SPECIFICATION

Treating method for protecting devices on wafer

FIELD OF THE INVENTION

The present invention relates to an improvement of a treating method for a wafer having many devices provided on its surface.

BACKGROUND INFORMATION

On wafers provided with patterns such as LSI, CMOS or power devices formed on a substrate made of a compound such as silicon or sapphire, respective devices (device chips) are formed and partitioned by streets running lengthwise and widthwise.

For such a wafer having many devices formed on its surface, it is required to make the wafer as thin as possible to reduce the thickness of the wafer in a state where the devices are mounted thereon. For this purpose, a thinning (back grind) treatment for reducing the thickness of the wafer is conducted by covering the surface on the device side with a protective tape having adhesion (back grind (BG) tape) for protection, fixing the BG tape side, and then grinding the wafer backside.

Further, it has been known to cover the surface of the device with a coating film before attaching the BG tape, and

after completion of the thinning (back grind) treatment, peel the BG tape and remove the coating film (JP-A-2003-094295).

With the wafer for which the thinning process is conducted, its wafer backside is attached to a dicing tape stuck whose rear side is provided on a wafer frame, the BG tape attached to the wafer surface is peeled away, and then dicing is conducted along the street with a blade rotating at a high rate to singularize the devices. In addition, the dicing tape is irradiated with ultraviolet ray (UV) to decrease its adhesion, and the singularized devices are transferred to a sheet for shipping, washed with pure water, subjected to inspection of devices, and then shipped to a next step.

In the above conventional steps, it has been often seen that fine particles such as grinding debris adhere to the devices formed on the wafer surface, leading to contamination of the devices during the grinding (back grind) step of the wafer backside and the singularizing (dicing) step.

That is, in the grinding step of the wafer backside, due to the difference in elevation between the wafer surface and the devices formed on the wafer surface, the BG tape can hardly cover the surface of devices thoroughly. Grinding dust or the like may undesirably slip in the gap between the wafer surface and the devices, causing contamination of the devices. Further,

an adhesive of the BG tape may cause contamination.

In addition, in the singularizing step of the devices, a treatment processing liquid is allowed to flow between the wafer and the rotating dicing blade to cool the cutting site and decrease friction resistance at the time of cutting for the purpose of smoothly conducting the dicing. The cutting dust generated by the dicing is washed away and removed by water (pure water). However, the cutting dust can hardly be removed thoroughly, and the devices may sometimes be contaminated.

When the wafer is subjected to dicing, the wafer backside is attached to an adhesive dicing tape, and this dicing tape is fixed to a wafer frame, whereby the dicing process is carried out.

In the dicing process, the wafer is cut into respective devices by a dicing blade along streets on the wafer. The cutting is conducted by the edge of the dicing blade so that the edge cuts into an adhesive layer of the dicing tape attaching to the wafer.

At this stage, the dicing blade generates dicing dust of the wafer, and concurrently the edge of blade swirls (winds) up the adhesive of the adhesive layer of the dicing tape and scatter it in fine particle form. Since the fine particles of the adhesive have adhesion, they adhere to the surface of device

and cannot be washed away, leading to the cause of contamination.

Further, the surface of device formed on the wafer is covered by an oxide film layer. At the time of cutting the wafer into respective devices by the dicing blade, the oxide film layer is partially cracked and peeled by the blade. The peeled oxide film scatters and may sometimes scratch the surface of device.

Particularly, with an image pickup device (image sensor) to be used for a camera, if even only a little part of the above dicing dust or fine particles of the adhesive attach to a lens (sensor image pixels) on the surface of the device (chip) or scratch the image pixels, performance of an element is reduced, which leads to a large cause of increasing the rate of defection. Accordingly, further improvement has been demanded to avoid such phenomenon.

Further, after completion of the dicing process, the singularized devices are transferred from the dicing tape to a sheet for shipping, washed with pure water, and then inspected for shipment to a next step. Even in these steps, hardly removable dust generated by production site circumstance or presence of workers attaches to the surface of devices such as image pickup devices and therefore causes reduction of

performance, and such a problem is not ignorable.

SUMMARY OF THE INVENTION

The present invention can securely protect devices from grinding dust generated from a wafer or contamination by dicing dust throughout the period of time from the beginning of a thinning (back grind) step for grinding a wafer backside having the above devices provided on its surface side to the completion of a singularizing (dicing) step of the devices. Further, the present invention can effectively prevent contamination of devices by fine particles of an adhesive generated from an adhesive layer of a dicing tape which are considered more harmful than the above grinding dust and dicing dust. The present invention can also securely prevent damages on devices by scattering of oxide film pieces.

The present invention provides a treating method for protecting devices on a wafer, comprising protecting devices provided on a surface of a wafer with a coating film, throughout a period of time prior to a thinning step (back grind) for grinding a wafer backside, via a back grinding step, until completion of a singularizing step of the devices, whereby the treatment can be conducted while protecting the devices on the wafer.

Another aspect of the present invention comprises forming a coating film by applying a coating material on a surface of a wafer on which devices are provided, attaching a BG film for back grinding thereon, fixing the side of the surface of the wafer, grinding a wafer backside to conduct thinning of the wafer; and after fixing the wafer backside to a dicing tape stuck on a wafer frame, peeling the BG tape, and conducting a singularizing step of cutting the wafer into respective devices. The coating film covers the surface of the devices throughout a period of time until completion of the singularizing step. After completion of the singularizing step, the coating film is removed by washing.

According to the present invention, the surface of devices is covered by a coating film throughout a period of time before beginning a thinning step for grinding a wafer backside having devices provided on its surface side, via completion of a singularizing step of the devices, just before shipment to a next step. By this treatment, the devices on the wafer surface can securely maintain the functions of devices without receiving any contamination during the respective treatment steps.

Further, by the presence of the coating film, it becomes possible to prevent attachment of the grinding dust generated

by the dicing blade and minute pieces of the adhesive generated from the dicing tape to the surface of the devices, generation of damages of the devices by scattering of partially peeled oxide film, and attachment of dust. And, since the coating film can be clearly removed by washing after the above treatment steps, it becomes possible to obtain a singularized device having a clear surface without contamination.

BRIEF DESCRIPTION OF THE DRAWINGS

The above summary and the following description explaining preferred examples of the present invention will be more clearly understood by referring to the accompanying drawing. The following description and illustrated explanation show preferred examples of the present invention. However, it should be mentioned that the present invention is not limited thereto.

[Fig.1] An explanatory view showing the outline of examples of protecting treatment method of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

After completion of a step for forming devices on the surface of a wafer (step 1), a wafer backside is subjected to grinding to conduct thinning of the wafer.

By conducting the thinning process of the wafer, the thickness of the entire device area can be reduced, and the thickness of the site on which devices are mounted can be made thin. In addition, by reducing the capacity occupied by the devices, mounting in an integrated style can be realized.

Since many devices are formed across the streets running lengthwise and widthwise, the wafer surface is covered by a coating material before entering the thinning step of the wafer backside (step 2).

As the base material of the coating agent, for example, a rosin such as gum rosin, wood rosin, rosin ester, hydrogenated rosin, hydrogenated rosin ester, polymerized rosin, polymerized rosin ester, maleic acid-modified rosin and rosin-modified phenolic resin may be mentioned.

In addition, an acrylic resin such as a copolymer of (meth)acrylic acid and other copolymerizable monomer, polyacrylic acid, polymethacrylic acid, or polyacrylamide, may also be mentioned.

Further, an epoxy resin such as a phenol novolac type epoxy resin or a cresol novolac type epoxy resin, a terpene resin, a phenolic resin, a polyester resin and polypropylene glycol may also be mentioned.

Preferred as the base material of the above coating

material, ones obtained by appropriately blending a rosin, a terpene resin, an acrylic resin, an epoxy resin, a phenolic resin, a polyester resin and polypropylene glycol as the case requires may be mentioned.

The average molecular weight of the acrylic resin is 1,000 to 100,000, preferably about 6,000 to 35,000.

As the base material of the coating material, preferred is a resin being removable by an alkaline detergent such as an aqueous alkaline liquid as mentioned below. As such a removable resin, preferred is, for example, a rosin, an alkali-soluble acrylic resin and an epoxy resin, or a mixture thereof among the above-mentioned resins.

To the base material of the coating material, a polysaccharide, a fatty acid, a fatty acid ester, a surfactant, etc. may further be added. These additives may be used individually or in an appropriately blended style. These additive components can improve a coating formation property and washing removability of the coating maerial.

As the polysaccharide of the above additives, for example, cellulose, starch, glycogen, etc. may be mentioned. As the fatty acid, caproic acid, caprylic acid, palmitic acid, stearic acid, lauric acid, etc. may be mentioned. As the fatty acid ester, methyl caproate, ethyl caproate, methyl caprylate, ethyl

caprylate, etc. may be mentioned. As the surfactant, an anionic, cationic, nonionic or amphoteric surfactant, etc. may be mentioned.

The glass transition temperature (Tg) of the coating material is not particularly limited, but preferably about 50 to 80℃.

The above coating material, additives, etc. may be used by appropriately incorporating them in an organic solvent, and uniformly dissolved and dispersed by a conventional method in a form of solution of, usually, at a level of about 10 to 40 mass%.

As the organic solvent, an alcohol, an ether, an ester, a ketone, an aromatic compound, etc. which are capable of dispersing the entire components in a uniform condition may be mentioned. These solvents may be used alone or as a mixture of two or more of them.

The coating material is applied by a method such as an immersion method, a roll coating method, a spin coating method or a spraying method, on the wafer surface on which devices are formed (step 2). Preferably, it is applied by a spin coating method and dried at about 80 to 150℃ to form a uniform coating film on the wafer surface.

The film thickness of the coating film is advisably about

1.50 to 7.50 μm, preferably about 2.00 to 4.50 μm.

The hardness of the coating film as formed above is preferably not so hard, and at a level of B to 2H in terms of pencil hardness.

To the wafer surface coated with such a coating material, a conventional BG tape having an adhesive layer formed on one surface of a plastic sheet for a thinning (back grind) step is further attached (step 3).

Then, the BG tape side covering the wafer surface is fixed, the wafer backside is ground (back grind) to make the thickness of the wafer further thin (step 4).

At this stage, even if grinding debris of the wafer slips into the gap between the BG tape and the wafer surface, the devices formed on the wafer surface are not contaminated since the devices are covered by the coating film.

After completion of the thinning process, the wafer backside is attached and fixed to a dicing tape (step 5) and installed on a dicing frame.

Then, the BG tape is peeled away (step 6), and the thinned wafer covered by the coating film is transferred to a next singularizing step (dicing) (step 7).

In the singularizing step, the fixed wafer is singularized into respective devices by a dicing blade rotating

at a high rate along streets running lengthwise and widthwise which partition the devices formed on the wafer surface.

In the dicing process, the dicing blade runs along the streets to cut the wafer into respective devices while supplying a cutting fluid. At this stage, by the cutting with the blade, cutting dust is generated from the wafer. In the cutting operation, concurrently, the edge of the blade cuts into the adhesive layer of the dicing tape and its underneath dicing tape substrate, and swirls (winds) up them in fine particle form.

Such cutting dust and fine adhesives are removed by the cutting fluid, but these cannot be thoroughly removed, and some part may remain. The cutting dust of wafer can be comparatively easily removed, but the fine particles generated from the adhesive layer have a property of easily adhering to the wafer surface since they still have adhesion. However, since the devices on the wafer surface side are covered with the coating film, the coating film can protect the devices from contamination.

The oxide film formed on the device surface is covered by the coating film as well, and therefore it becomes possible to effectively prevent scattering of the oxide film debris generated by partial peeling of the oxide film by the dicing blade (delamination) and damages thereby caused on the device

surface.

After completion of the dicing, the coating material covering the respective devices can be removed by washing (step 8).

As the detergent for removing the coating film made of the coating material, as mentioned above, it is particularly effective to conduct washing with an alkaline detergent such as an aqueous alkaline solution.

As the detergent, an aqueous alkaline solution made of an alkali agent such as caustic soda, caustic potash or ammonia may be mentioned.

Further, a water-soluble solution of an organic alkali such as alkanol amine, amyl alcohol or a water-soluble amine, an inorganic alkali salt such as silicate or carbonate may be used.

After removal of the coating film which has covered the device surface throughout the processing steps, the adhesive layer of the dicing tape is irradiated with ultraviolet ray (UV) (step 9) so that the adhesion of the adhesive layer can be reduced.

The singularized devices placed on the adhesive layer of the dicing tape of which the adhesion is reduced are transferred in such a style that they are arranged in line on an adhesive

sheet for shipment to a next step (step 10).

After the devices are transferred to the sheet for shipment, these are further washed with pure water sufficiently (step 11) to obtain clean devices without stain.

The cleaned respective devices are subjected to an inspection step (step 12), and the ones satisfying the inspection standard may be shipped to a next step.

As the case requires, removal of the coating film may be conducted after the singularized devices are transferred and mounted on the sheet for shipment, and thereafter the devices may be sufficiently washed with pure water.

EXAMPLES

For preparation of examples and comparative examples, the following coating materials were prepared.

Sample 1: a coating material with an average molecular weight of 6,000, of which the resinous solid content contains 35% of an acrylic resin with a molecular weight of at least 10,000, 25% of an acrylic resin with a molecular weight of less than 10,000, 32% of a rosin alcohol and 8% of a plasticizer.

Sample 2: a coating material with an average molecular weight of 8,000, of which the resinous solid content contains 47% of an acrylic resin with a molecular weight of at least 10,000,

33% of an acrylic resin with a molecular weight of less than 10,000, 10% of a rosin alcohol and 10% of a plasticizer.

Sample 3: a coating material with an average molecular weight of 20,000, of which the resinous solid content contains 89% of an acrylic resin with a molecular weight of at least 10,000, 11% of an acrylic resin with a molecular weight of less than 10,000, 0% of a rosin alcohol and 0% of a plasticizer.

Sample 4: a coating material with an average molecular weight of 25,000, of which the resinous solid content contains 74% of an acrylic resin with a molecular weight of at least 10,000, 9% of an acrylic resin with a molecular weight of less than 10,000, 9% of a rosin alcohol and 8% of a plasticizer.

Sample 5: a coating material with an average molecular weight of 35,000, of which the resinous solid content contains 89% of an acrylic resin with a molecular weight of at least 10,000, 11% of an acrylic resin with a molecular weight of less than 10,000, 0% of a rosin alcohol and 0% of a plasticizer.

Using the above samples, Examples 1 to 9 were conducted.

Example 1

A coating material was prepared by adding an alcohol double the amount (volume) of Sample 1 as a solvent. This coating agent was applied by spin coating to the surface of a 8-inch wafer on which a CMOS image sensor was formed as a device

on a Si substrate, to form a coating film having a film thickness of 4.08 μm.

Examples 2 to 9

Using Samples 2 to 5 as indicated in Table 1, coating films with a film thickness as indicated in Table 1 were prepared in accordance with Example 1.

Comparative Example 1

In Comparative Example 1, the same operation was conducted provided that no coating agent was used and no coating film was formed.

TEST

The following tests were conducted to examine properties when the coating film was formed with the coating material in Examples 1 to 9 and Comparative Example 1.

Test of delamination ratio

After forming the coating film, a series of a wafer-thinning process and a dicing process as mentioned above was carried out and then the coating film was removed by use of a detergent. Afterward, observation was carried out on the surface state where peeling of an oxide film was caused on the device surface (delamination) by use of a visual inspection machine.

The state of delamination in Comparative Example 1 where no coating film was formed was represented by 100%, and the states of the Examples were indicated by numerical values (%) in the same manner.

Estimation standard

It is shown that as the numerical value (%) is small, the ratio that delamination happens becomes small.

Results of tests

The results of tests are indicated in Table 1.

In Table 1, the glass transition temperature (Tg) by ℃ of Samples 1 to 5 of the coating materials

and the pencil hardness of the formed coating film are also indicated.

Consideration

In Examples 1 to 9, the ratios that delamination happens in the oxide film on the device surface are ranging from 44 to 96%. These ratios are smaller than the result of Comparative Example 1 i.e. 100%. It is shown that the formation of the coating film by use of the coating material effectively works for protection of devices.

Table 1

	Coating material	Average molecular weight	Tg	Film thickness (μm)	Pencil hardness	Delami-nation ratio

Ex.1	Sam.1	6000	65	4.08	B	86
Ex.2	Sam.2	8000	76	2.06	HB	96
Ex.3	Sam.2	8000	76	3.01	HB	65
Ex.4	Sam.2	8000	76	3.93	HB	54
Ex.5	Sam.2	8000	76	7.00	HB	55
Ex.6	Sam.3	20000	54	3.18	2H	70
Ex.7	Sam.3	20000	54	3.98	2H	61
Ex.8	Sam.4	25000	53	4.04	H	44
Ex.9	Sam.5	35000	68	4.11	2H	58
Com. Ex.1	Non	–	–	–	–	100

WE CLAIM:

1. A treating method for protecting devices on a wafer, comprising protecting devices provided on a surface of a wafer with a coating film made of a coating material, throughout a period of time prior to a thinning step (back grind) for grinding a wafer backside, via a back grinding step, until completion of a dicing step of the device.

2. A treating method for protecting devices on a wafer, comprising forming a coating film with a coating material on a surface of a wafer on which devices are provided, attaching a surface-protecting film (BG film) for back grinding thereon, fixing the side of the surface of the wafer, grinding a wafer backside (back grind) to conduct thinning of the wafer, fixing the wafer backside to a dicing tape stuck on a wafer frame, peeling the BG tape, conducting a singularizing step (dicing) of cutting the wafer into respective devices, and removing the coating film used for covering the surface of the wafer throughout a period of time until the singularizing step by washing.

3. The treating method according to Claim 1 or 2, wherein the coating material is an acrylic resin-based surface coating material.

4. The treating method according to Claim 3, wherein the acrylic

resin of the coating material has an average molecular weight of 1,000 to 100,000 and the coating film is formed in a film thickness of 1.50 to 7.50 μm.

5. The treating method according to Claim 4, wherein the coating film has a film thickness of 2.00 to 4.50 μm.

6. The treating method according to any one of Claims 3 to 5, wherein the coating film formed on the devices by use of the coating material has a pencil hardness of B to 2H.