continuous kneader or a batch kneader, and then arranging the composition on both sides of the substrate sheet 1. Then, the resultant structure is sandwiched and pressed between two molds each having a concave

part corresponding to a belt-like pattern of the mold cleaning material and the thin film 3. As a result, the belt-like pattern and the thin film 3 are formed integrally on both surfaces of the substrate sheet 1. Then, the resultant structure is rolled or cut into arbitrary dimensions. In this way, the sheet for regenerating a mold can be produced.

[0033]

In the above-described embodiment, the thin film 3 is formed on the entire surface portions of the substrate sheet 1 positioned between the projected lines 2A of the belt-like pattern. However, since the thin film 3 is used for identifying the mixing state of the composition of the mold cleaning material as mentioned above, it may be formed only at a portion of the surface of the substrate sheet 1 between the projected lines 2A.

[0034]

Additionally, while the above-described embodiment includes forming the belt-like pattern simultaneously with the thin film 3 via a shape molding, it is also possible to carry out shape molding of the belt-like pattern followed by the formation of the thin film 3 via coating.

[0035]

In the above-described embodiment, both longitudinal directions of the projected lines 2A of the belt-like pattern are the same with each other on the surface of the substrate sheet 1 and the back surface thereof. However, as shown in FIG. 2, both longitudinal directions may be different from each other (e.g. a 90° difference in Fig. 2). As illustrated in FIG. 3, the belt-like pattern and the thin film 3 may be formed on only one surface of the substrate sheet 1.

[0036]

Additionally, in the above-described embodiment, the projected lines 2A of the belt-like pattern have a rectangular shape at the cross section perpendicular to the

longitudinal direction of the pattern. However, any other cross-sectional shapes may be used. For example, a trapezoidal shape (see, for example, FIG. 4(a)), a triangular shape (see, for example, FIG. 4(b)), or a semi-circular shape (see, for example, FIG. 4(c)) may be used. Further, the cross-sectional shape may be a dome-like shape at the top portion thereof and a rectangular shape at the lower portion thereof (see, for example, FIG. 4(d)). In a variant, the cross-sectional shape may be a dome-like shape at the top portion thereof and a trapezoidal shape at the lower portion thereof (see, for example, FIG. 4(e)). In another variant, the cross-sectional shape may be a pentagonal shape with a curved top portion (see, for example, FIG. 4(f)). In still another variant, as illustrated in FIG. 4(g), the top portion of the cross-sectional shape may be formed into a dome with a smaller width as compared to the embodiment of FIG. 4(d).

[0037]

In particular, according to the embodiments as illustrated in FIGs. 4(b) to 4(g), each top portion of the projected lines 2A of the belt-like pattern is formed to be non-flat. Therefore, air present in the cavity can be vented easily even if an opening of the cavity is small, since the top portion of the mold cleaning material blocks the opening partially. As a result, filling property of the molding cleaning material is improved and cleaning property in the cavity is also improved. More particularly, in the embodiments as illustrated in FIGs. 4(d) to 4(g), a curvature radius of the top portion may be within a range of 0.2 mm to 3.0 mm from a viewpoint of further improving filling property of the mold cleaning material 2 and cleaning property in the cavity.

[0038]

According to the above-described embodiments, the mold cleaning material is formed into the belt-like pattern and thin film 3. However, as illustrated in FIG. 5, the mold cleaning material may be formed into a dot-like pattern and thin film 3. Particular examples of the shape of each dot 2B of the dot-like pattern include, in

addition to a circular cylindrical shape as illustrated in FIG. 5, a cone, truncated cone, cylinder, column, pyramid, truncated pyramid and rectangular cylinder. Although the embodiment of FIG. 5 has a dot-like pattern and thin film 3 on only one surface of the substrate sheet 1, the dot-like pattern and thin film 3 may be formed on both surfaces of the substrate sheet 1.

[0039]

According to the embodiments of FIGs. 1 and 2, the cleaning material is formed on both surfaces of the substrate sheet 1 to have the same pattern. However, the patterns on both surfaces of the substrate sheet 1 may be different from each other. For example, the surface of the substrate sheet 1 may have a belt-like pattern while the other surface may have a dot-like pattern.

[0040]

The dimension of the projected lines 2A of the belt-like pattern and that of the dots 2B of the dot-like pattern are set appropriately in accordance with the size, arrangement, or the like, of the cavity of the mold. In particular, in the case of cleaning a mold for transfer molding for use in encapsulating a semiconductor device with a resin, the width and thickness of each of the projected lines 2A and the dots 2B may be set within a range of 1 to 5 mm, and the distance between the adjacent (opposing) projected lines 2A and dots 2B may be set within a range of 1 to 5 mm.

[0041]

In order to optimize ventilation of air in the cavity and filling of the mold cleaning material by optimizing a balance between the volume of the air vent gap and the amount of the mold cleaning material, a distance between the adjacent (opposing) projected lines 2A and dots 2B may be set to be 0.5 to 2.0 times the width of each of the projected lines 2A and dots 2B. When the distance between the adjacent projected lines 2A and dots 2B is less than 0.5 times the width of the projected line 2A, the

opening of the cavity may be blocked by the projected lines 2A or dots 2B while a mold is cleaned, resulting in degradation of ventilation of air in the cavity and insufficient filling of the mold cleaning material. In contrast, when the distance between the adjacent projected lines 2A is increased to more than 2.0 times the width of the projected line 2A, the mold cleaning material may be distributed at low density in the sheet for regenerating a mold, resulting in insufficient filling of the mold cleaning material. In particular, the gap between the adjacent (opposing) projected lines 2A and dots 2B may be set to have a sectional area corresponding to 0.5 to 5 times the sectional area of each of the projected lines 2A and dots 2B.

[0042]

From a viewpoint of improving filling property of the mold cleaning material by stabilizing the shapes of the projected lines 2A and dots 2B, the width of each of the projected lines 2A and dots 2B may be set to be within a range of 0.8 to 1.2 times the thickness thereof. When the width of each of the projected lines 2A and dots 2B is less than 0.8 times the thickness thereof, the projected lines 2A and dots 2B tend to be deformed easily. Thus, it is difficult to maintain the air vent gap while a mold is cleaned, resulting in degradation of ventilation of air in the cavity and insufficient filling of the mold cleaning material. In contrast, when the width of each of the projected lines 2A and dots 2B is increased to more than 1.2 times the thickness thereof, the opening of the cavity may be blocked by the mold cleaning material before the mold cleaning material is filled completely into the cavity, resulting in degradation of ventilation of air in the cavity and insufficient filling of the mold cleaning material.

[0043]

Examples of the cloth sheet of the substrate sheet 1 include a woven fabric, a nonwoven fabric and a knitted fabric. Of these, a woven fabric and a nonwoven fabric containing long fibers have an appropriate rough surface, thus improving an anchor

effect of the projected lines 2A, dots 2B and the thin film 3, and enhancing adhesion with the projected lines 2A (having grip property). From this viewpoint, such woven fabric and nonwoven fabric containing long fibers may be used, and the nonwoven fabric may be used in particular from a viewpoint of uniform grip property. In addition, as the nonwoven fabric, a spunbond nonwoven fabric may be used from a viewpoint of mechanical strength, uniformity and workability. Further, a cloth sheet subjected to an embossing treatment may be used, since the sheet has a rough surface to improve an anchor effect of the projected lines 2A. The substrate sheet 1 generally has a thickness within a range of 0.1 to 0.8 mm.

EXAMPLES

[0044]

Next, examples and comparative examples will be described. However, the present invention is not limited to these examples.

[0045]

(Cloth sheet)

A spunbond nonwoven fabric formed of polyester long fibers (E01070, available from Asahi Kasei Corporation) was prepared as a substrate sheet. The nonwoven fabric had a tear strength of 8.5 N, a thickness of 0.35 mm, and a basis weight of 70 g/m².

[0046]

(Mold Cleaning Material)

First, 100 parts by weight of ethylene propylene rubber, 50 parts by weight of silica powder, 5 parts by weight of titanium dioxide, 2 parts by weight of an organic peroxide [n-butyl-4,4-bis(t-butylperoxy)valerate], 10 parts by weight of imidazole{(2,4-

diamino-6-[2'-methylimidazolyl-(1')]ethyl-s-triazine}, and 5 parts by weight of montan wax were provided.

[0047]

Then, the above ingredients were mixed and kneaded with a kneader. For comparison, a mold cleaning material prepared by sufficient kneading and a mold cleaning material prepared by insufficient kneading are provided separately.

[0048]

(Fabrication of Sheet for Regenerating Mold)

Two substrate sheets were provided, and the mold cleaning material prepared by sufficient kneading was applied to both surfaces of one substrate. In addition, the mold cleaning material prepared by insufficient kneading was applied to both surfaces of the other substrate. Each mold cleaning material was formed into a belt-like pattern (a distance of 5mm between projected lines) having a rectangular section (width 5 mm X height 3 mm), and into a thin film (thickness 100 μ m). In this manner, two types of sheets for regenerating a mold were obtained.

[0049]

(Identification of Sheet for Regenerating Mold)

The two types of sheets for regenerating a mold were checked by the naked eye for states of thin film formation. The thin film of the sheet using the mold cleaning material prepared by sufficient kneading showed a uniform color tone. In contrast, the thin film of the sheet using the mold cleaning material prepared by insufficient kneading showed a non-uniform color tone.

[0050]

As can be seen from the foregoing, the mold cleaning material obtained by sufficient kneading shows a homogeneous mixing state of the composition, while the

mold cleaning material obtained by insufficient kneading shows a non-homogeneous mixing state of the composition.

[0051]

(Cleaning Property)

The two types of sheets for regenerating a mold were used to carry out cleaning of a mold for transfer molding for use in encapsulating a semiconductor device with a resin. As a result, the sheet using the mold cleaning material prepared by sufficient kneading cleaned the mold throughout the cavity. In contrast, the sheet using the mold cleaning material prepared by insufficient kneading failed to clean the mold throughout the cavity.

[0052]

As can be seen from the foregoing, the mold cleaning material prepared by sufficient kneading shows an excellent filling property (cleaning property) in a cavity, while the mold cleaning material prepared by insufficient kneading shows poor filling property (cleaning property).

[0053]

(Comparative Example)

In the same manner as the above Example, two types of sheets for regenerating a mold were obtained by using mold cleaning materials having different states of kneading. However, herein, only the belt-like pattern was formed without forming the thin film. Thus, the substrate sheet was exposed between the adjacent projected lines of the belt-like pattern.

[0054]

After checking the projected lines of the belt-like pattern of Comparative Example by the naked eye, it was not possible to identify the kneading states of the mold cleaning materials.

[0055]

Therefore, it can be seen from the above results that the thin film of the Example is effective for identifying mixing states of composition of a mold cleaning material.

[0056]

Further, in the above Example, the thin film had a thickness of 100 μm but the results of the same tendency were obtained when the thin film had a thickness of 20 μm , 150 μm and 500 μm .

[0057]

The above Example used an unvulcanized rubber-based composition as the mold cleaning material, but the results of the same tendency were obtained when using a thermosetting resin-based composition containing a melamine resin as a main ingredient.

[0058]

While the invention has been described in detail with reference to specific embodiments thereof, it will be apparent to one skilled in the art that various changes and modifications can be made therein without departing from the spirit and scope thereof.

Incidentally, the present application is based on Japanese Patent Application No. 2011-178946 filed on August 18, 2011, and the contents are incorporated herein by reference.

All references cited herein are incorporated by reference herein in their entirety.

[0059]

The sheet for regenerating a mold according to the present invention allows identification of mixing states of composition of a mold cleaning material by the naked

eye, and thus enables only the high-quality products to be used for cleaning of a cavity surface of a mold.

Description of Reference Numerals and Signs

[0060]

1: substrate sheet

2A: projected line

3: thin film

CLAIMS

1. A sheet for regenerating a mold, comprising:

a paper sheet or a cloth sheet; and

a mold cleaning material comprising an unvulcanized rubber-based visually assessable composition or a thermosetting resin-based composition with an inorganic filler dispersed therein in an un-dissolved state, the mold cleaning material is formed on both surfaces of the paper sheet or the cloth sheet so as to project in a predetermined pattern having an air vent gap, the pattern being identical on both sides, but the arrangement of each pattern does not completely overlie each other,

wherein a thin film comprising the composition is formed on each surface portion of the paper sheet or the cloth sheet positioned at a portion of the air vent gap, so that a mixing state of the visually assessable composition forming the pattern is identifiable via macroscopic inspection from a formation state of the thin film, and

wherein the colour of the main ingredient of the composition and that of the inorganic filler and opposite to each other or show a clear contrast between light and shade, and

wherein the thin film has a thickness of 20 to 500 μm .

2. The sheet for regenerating a mold according to claim 1, wherein the pattern has a non-flat top part wherein the non-flat top part is formed of a convex part having a curvature radius within a range of 0.2 to 3.0 mm.

3. The sheet according to claim 1 or claim 2, wherein the pattern is formed of a plurality of belts or a plurality of dots wherein the belts or dots have a width and a thickness each within a range of 1 to 5 mm, and a distance between the adjacent belts or dots is set within a range of 1 to 5 mm and wherein a distance between the adjacent belts or dots is set to be 0.5 to 2.0 times a width of the belts or dots.

4. The sheet according to claim 3, wherein a width of the belts or dots is set to be 0.8 to 1.2 times a thickness of the belts or dots.

5. The sheet according to any one of claims 1 to 4, wherein the cloth sheet is a nonwoven

spunbond fabric.

6. The sheet according to any one of claims 1 to 5, wherein the cloth sheet is subjected to an embossing treatment.