FORMULATION AND PROCESSING SOLUTION FOR DICING PROCESS~~, AND METHOD FOR PROCESSING~~

FIELD OF THE INVENTION

The present invention relates to a processing formulation (composition) and a processing solution that are used in used a dicing process by which many chip-shaped devices formed on a wafer are separated by a dicing blade. The present invention also relates to a wafer processing method using the formulation and processing solution.

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, many devices are formed and partitioned by division lines, often referred to as scribe streets or simply streets. When the devices separated lengthwise and widthwise by streets are singularized into individual pieces by dividing the wafer at the streets, dicing is typically carried out by a blade rotating at high speed or by irradiation with a laser beam.

When the dicing is carried out by a blade, the dicing is carried out smoothly by allowing a processing solution to flow in the region between the wafer and a rotating dicing blade to cool the part to be cut, and at the same time, to reduce frictional resistance at the time of cutting. During the dicing process, it is necessary to wash away and remove offcuts generated by dicing to prevent contamination of the separated devices.

To deal with the above problem, pure water was initially used as the processing solution, and various methods have been studied to improve upon the removal of splintered dicing offucts. For example, there has been known a processing solution comprising a polymer which contains at least 50 mass% of vinyl pyrrolidone and is a polymer with an ethylene group-containing monomer such as vinyl acetate, having a weight average molecular weight of 40,000 to 160,000; and a blowing agent (JP-B-5253765).

By using such a processing solution as described in JP-B-5253765, it becomes possible to more efficiently remove splintered dicing offcuts of the wafer as compared with the cases using pure water. However, it was found that other matter still adheres to and remains on the devices, namely unremoved matter still exists.

The cause of such matter was unknown at an early stage. As a result of various researches, the following has been found. In the dicing operation of wafers, the wafers are adhered to an adhesive resin sheet (dicing tape) and the dicing tape is fixed to a wafer frame, and then the dicing process is carried out. In the dicing process, a dicing blade runs along the streets of the wafers to cut them into individual devices. The edge of the dicing blade slightly cuts into an adhesive layer of the dicing tape to complete the cutting of the wafer. At this moment, the edge of the dicing blade cuts and raises the adhesive of the adhesive layer and scatters it as minute pieces, and resultantly the minute pieces adhere as particle contaminants to the device surfaces.

Particularly, for image sensors to be used for cameras, attachment of even a small amount of dicing offcuts and minute pieces of adhesive to the lenses on the surface of the device chips causes deterioration of performance of the devices and increases the number of defective devices. Further improvements to deal with such attachment have been demanded.

SUMMARY OF THE INVENTION

As mentioned above, there has been a demand for a formulation for a dicing process and a processing solution made from the formulation, by which it becomes possible to efficiently remove not only the dicing offcuts formed from the wafers in the dicing step but also minute pieces of adhesive released from the adhesive layer of the dicing tape, which is considered to have a more adverse effect than the dicing dust.

Further, the dicing process is carried out while a large amount of pure water is poured and flowed constantly, and this step requires a very large amount of pure water and is costly, and sometimes brings about a shortage of water for domestic use of local residents.

~~The present invention provides a formulation for a dicing process, which comprises 1.0 to 1.5 mass% in relation to 100 mass% of formulation of a partially saponified polyvinyl alcohol having a polymerization degree of 200 to 400 and a saponification degree of 75 to 85 mol%; 0.4 to 0.6 mass% in relation to 100 mass% of formulation of polyoxyethylene- polyoxypropylene glycol ether having a number average molecular weight of 10,000 to 20,000 with a polymerization ratio of polyoxyethylene to polyoxypropylene of 75:25 to 85:15; and pure water.~~

According to a first aspect of the present invention, there is provided a formulation for dicing process, which comprises 1.0 to 1.5 mass% of a partially saponified polyvinyl alcohol having a polymerization degree of 200 to 400 and a saponification degree of 75 to 85 mol%; 0.4 to 0.6 mass% of polyoxyethylene-polyoxypropylene glycol ether having a number average molecular weight of 10,000 to 20,000 with a polymerization ratio of polyoxyethylene to polyoxypropylene of 75:25 to 85:15; and pure water.

According to a second aspect of the present invention, there is provided a processing solution for dicing process, which is obtained by diluting the above formulation for dicing process to 10,000 to 100,000 times

The term "pure water" as used herein means purified water, i.e., water that has been filtered or processed to remove impurities.

The formulation for a dicing process may further contain about 0.1 mass% in relation to 100 mass% of formulation of phenyl glycol.

The formulation for a dicing process is usually diluted 10,000 to 100,000 times with pure water to form a processing solution, and in a dicing process step, the processing solution is applied by flowing or ejecting it on parts at which dicing is carried out with the dicing blade.

According to embodiments of the present invention, when a wafer for semiconductors, etc. is subjected to the dicing process, the minute pieces of adhesive released from the adhesive layer of the dicing tape by the dicing blade can be washed away together with the dicing offcuts by the processing solution. It is therefore possible to obtain a clear wafer surface, reduce defective products of chips on the wafer and increase the yield.

Further, ~~in~~as per embodiments of the present invention, the formulation for a dicing process is effective even if it is diluted to a high degree to form a processing solution so that it is possible to flow the processing solution used for the dicing process to regeneration facilities of used water without extra load and labor. As a result, the used water can be reused for other steps, etc. and wastewater treatment can be efficiently made.

BRIEF DESCRIPTION OF THE DRAWINGS

CLAIMS

~~1. A formulation for a dicing process, which comprises 1.0 to 1.5 mass% in relation to 100 mass% of formulation of a partially saponified polyvinyl alcohol having a polymerization degree of 200 to 400 and a saponification degree of 75 to 85 mol%; 0.4 to 0.6 mass% in relation to 100 mass% of formulation of polyoxyethylene-polyoxypropylene glycol ether having a number average molecular weight of 10,000 to 20,000 with a polymerization ratio of polyoxyethylene to polyoxypropylene of 75:25 to 85:15; and pure water.~~

~~2. The formulation for a dicing process according to claim 1, wherein the partially saponified polyvinyl alcohol has a polymerization degree of 300 and a saponification degree of 80 mol%.~~

~~3. The formulation for a dicing process according to claim 1, wherein the polyoxyethylene-polyoxypropylene glycol ether has a number average molecular weight of 15,500 with a polymerization ratio of polyoxyethylene to polyoxypropylene of 83:17.~~

~~4. The formulation for a dicing process according to claim 1, wherein the formulation further comprises 0.1 mass% in relation to 100 mass% of formulation of phenyl glycol.~~

~~5. The formulation for a dicing process according to claim 1, wherein the partially saponified polyvinyl alcohol has a polymerization degree of 300 and a saponification degree of 80 mol%,~~

and the formulation further comprises 0.1 mass% in relation to 100 mass% of formulation of phenyl glycol.

6. A formulation for a dicing process, which comprises 1.0 to 1.5 mass% in relation to 100 mass% of formulation of a partially saponified polyvinyl alcohol having a polymerization degree of 300 and a saponification degree of 80 mol%; 0.4 to 0.6 mass% in relation to 100 mass% of formulation of polyoxyethylene-polyoxypropylene glycol ether having a number average molecular weight of 15,500 with a polymerization ratio of polyoxyethylene to polyoxypropylene of 83:17; and pure water.

7. The formulation for a dicing process according to claim 6, wherein the formulation further comprises 0.1 mass% in relation to 100 mass% of formulation of phenyl glycol.

8. A processing solution for a dicing process, which comprises the formulation for a dicing process according to claim 1, wherein the formulation is diluted 10,000 to 100,000 times by pure water.

9. A wafer dicing process comprising:

providing a wafer fixed by adhesive onto a dicing tape, the wafer having circuit structures formed on the wafer surface, and the circuit structures being separated from one another by streets;

dicing the wafer along the streets using a rotating dicing

~~blade to divide the wafer into individual circuit structures; and~~

~~continuously flowing a processing solution to the region where the dicing blade contacts the wafer to remove dicing offcuts and adhesive particles released from the dicing tape during dicing,~~

~~wherein the processing solution comprises a formulation diluted 10,000 to 100,000 times by pure water, and~~

~~wherein the formation comprises 1.0 to 1.5 mass% in relation to 100 mass% of formulation of a partially saponified polyvinyl alcohol having a polymerization degree of 200 to 400 and a saponification degree of 75 to 85 mol%; 0.4 to 0.6 mass% in relation to 100 mass% of formulation of polyoxyethylene- polyoxypropylene glycol ether having a number average molecular weight of 10,000 to 20,000 with a polymerization ratio of polyoxyethylene to polyoxypropylene of 75:25 to 85:15; and pure water.~~

~~10. The wafer dicing process according to claim 9, wherein the partially saponified polyvinyl alcohol of the formulation for dicing process has a polymerization degree of 300 and a saponification degree of 80 mol%.~~

~~11. The wafer dicing process according to claim 9, wherein the partially saponified polyvinyl alcohol of the formulation has a polymerization degree of 300 and a saponification degree of 80 mol%; and the polyoxyethylene- polyoxypropylene glycol ether of the formulation has a number average molecular weight of 15,500 with a polymerization ratio of polyoxyethylene to polyoxypropylene of~~

~~83:17.~~

~~12. The wafer dicing process according to claim 9, wherein the formulation further comprises 0.1 mass% in relation to 100 mass% of formulation of phenyl glycol.~~

1. A formulation for dicing process, which comprises 1.0 to 1.5 mass% of a partially saponified polyvinyl alcohol having a polymerization degree of 200 to 400 and a saponification degree of 75 to 85 mol%; 0.4 to 0.6 mass% of polyoxyethylene-polyoxypropylene glycol ether having a number average molecular weight of 10,000 to 20,000 with a polymerization ratio of polyoxyethylene to polyoxypropylene of 75:25 to 85:15; and pure water.

2. The formulation for dicing process according to Claim 1, wherein the partially saponified polyvinyl alcohol has a polymerization degree of 300 and a saponification degree of 80 mol%.

3. The formulation for dicing process according to Claim 1 or 2, wherein the polyoxyethylene-polyoxypropylene glycol ether has a number average molecular weight of 15,500 with a polymerization ratio of polyoxyethylene to polyoxypropylene of 83:17.

4. The formulation for dicing process according to any one of Claims 1 to 3, wherein the formulation further comprises 0.1 mass% of phenyl glycol.

5. A processing solution for dicing process, which is obtained by diluting the formulation for dicing process as described in any one of Claims 1 to 4 to 10,000 to 100,000 times.