

DESCRIPTION

TEMPLATE ASSEMBLY AND METHOD FOR MANUFACTURING TEMPLATE ASSEMBLY

TECHNICAL FIELD

[0001]

The present invention relates to a template assembly used in polishing of a surface of workpieces, such as various semiconductor wafers starting with silicon wafers, to hold the workpiece and a method of producing the template assembly.

BACKGROUND ART

[0002]

The apparatuses that can be mentioned as apparatuses for polishing surfaces of a workpiece such as a silicon wafer are a single-side polishing apparatus to polish one surface of the workpiece at a time and a double-side polishing apparatus to polish both surfaces of the workpiece simultaneously. A typical single-side polishing apparatus 200 as shown in FIG. 8 is constituted of a turn table 203 to which a polishing pad 202 is attached, a polishing agent supply mechanism 204, a polishing head 201, and so on. The polishing apparatus 200 holds a workpiece W with the polishing head 201, rotates the turn table 203 and the polishing head 201 while supplying a polishing agent 205 to the polishing pad 202 from the polishing agent supply mechanism 204, and brings a surface of the workpiece W into sliding contact with the polishing pad 202 to polish the workpiece W.

[0003]

A polishing head with a retainer ring or a polishing head with a template assembly is used as a means of holding a workpiece.

This polishing head with a retainer ring serves a function to press a polishing pad at the periphery of the workpiece by the retainer ring and thereby to prevent compressive deformation of the polishing pad due to the workpiece itself, so as to prevent an outer peripheral sag of the workpiece. The structure of this polishing head however is complicated and makes its cost high.

[0004]

FIG. 9 shows an example of a conventional polishing head with a template assembly. As shown in FIG. 9, this template assembly has a backing pad 102 and an annular template 103 adhering to the outer circumferential portion of the lower surface of the backing pad. The inner surface of the template and the lower surface of the backing pad 102 define a recess. During polishing, a workpiece W is received and held in this recess. The polishing head 101 is configured such that this template assembly is stuck to a polishing head body 104 by double-stick tape 105. Glass epoxy resin, for example, is used as the material of the template 103.

[0005]

In this polishing head 101 with the template assembly, the shape of the outer circumference of the wafer W is controlled by a difference between the depth of the recess of the template assembly and the thickness of the wafer W. In other words, proper selection of the thickness of the template 103 enables adjustment of the pressure of the workpiece outer circumference during polishing, so the outer peripheral sag can be

comparatively readily inhibited without using a polishing head having a complicated structure.

[0006]

However, variation in the depth of the recess of the template assembly is larger compared with the precision of the thickness of a wafer. This makes it difficult to stably achieve the target difference in the thickness.

Accordingly, the surface of the backing pad is subjected to a buffing process after the backing pad is formed or the template is ground or lapped to improve the variation in the depth of the recess (See Patent Document 1).

[0007]

A template assembly with a PET base, as shown in FIG. 10, is also known (See Patent Document 2). As shown in FIG. 10, in the template assembly 110, a template 103 subjected to a grinding or lapping process is stuck directly to a PET base 106 and a backing pad 102 having a thickness whose variation is reduced by a buffing process is attached to the inside of the template.

CITATION LIST

PATENT LITERATURE

[0008]

Patent Document 1: Japanese Unexamined Patent publication (Kokai) No. 2009-208199

Patent Document 2: Japanese Unexamined Patent publication (Kokai) No. 2008-93811

Patent Document 3: Japanese Unexamined Patent publication (Kokai) No. H7-58066

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0009]

The above method of buffing the backing pad or grinding and polishing the template is effective in reducing variation in thickness of each of the backing pad and the template. It is however difficult to improve the precision of adhesion between the template and the backing pad, which is an elastic body. The precision of the template assembly such as in-plane variation in depth of the recess cannot greatly be improved.

[0010]

The recess of a commercially available template assembly has the depth with precision of a variation of $\pm 20 \mu\text{m}$ from the target value. In-plane variation of the depth is about $15 \mu\text{m}$.

Variation in thickness from the target thickness of the template can be improved to within $\pm 3 \mu\text{m}$ and in-plane variation in its thickness can be improved to $3 \mu\text{m}$ or less after grinding and polishing the template. After the template is stuck to the backing pad, however, the recess of the template assembly has the depth with precision of a variation of $\pm 10 \mu\text{m}$ from the target value and the in-plane variation in the depth is degraded to about $10 \mu\text{m}$.

[0011]

In the template assembly 110 shown in FIG. 10, which has the template and the backing pad directly stuck to the PET base, the precision of adhesion can comparatively readily be improved because glass epoxy resin used as the template is hard, so the precision of the template assembly can be improved. Since the

backing pad having a discoid shape is attached to the inner surface of the template, however, a space is created between the template and the backing pad. During polishing, slurry enters this space. This slurry is a source of generating particles that exerts an adverse effect on the quality of a polished workpiece such as a fine scratch and a defect of the workpiece.

[0012]

Compared with the template assembly having the template stuck to the backing pad as shown in FIG. 9, the template assembly 110 having the template with an increased thickness has a smaller gap between the template and the polishing pad because the template hardly sinks in during polishing. This results in a shortage of slurry supply to a workpiece surface and may adversely affect the workpiece quality. Accordingly, the template cannot be thickened too much.

[0013]

It is also known that an annular groove is formed in the backing pad along the inner surface of the template so that the outer peripheral sag of a workpiece is inhibited (See Patent Document 3). Even this method cannot improve defects on the workpiece surface because the slurry enters the groove during polishing and becomes the source of generating particles.

[0014]

The present invention was accomplished in view of the above-described problems. It is an object of the present invention to provide a template assembly that can reduce the in-plane variation in depth of the recess and thereby improve flatness of a polished workpiece while inhibiting the occurrence of a scratch and a defect of the workpiece.

SOLUTION TO PROBLEM

[0015]

To achieve this object, the present invention provides a template assembly configured to hold a workpiece in polishing of the workpiece, comprising: a polyethylene terephthalate (PET) base; an annular template adhering to an outer circumferential portion of a lower surface of the PET base, the template having an annular notch formed at an upper portion of an inner surface of the template; and a discoid backing pad whose peripheral portion is fitted into the notch, the backing pad adhering to a central portion of the lower surface of the PET base, wherein a recess configured to receive and hold the workpiece during polishing is defined by the inner surface of the template and a lower surface of the backing pad.

[0016]

Such a template assembly has no space between the template and the backing pad and generate no particle during polishing, thereby enabling inhibition of the occurrence of the scratch and defect of the workpiece. In addition, since the template and the backing pad are stuck to the PET base, this template assembly can reduce in-plane variation in their thickness and hence in-plane variation in depth of the recess and thereby improve the flatness of the polished workpiece.

[0017]

The notch preferably has a thickness equal to or less than a target thickness of the backing pad.

Such a template assembly prevents the formation of a space between the template and the backing pad. If the notch has a thickness less than the target thickness

of the backing pad, then a polishing pressure of the outer circumferential portion of the workpiece can be reduced and the amount of polishing the outer circumferential portion of the workpiece can thereby be reduced, so the outer peripheral sag can be inhibited.
[0018]

The template is preferably made of glass epoxy resin.

Such a template has excellent mechanical properties and can prevent metal contamination and scratch of the workpiece.
[0019]

Moreover, in-plane variation in depth of the recess is preferably equal to or less than 10 μm .

Such a template assembly can reliably improve the flatness of the polished workpiece.
[0020]

Furthermore, the present invention provides a method of producing the inventive template assembly, comprising: preparing the annular template having the annular notch formed at the upper portion of the inner surface of the template; sticking the discoid backing pad on the central portion of the PET base; and sticking the template on the outer circumferential portion of the lower surface of the PET base such that the peripheral portion of the backing pad is fitted into the notch of the template.

[0021]

This method can produce the inventive template assembly that can reduce the in-plane variation in the thickness of the template and the backing pad and improve the flatness of the polished workpiece while inhibiting the occurrence of the scratch and defect of

the workpiece.

[0022]

The step of preparing the template may include: preparing a substrate for the template; cutting the prepared substrate into an annular shape; and then forming the notch by grinding an upper portion of an inner surface of the annular substrate.

In this manner, the annular template having the notch can readily be prepared.

[0023]

The step of preparing the template preferably includes: before forming the notch, lapping and/or polishing the template such that in-plane variation in thickness of the template is equal to or less than 10 μm .

In this manner, the in-plane variation in depth of the recess that is defined by the inner surface of the template and the lower surface of the backing pad can reliably be reduced.

ADVANTAGEOUS EFFECTS OF INVENTION

[0024]

The inventive template assembly includes a PET base, an annular template adhering to the outer circumferential portion of the lower surface of the PET base, and a discoid backing pad adhering to the central portion of the lower surface of the PET base; an annular notch is formed at an upper portion of the inner surface of the template; a peripheral portion of the backing pad is fitted into the notch. This template assembly can inhibit the occurrence of the scratch and defect of a workpiece without generating particles during polishing, and reduce the in-plane variation in thickness of the template and the backing pad and hence the in-plane

variation in depth of the recess, thereby enabling improvement in flatness of a polished workpiece.

BRIEF DESCRIPTION OF DRAWINGS

[0025]

FIG. 1 is a schematic diagram of an example of the inventive template assembly;

FIG. 2 is an enlarged view around the notch having the same thickness as the target thickness of the backing pad of the inventive template assembly;

FIG. 3 is an enlarged view around the notch having a smaller thickness than the target thickness of the backing pad of the inventive template assembly;

FIG. 4 is a diagram of the relationship of roll off to variation in depth of the recess from the target value in examples 1 and 2 and comparative examples 1 and 2;

FIG. 5 is a diagram showing the average, the maximum, and the minimum of roll off in examples 1 and 2 and comparative examples 1 and 2;

FIG. 6 is a radar chart of a difference in position of roll off at eight points in a plane in examples 1 and 2 and comparative examples 1 and 2;

FIG. 7 is a diagram showing the number of defects of wafers in examples 1 and 2 and comparative examples 1 and 3;

FIG. 8 is a schematic diagram of an example of a common polishing apparatus;

FIG. 9 is a schematic diagram of an example of a conventional template assembly;

FIG. 10 is a schematic diagram of another example of a conventional template assembly; and

FIG. 11 is an explanatory view of a method of

measuring the depth of the recess in examples 1 and 2 and comparative examples 1 to 3.

DESCRIPTION OF EMBODIMENTS

[0026]

An embodiment of the present invention will be hereinafter described, but the present invention is not limited to this embodiment.

First, the inventive template assembly will be described with reference to FIGs. 1 and 2.

As shown in FIG. 1, the inventive template assembly 1 has a polyethylene terephthalate (PET) base 2, an annular template 3, and a discoid backing pad 4. The thickness and the shape of the PET base 2 are not particularly limited; for example, the shape may be discoid.

[0027]

The backing pad 4 holds a workpiece W by attaching the workpiece W on its lower surface containing water. The backing pad 4 may be made of, for example, foamed polyurethane. This backing pad 4 containing water can reliably hold the workpiece W by surface tension of the wafer contained in the backing pad 4.

[0028]

The template 3 is stuck on an outer circumferential portion of the lower surface of the PET base 2. The backing pad 4 is stuck on a central portion of the lower surface of the PET base 2.

The inner surface of the template 3 and the lower surface of the backing pad 4 define a recess 6. During polishing of the workpiece W, the workpiece W is received in this recess 6, and the edge and the upper surface of the workpiece W are held on the inner surface

of the template 3 and the lower surface of the backing pad 4, respectively.

[0029]

The template assembly having the template 3 and backing pad 4 that both adhere directly to the PET base 2 in this manner can reduce the difference between the actual depth and the target depth of the recess 6 and the in-plane variation of the depth of the recess 6. Accordingly, the flatness of the workpiece W polished with the inventive template assembly can be improved especially by reducing the outer peripheral sag of the workpiece W. In particular, when the in-plane variation in depth of the recess is 10 μm or less, the flatness of the workpiece W can reliably be improved.

[0030]

The template 3 is preferably made of a material that is softer than the workpiece W and has high abrasion resistance that makes it hard to wear when being brought into sliding contact with a polishing pad during polishing, for such a material avoids contamination, a scratch, and an impression of the workpiece W. From this viewpoint, an exemplary material of the template 3 may be glass epoxy resin.

[0031]

As shown in FIG. 1, an annular notch 5 is formed at an upper portion of the inner surface of the template 3. The backing pad 4 is stuck on the central portion of the lower surface of the PET base 2 such that a peripheral portion of the backing pad 4 is fitted into the notch 5. This configuration allows the template assembly to use the template 3 and the backing pad 4 that are directly stuck on the PET base 2 and have no space between the template 3 and the backing pad 4.

This template assembly can thereby prevent the generation of particles due to slurry entering a space during polishing and inhibit the occurrence of a fine scratch and defect of the workpiece, which are problems of a conventional template assembly.

[0032]

As shown in FIG. 2, the notch 5 preferably has a thickness d that is equal to or less than the target thickness of the backing pad 4 so that no space is defined between the backing pad 4 and the template.

As shown in FIG. 3, the notch 5 may have a thickness d less than the target thickness of the backing pad 4 so that the outer peripheral sag of the workpiece is more effectively inhibited. In this manner, the peripheral portion of the backing pad 4 that is held by the template 3 is compressed annularly, resulting in reduction in polishing pressure of the outer circumferential portion of the workpiece. This reduction reduces the amount of polishing the outer circumferential portion of the workpiece and thereby enables the inhibition of the outer peripheral sag of the workpiece.

[0033]

The inventive template assembly with the notch 5 can adjust the polishing pressure of the outer circumferential portion of the workpiece by adjusting the thickness of the notch 5 without changing the thickness of the template 3. The template assembly can therefore inhibit a shortage of slurry supply due to a decreased space between the template 3 and the polishing pad, thereby enabling the inhibition of the occurrence of surface defects of the workpiece.

This configuration also allows for the combination

with the method of forming an annular groove in the backing pad 4.

[0034]

Next, the method of producing the inventive template assembly will be described.

As shown in FIG. 1, the annular template 3 having the annular notch 5 formed at the upper portion of its inner surface is first prepared. This step may be performed for example as follows:

A substrate for the template such as a glass epoxy resin substrate is prepared. This substrate is lapped and/or polished so as to have the target thickness.

[0035]

At this time, the in-plane variation in thickness of the template 3 is preferably reduced to 10 μm or less. In this manner, the surface shape of the outer circumferential portion of the workpiece can be inhibited from partially degrading during polishing of the workpiece.

If lapping is performed at this time, then exemplary abrasive grains that can be used are alumina or SiC abrasive grains. If polishing is performed at this time, then an alkali solution containing colloidal silica, for example, can be used.

[0036]

The substrate is then cleaned to remove the abrasive grains and/or alkali solution attached in the lapping and/or polishing.

The substrate is next cut into the annular template 3, for example, by a numerical control. The notch 5 is then formed by grinding the upper portion of the inner surface of the annular template 3. In this grinding, the thickness of the notch 5 is adjusted to a

prescribed thickness that is equal to or less than the target thickness of the backing pad 4, as described above.

[0037]

The discoid backing pad 4 is stuck on the central portion of the PET base 2. The diameter of the backing pad 4 is adjusted such that the backing pad can be fitted into the annular notch 5 formed as above. The template 3 is stuck on the outer circumferential portion of the lower surface of the PET base 2 such that the peripheral portion of the backing pad 4 is fitted into the notch 5 of the template 3.

[0038]

This inventive method can produce the inventive template assembly.

EXAMPLE

[0039]

The present invention will be more specifically described with reference to examples and comparative examples, but the present invention is not limited to these examples.

[0040]

(Example 1)

The inventive template assembly as shown in FIG. 1 was produced according to the inventive producing method to evaluate the precision of the depth of the recess. The precision of the depth of the recess was evaluated by the difference in depth from the target depth and the in-plane variation in depth.

A glass epoxy resin substrate was lapped so as to have a thickness close to the target thickness. The substrate was then polished with a slurry containing

about 1 μm of cerium oxide powder and cut into an annular shape with a prescribed size. The notch having the same thickness as the backing pad was then formed by annularly grinding the substrate up to a position of 5 mm away from the inner circumference with a lathe.

[0041]

The template thus produced was stuck to the PET base on which the backing pad was stuck on its central portion to complete the production of the template assembly.

The depth of the recess of this template assembly was measured. As shown in Table 1, the difference from the target depth was an average (Ave) of $-0.51 \mu\text{m}$, and a maximum of $4.8 \mu\text{m}$ on the plus side (Max) and $6.5 \mu\text{m}$ on the minus side (Min). As shown in Table 2, the in-plane variation in depth was an average (Ave) of $5.3 \mu\text{m}$ and a maximum (Max) of $7 \mu\text{m}$ in terms of the range of eight measurement points. It was revealed from these results that the precision of the depth of the recess was greatly improved compared with the results in comparative examples 1 and 2 as described later.

[0042]

At that time, the depth of the recess was measured in the following manner. As shown in FIG. 11, the workpiece was marked at eight points in its plane within 1 to 2 mm away from its outer circumference. The thickness of the marked portions was measured (this measured thickness is referred to as workpiece thickness). This workpiece was put into the recess of the template assembly. The thickness of the marked portions of the workpiece was measured while a load of 100 g/cm^2 was applied to the workpiece (this measured thickness is referred to as workpiece-portion thickness).

The thickness of the template was also measured at a position of 1 to 2 mm away from the inner circumference of the template toward the outer circumference (this measured thickness is referred to as template thickness). These measured values were used to calculate the depth of the recess by using the following expression. The average of the eight points and its range were used as the central value of the recess depth.

$$\text{Recess depth} = \text{template thickness} - (\text{workpiece-portion thickness} - \text{workpiece thickness})$$

These thicknesses were measured with a height gage HDF-300N made by Mitutoyo Corp.

[0043]

Then, 300-mm-diameter silicon wafers were polished with a polishing apparatus, as shown in FIG. 8, having the template assembly produced in example 1 to evaluate flatness and surface defects of the wafers. The flatness was evaluated by roll off measurement with an edge roll off measuring system LER-310M made by Kobelco Research Institute.

[0044]

The portion of 3 to 6 mm away from the outer circumference was regarded as a reference surface to calculate the value of roll off. The roll off was measured on four wafers at 0.5mm, 0.7 mm, 1.0 mm, and 2.0 mm away from their outer circumference.

Table 3 shows the average of roll off values at these points. Table 4 shows the relationship between the difference in the recess depth from the target depth shown in Table 1 and the roll off shown in Table 3. As shown in FIG. 4, the difference in the recess depth from the target depth was a minus value (the recess depth was shallower). As the absolute value of this difference

increased, the template was more difficult to reduce the polishing pressure of the outer circumferential portion of the workpiece. In particular, the roll off was significantly changed at 0.5 mm away from the outer circumference, which is easy to be affected by the recess depth.

[0045]

FIG. 5 shows the average (Ave), the maximum (Max), and the minimum (Min) of the roll off at 0.5 mm away from the outer circumference of each wafer. FIG. 6 shows radar charts that demonstrate how the positions of the roll off were changed at the measured eight points in the plane.

As shown in FIGs. 5 and 6, example 1 carried out a further improvement in the roll off and a greater improvement in the in-plane variation compared with comparative examples 1 and 2 as described later, because example 1 achieved substantially the same recess depth as the target depth.

In addition, as shown in FIG. 6, the radar chart exhibits substantially concentric circles, which means that the in-plane variation in the roll off was inhibited.

[0046]

FIG. 7 shows the result of the surface defects of the wafers. As shown in FIG. 7, the occurrence of the surface defects of the wafers was inhibited compared with the result in comparative example 3 as described later.

The surface defects were evaluated with Magics 350 made by Lasertec Corporation as values converted such that the total number of defects in comparative example 1 was regarded as 1.0.

[0047]

(Example 2)

The inventive template assembly was produced in the same manner as example 1 except that the thickness of the template was 10 μm thinner than the thickness in example 1 and the thickness of the notch was 20 μm thinner than the thickness of the backing pad. The same evaluation as example 1 was conducted. It is to be noted that the thickness of this notch was adjusted such that although the used template was 10 μm thinner than the thickness in example 1, the depth of the recess when a load of 100 g/cm² was applied to the workpiece became substantially the same as in example 1 by pressing the peripheral portion of the backing pad with the template.

[0048]

The depth of the recess of this template assembly was measured. As shown in Table 1, the difference from the target depth was an average of -0.43 μm , and a maximum of 2.0 μm on the plus side and 2.8 μm on the minus side. As shown in Table 2, the in-plane variation in depth was an average of 5.8 μm and a maximum of 7 μm in terms of the range of eight measurement points. It was revealed from these results that the precision of the depth of the recess was greatly improved compared with the results in comparative examples 1 and 2 as described later.

[0049]

Then, 300-mm-diameter silicon wafers were polished with a polishing apparatus, as shown in FIG. 8, having the template assembly produced in example 2 to evaluate flatness and surface defects of the wafers as in example 1.

Although example 2 used the template having the

different thickness from the thickness in example 1 as above, since the recess depth was substantially the same as example 1, the same result of the roll off of the polished wafers was obtained. It was revealed from the radar chart shown in FIG. 6 that the in-plane variation in roll off was inhibited as in example 1.

FIG. 7 shows the result of the surface defects of the wafers. As shown in FIG. 7, the occurrence of the surface defects of the wafers was inhibited compared with the result in comparative example 3 as described later.

[0050]

The roll off values of the polished wafers in examples 1 and 2 were on the same level. The in-plane variations of the roll off were also on the same level. More specifically, even when the template is thinned like example 2, the recess having the target depth can be formed by adjusting the thickness of the notch. This allows the template to have a thinner thickness than the conventionally required thickness, even when a deep recess, which may reduce slurry supply to the wafer surface during polishing, is chosen, for example, in consideration for the effect of the compressibility of a polishing pad to be used. The roll off and the surface defects of the wafers can thereby be improved while the reduction in slurry supply to the workpiece surface is inhibited during polishing.

[0051]

(Comparative example 1)

The same evaluation as example 1 was conducted by using a conventional template assembly, which is commercially available, having a template stuck on the outer circumferential portion of the lower surface of a

baking pad as shown in FIG. 9 without performing lapping and polishing on the template.

The depth of the recess of this template assembly was measured. As shown in Table 1, the difference from the target depth was an average of $-4.46\text{ }\mu\text{m}$, and a maximum of $11.0\text{ }\mu\text{m}$ on the plus side and $16.9\text{ }\mu\text{m}$ on the minus side. As shown in Table 2, the in-plane variation in depth was an average of $15.63\text{ }\mu\text{m}$ and a maximum of $26\text{ }\mu\text{m}$ in terms of the range of eight measurement points. It was revealed from these results that the precision of the depth of the recess was considerably worse compared with the results in examples 1 and 2.

[0052]

Then, 300-mm-diameter silicon wafers were polished with a polishing apparatus, as shown in FIG. 8, having the template assembly in comparative example 1 to conduct the same evaluation as example 1.

As shown in Tables 1 and 2, since the difference in the recess depth from the target depth in comparative example 1 was larger than those in examples 1 and 2, the roll off and the in-plane variation were also larger. It was revealed from the radar chart shown in FIG. 6 that some wafers had a deviation in roll off in its plane.

[0053]

FIG. 7 shows the result of the surface defects of the wafers. As shown in FIG. 7, since the template assembly used in comparative example 1 had no space between the template and the backing pad unlike FIG. 10, the occurrence of the surface defects of the wafers was inhibited compared with comparative example 3.

[0054]

(Comparative example 2)

The same evaluation as comparative example 1 was conducted by using the same template assembly as comparative example 1 except that the template was lapped.

The depth of the recess of this template assembly was measured. As shown in Table 1, the difference from the target depth was an average of $-3.04\text{ }\mu\text{m}$, and a maximum of $8.9\text{ }\mu\text{m}$ on the plus side and $10.9\text{ }\mu\text{m}$ on the minus side. As shown in Table 2, the in-plane variation in depth was an average of $9.77\text{ }\mu\text{m}$ and a maximum of $16\text{ }\mu\text{m}$ in terms of the range of eight measurement points.
[0055]

It was revealed that although the precision of depth of the recess was improved by performing lapping on the template compared with comparative example 1, this precision of depth was considerably worse compared with the results in examples 1 and 2.
[0056]

Then, 300-mm-diameter silicon wafers were polished with a polishing apparatus, as shown in FIG. 8, having the template assembly in comparative example 2 to evaluate the flatness as in example 1.

As shown in Tables 1 and 2, since the difference in the recess depth from the target depth in comparative example 2 was smaller than that in comparative example 1, the roll off and in-plane variation were improved compared with comparative example 1, but significantly worse than those in examples 1 and 2. It was revealed from the radar chart shown in FIG. 6 that some wafers had a deviation in roll off in its plane like comparative example 1 and the variation in the roll off at the outer circumference was not inhibited.
[0057]

Since the difference in the recess depth from the target depth can be reduced by an adjustment of the thickness of components to be used or an improvement of sticking method, the average of roll off can be improved to some degree as demonstrated in comparative example 2. The in-plane variation in roll off, however, cannot be improved. In contrast, the inventive template assembly can also improve this in-plane variation as above.

Table 1 shows summarized results of the difference in the recess depth from the target depth in examples 1 and 2 and comparative examples 1 and 2. Table 2 shows summarized results of the in-plane variation in the recess depth in examples 1 and 2 and comparative examples 1 and 2.

[0058]

(Table 1)

	COMPARATIVE EXAMPLE 1	COMPARATIVE EXAMPLE 2	EXAMPLE 1	EXAMPLE 2
N	40	26	10	5
Ave	-4.46	-3.04	-0.51	-0.43
S	7.37	6.00	3.53	2.03
Max	11.0	8.9	4.8	2.0
Min	-16.9	-10.9	-6.5	-2.8

[0059]

(Table 2)

	COMPARATIVE EXAMPLE 1	COMPARATIVE EXAMPLE 2	EXAMPLE 1	EXAMPLE 2
N	40	26	10	5
Ave	15.63	9.77	5.30	5.80
S	4.91	2.67	1.64	1.30
Max	26.0	16.0	7.0	7.0
Min	8.0	6.0	2.0	4.0

[0060]

(Table 3)

	DIFFERENCE IN RECESS DEPTH FROM TARGET DEPTH	ROLL OFF			
		0.5mm	0.7mm	1.0mm	2.0mm
comparative example 1	-4.46	0.27	0.10	0.05	0.01
comparative example 2	-3.04	0.23	0.08	0.04	0.01
example 1	-0.51	0.13	0.07	0.03	0.00
example 2	-0.43	0.12	0.08	0.03	0.00

[0061]

(Comparative example 3)

With a polishing apparatus, as shown in FIG. 8, having a conventional template assembly with a template having no notch as shown in FIG. 10, 300-mm-diameter silicon wafers were polished to evaluate the in-plane variation in the recess depth and surface defects of the wafers as in example 1.

The result was that although the same level of the in-plane variation in the recess depth as examples 1 and 2 was obtained, the surface defects of the wafers were degraded compared with examples 1 and 2 and comparative example 1. It can be understood that these surface defects were due to particles generated by slurry entering the space between the template and the backing pad during polishing.

[0062]

It is to be noted that the present invention is

not limited to the foregoing embodiment. The embodiment is just an exemplification, and any examples that have substantially the same feature and demonstrate the same functions and effects as those in the technical concept described in claims of the present invention are included in the technical scope of the present invention.

CLAIMS

1. A template assembly configured to hold a workpiece in polishing of the workpiece, comprising:

a polyethylene terephthalate (PET) base;

an annular template adhering to an outer circumferential portion of a lower surface of the PET base, the template having an annular notch formed at an upper portion of an inner surface of the template; and

a discoid backing pad whose peripheral portion is fitted into the notch, the backing pad adhering to a central portion of the lower surface of the PET base, wherein

a recess configured to receive and hold the workpiece during polishing is defined by the inner surface of the template and a lower surface of the backing pad.

2. The template assembly according to claim 1, wherein the notch has a thickness equal to or less than a target thickness of the backing pad.

3. The template assembly according to claim 1 or claim 2, wherein the template is made of glass epoxy resin.

4. The template assembly according to any one of claims 1 to 3, wherein in-plane variation in depth of the recess is equal to or less than 10 μm .

5. A method of producing a template assembly according to any one of claims 1 to 4, comprising:

preparing the annular template having the annular

notch formed at the upper portion of the inner surface of the template;

sticking the discoid backing pad on the central portion of the PET base; and

sticking the template on the outer circumferential portion of the lower surface of the PET base such that the peripheral portion of the backing pad is fitted into the notch of the template.

6. The method according to claim 5, wherein the step of preparing the template includes:

preparing a substrate for the template;

cutting the prepared substrate into an annular shape; and then

forming the notch by grinding an upper portion of an inner surface of the annular substrate.

7. The method according to claim 5 or claim 6, wherein the step of preparing the template includes:

before forming the notch, lapping and/or polishing the template such that in-plane variation in thickness of the template is equal to or less than 10 μm .