【DESCRIPTION】

【Invention Title】

POLISHING PAD

【Technical Field】

The present invention relates to a polishing pad.

【Background Art】

Chemical mechanical polishing (CMP) is a core process of flattening and mirroring wafers or glass panels, and polishing is performed by a mechanical and chemical action of a polishing pad and slurry containing nanoparticles.

FIG. 1 is a schematic diagram of a CMP device. The CMP device performs polishing by pressing a polishing object 2 (e.g., wafer) on a surface of a waste polishing pad 6 fixed to a rotary table 1 (platen) while a carrier 3 firmly holds the polishing object. Specifically, liquid slurry (abrasive) is applied from a nozzle 5 to the polishing pad 6 while the carrier 3 and the rotary table 1 each rotate independently, so the chemical and mechanical polishing is performed. In addition, as a conditioner 4 is pressed against the polishing pad at a position spaced apart from the polishing object 2 during a polishing process, the surface of the polishing pad is roughened, so the surface state of the polishing pad remains rough.

The polishing pad is one of the main consumables used in the chemical mechanical polishing process, and is made of a soft polymer material to increase surface mirroring performance, and

contains numerous grooves and pores on its surface to efficiently discharge polishing by-products generated during the polishing process and supply slurry.

Since the polishing pad is always exposed to an environment of continuous mechanical friction between high-hardness nano-abrasive particles and a polishing target material, micro-pores on the surface are clogged and the unevenness of the surface responsible for the polishing is worn, thereby reducing the polishing performance over time. Therefore, the polishing performance is prevented from deteriorating through a pad surface conditioning process that periodically grinds the surface.

Since there is no realistic recycling plan for the polishing pad that have been used for a certain period of time, the polishing pad is disposed of as industrial wastes. However, since the consumption of the polishing pad is gradually increasing and the disposal of the polishing pad causes environmental pollution, intensive research on recycling methods such as recycling is required.

As the conventional technologies for recycling the waste polishing pad, a method of using a compensating material to compensate for a worn portion of a waste polishing pad, a method of recycling a waste polishing pad by disassembling and reassembling components such as upper and lower pads that constitute the waste polishing pad, etc., have been known.

However, these methods do not meet economic feasibility

in terms of recycling efficiency of the waste polishing pad. In addition, in this recycling process, the existing polished surface is ground and flattened, and a new groove is formed on the flattened surface. Since the pore shape of the flattened surface is damaged due to pressure, friction, etc., applied during the grinding process, there was a problem of not ensuring sufficient roughness of the polished surface of the recycled polishing pad.

[Patent Document]

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【Disclosure】

【Technical Problem】

The present invention is devised to solve the above-described problems of the related art, and

it is an object of the present invention to provide a polishing pad that has polishing performance comparable to a new polishing pad and has excellent flatness even if a waste polishing pad is recycled and used.

It is another object of the present invention to provide a recycled polishing pad with excellent polishing performance manufactured by the recycling method.

【Technical Solution】

To achieve the object, the present invention provides a polishing pad, including:

an upper pad on which a groove is formed and a lower pad located below the upper pad,

wherein the polishing pad has a Cp value of 0.10 to 1.3, represented by Equation 1 below.

[Equation 1]

Cp = Compression ratio × Thickness change rate/100

【Advantageous Effects】

According to the present invention, since the waste polishing pad is recycled through the simple process, the polishing pad provides the very excellent recycling efficiency and the polishing performance comparable to that of a new polishing pad.

In addition, according to the present invention, since the polishing pad has excellent polishing performance, the polishing pad can be used in the CMP process without the deterioration in performance due to the recycling.

【Description of Drawings】

FIG. 1 is a perspective view illustrating a structure of a representative CMP device.

FIG. 2 is a cross-sectional view illustrating a method of manufacturing a polishing pad according to an embodiment of the present invention.

FIG. 3 is a flowchart of the method of manufacturing a polishing pad according to an embodiment of the present

invention.

FIG. 4 is a schematic diagram of a polishing pad according to an embodiment of the present invention.

FIG. 5 is a graph explaining a method of calculating a compression ratio of the polishing pad according to an embodiment of the present invention.

【Best Mode】

Hereinafter, the embodiments of the present invention will be described in detail with reference to the accompanying drawings so that those skilled in the art may easily practice the present invention. However, the present invention may be implemented in various different forms, and is not limited to the embodiments described herein. Throughout this specification, similar components will be denoted by like reference numerals.

When a component is referred to as being "connected to, coupled to, or installed in" another component, it should be understood that it may be directly connected to or installed in another component, but other components may exist therebetween. On the other hand, when a component is referred to as being "directly connected to, provided in, or installed in" another component, it should be understood that no other components exist therebetween. Meanwhile, other expressions describing a relationship between components, that is, "~ on upper portion," "directly on upper portion," "~ between," "~ directly between," "~ neighboring to," "~directly neighboring to" and the like,

should also be similarly interpreted.

FIG. 2 is a cross-sectional view illustrating a method of manufacturing a polishing pad according to an embodiment of the present invention, and FIG. 3 is a flowchart of a method of recycling a polishing pad according to an embodiment of the present invention. Hereinafter, the method of manufacturing a polishing pad according to the present invention will be described with reference to FIGS. 2 and 3.

As shown in FIG. 2, the method of manufacturing a polishing pad according to the present invention includes the steps of:

a) separating an adhesive layer 14 of a lower surface of a lower pad 13 from a waste polishing pad 100;

b) grinding a polished surface on which the groove 15 of the waste polishing pad 100 is formed and then flattening the polished surface;

c) forming a groove 17 on the polished surface of the flattened waste polishing pad; and

d) forming the adhesive layer 14 on the lower surface of the lower pad 13 of the waste polishing pad.

As the conventional technologies for recycling the waste polishing pad, a method of using a compensating material to compensate for a worn portion of a polishing pad, a method of recycling a polishing pad by disassembling and reassembling

components such as upper and lower pads that constitute the polishing pad, etc., have been known.

However, these methods are difficult to use in practice due to low recycling efficiency and subsequent low economic feasibility.

The present invention provides excellent roughness to a polished surface by restoring a pore shape damaged during the grinding process through grinding treatment, and thus has a feature of providing polishing performance comparable to that of a new polishing pad.

In an embodiment of the present invention, the flattening step of step b) may be performed by a method of grinding 0.3 mm to 1.3 mm, preferably 0.3 mm to 1.0 mm, and more preferably 0.3 mm to 0.8 mm downward from a bottom of a groove.

In an embodiment of the present invention, the thickness of the flattened polishing pad in the step b) may be 2 mm or more, preferably 2.0 to 3.0 mm, and more preferably 2.5 to 2.9 mm.

In the polishing pad manufactured in this way, the thickness of the upper pad may be 0.6 to 1.7 mm, preferably 0.9 to 1.7 mm, more preferably 1.2 to 1.6 mm, and most preferably 1.4 to 1.6 mm.

In addition, in the polishing pad, the thickness of the lower pad may be 0.7 to 1.4 mm, and preferably 0.8 to 1.3 mm.

In an embodiment of the present invention, the method of recycling the waste polishing pad may not include performing a separate conditioning process. In the related art, a conditioning process was performed to restore the damaged roughness. However, the conditioning process is not a process of restoring the damaged pores, but forms roughness by scratching the pores of the polished surface, so the roughness of the polished surface may not be fundamentally formed, and the effect does not also last for a long time.

The present invention solves this problem through the process of grinding the damaged part, so sufficient roughness may be provided to the polished surface and the effect may be also maintained for a long period of time.

In an embodiment of the present invention, a process of washing the waste polishing pad may be further performed between the steps a) and steps b). In this case, the washing method is not particularly limited and may be performed by a method known in the art.

In an embodiment of the present invention, the upper pad of the waste polishing pad may be made of a porous polyurethane material, but is not limited to this material.

In an embodiment of the present invention, the groove 17 may have a depth of about 0.8 mm to about 1.0 mm, but the depth of the groove is not limited thereto. The groove may have a uniform depth or may have different depths. The process of

forming the groove may be performed by the method known in the art.

The present invention provides the recycled polishing pad recycled by the above method.

The recycled polishing pad of the present invention restores physical properties by grinding the polished surface to a certain thickness, thereby providing excellent roughness to the polished surface for a long period of time.

Hereinafter, the polishing pad manufactured in the present invention will be exemplarily described with reference to FIG. 4.

The present invention provides a polishing pad including an upper pad on which a groove is formed and a lower pad located below the upper pad, in which the polishing pad has a Cp value of 0.10 to 1.3, represented by Equation 1 below.

[Equation 1]

Cp = Compression ratio × Thickness change rate/100

The polishing pad includes an upper pad 11 on which a groove is formed. The upper pad 11 includes a polished surface with a plurality of first grooves 17. The grooves 15 support a large flow of slurry on a surface of the polishing pad. The grooves 17 have a depth of about 0.8 mm to about 1.0 mm.

The upper pad 11 may be made of a porous polyurethane

material and may have pores that support fine flow, but is not limited thereto.

In some embodiments, the polishing pad may include a first adhesive layer 12, a lower pad 13, and a second adhesive layer 14.

The lower pad 13 located below the upper pad may be made of a material that has resilience against a force pressing a substrate, and functions to evenly support the upper pad 11 by buffering the force. The lower pad 13 may be, for example, a polyurethane foam lower layer pad, an impregnated felt lower layer pad, a microporous polyurethane lower layer pad, a sintered urethane lower layer pad, or a polyolefin foam lower layer pad, but is not limited thereto. Generally, the lower pad 13 has lower hardness than the upper pad 11. In addition, the lower pad 13 may have greater compressibility than the upper pad 11.

The first adhesive layer 12 may be positioned between the upper pad 11 and the lower pad 13 to attach the lower pad 13 to the upper pad 11. The second adhesive layer 14 may be provided between the lower pad 13 and the platen to fix the polishing pad 100 to the rotary table (platen) of the polishing device (FIG. 1). The first adhesive layer 12 and the second adhesive layer 14 may include a pressure sensitive adhesive (PSA) or a hot melt adhesive (HMA). For example, a pressure sensitive adhesive may be an adhesive containing a polyacrylic component, an epoxy component, or a rubber component, or a double-sided pressure

sensitive adhesive tape in which an adhesive material is applied to both sides of a substrate (e.g., PET film or felt), but is not limited thereto. For example, the hot melt adhesive may be a cured reactive hot melt adhesive, but is not limited thereto.

The polishing pad has a Cp value of 0.10 to 1.3, represented by Equation 1 below.

[Equation 1]

Cp = Compression ratio × Thickness change rate/100

The inventors of the present invention found that when grinding the upper layer of the upper pad in order to reuse the waste polishing pad, the thicknesses of each of the upper and lower pads of the polishing pad has a specific range, so that the compression ratio of the entire polishing pad and the thickness change rate of the entire polishing pad may have different values, and after quantifying these values, depending on the resulting value of multiplying these values, the polishing performance and flatness of the recycled polishing pad may have good values.

As a result, the polishing pad of the present invention is characterized in that the recycled polishing pad has good polishing performance when the Cp value represented by Equation 1 below is 0.10 to 1.3.

When the compression ratio is expressed as %, the Cp value uses only numbers excluding % as a value. In addition, the

percentage value obtained by dividing the thickness change rate represented by % by 100 is used.

For example, in the case of the polishing pad with a compression ratio of 1.4% and a thickness change rate of 26.5%, the Cp value is 0.37, which is 1.4 multiplied by 0.265.

In the present invention, the Cp value may be 0.10 or more, 0.13 or more, 0.20 or more, 0.35 or more, 0.65 or more, 0.85 or more, 1.0 or more, and 1.20 or more, and may be 1.3 or less, 1.0 or less, 0.80 or less, 0.60 or less, 0.45 or less, and 0.20 or less.

When the Cp value is lower than 0.10, the improvement in pad performance due to recycling as a recycled pad is insignificant, and when the Cp value is higher than 1.3, there is a problem of poor polishing performance.

In an embodiment of the present invention, the thickness of the polishing pad may be 2 mm or more, preferably 2.0 to 3.0 mm, and more preferably 2.5 to 2.9 mm.

In an embodiment of the present invention, the thickness of the upper pad may be 0.6 to 1.7 mm, preferably 0.9 to 1.7 mm, more preferably 1.2 to 1.6 mm, and most preferably 1.4 to 1.6 mm.

In an embodiment of the present invention, the thickness of the lower pad may be 0.7 to 1.4 mm, and preferably 0.8 to 1.3 mm.

In an embodiment of the present invention, the thickness

change rate in Equation 1 above is the ratio of the current thickness to the thickness of the initially manufactured polishing pad, and may be specified through Equation 2 below.

[Equation 2]

Thickness change rate (%) = (initial pad thickness - pad thickness during analysis) × 100/initial pad thickness

In an embodiment of the present invention, the polishing pad may have a polishing performance of 2,000 to 2,650 A/min.

In an embodiment of the present invention, the lower pad may have a compression ratio of 1 to 8%.

In the present invention, the compression ratio may be measured by Equation 3 below, and Equation 3 below may be calculated specifically through FIG. 5.

[Equation 3]

Compression ratio(%) = (L3-L4) x 100/L3

(The L3 is an initial thickness of a second cycle when measuring the compression ratio in a viscoelastic device, and the L4 is a thickness during the second 30 second loading.)

Specifically, referring to FIG. 5, when repeatedly measuring 1500g of prepared specimen (5×5 cm) in a viscoelastic device with a loading time of 30 seconds and an unloading time of 30 seconds, respectively, twice, the L3 and L4 are each set as an initial thickness of second cycle and set as the thickness during the second 30 second loading.

The compression ratio may be 1% or more, 2% or more, 4%

or more, 6% or more, and may be 8% or less, 6% or less, and 4% or less. When the compression ratio is less than 1%, there is a problem of polishing unevenness due to low polishing uniformity on the entire surface of the wafer during the CMP polishing process, and when the compression ratio exceeds 8%, even if the pad is recycled, a pad life time during which the pad may be actually used is too short, making it difficult to apply the pad to the polishing process.

In addition, when the compression ratio is too low, the polishing unevenness occurs, so the pad may be designed to secure the polishing uniformity by attaching a pad with compression characteristics to a lower portion of the high-hardness top pad.

In an embodiment of the present invention, the polishing pad may be a recycled polishing pad that is used by recycling the waste polishing pad.

【Mode for Invention】

Hereinafter, the present invention will be described in detail with reference to Examples. However, the embodiments according to the present invention may be modified into various other forms, and the scope of the present invention should not be construed as being limited to the embodiments described in detail below. The Examples of the present invention are provided to more completely explain the present invention to those with average knowledge in the art.

Example 1: Recycling of Polishing Pad

[Examples 1-1 to 1-6 and Comparative Example 1-1]

The same type of polishing pad discarded after use was obtained and the thickness of the upper pad was measured. The thickness of the upper pad was 1.9 mm, the thickness of the lower pad was 1.4 mm, and the initial thickness of the pad before use was 3.3 mm. The compression ratio of the lower pad was 6%.

Regarding this, the recycling process was performed as follows.

First, an adhesive layer bonded to the lower pad was separated and removed from the waste polishing pad. Next, the waste polishing pad was washed and dried. Next, the polished surface of the dried waste polishing pad was ground to different thicknesses for each Example and Comparative Example through turning using lathe processing, and then the polished surface was flattened.

Next, the waste polishing pad was recycled by forming a groove on the polished surface of the waste polishing pad using groove processing equipment (CNC). Thereafter, one side of the double-sided adhesive tape was attached to the lower surface of the recycled polishing pad, and then the lower layer pad with a thickness of 1.4 mm was attached to complete the recycled pad. As the lower pad, the same lower pad as the initially used pad was used.

The results were shown in Table 1 below.

[Examples 2-1 to 2-5 and Comparative Example 2-1]

Except that the thickness of the upper layer pad is 1.9mm, the thickness of the lower layer pad is 0.8mm, the initial thickness of the pad before use is 2.7mm, and the compression ratio of the lower pad is 2.5%, the pad discarded after use as in Example 1 was used to perform the recycling process, and was ground at different thicknesses for each Example and Comparative Example.

Thereafter, one side of the double-sided adhesive tape was attached to the lower surface of the recycled polishing pad, and then the lower pad with a thickness of 0.8mm was attached to complete the recycled pad. As the lower pad, the same lower pad as the initially used pad was used.

The results were shown in Table 2 below.

[Examples 3-1 to 3-3 and Comparative Example 3-1]

Except that the thickness of the upper pad is 1.9mm, the thickness of the lower pad is 1.4mm, the initial thickness of the pad before use is 3.5mm, and the compression ratio of the lower pad is 15.0%, the pad discarded after use as in Example 1 was used to perform the recycling process, and the grinding was performed at different thicknesses for each Example and Comparative Example.

Thereafter, one side of the double-sided adhesive tape was attached to the lower surface of the recycled polishing pad,

and then the lower pad with a thickness of 1.4mm was attached to complete the recycled pad. As the lower pad, the same lower pad as the initially used pad was used.

The results were shown in Table 3 below.

[Examples 4-1 to 4-4 and Comparative Example 4-1]

Except that the thickness of the upper pad is 1.55mm, the thickness of the lower pad is 1.4mm, the initial thickness of the pad before use is 3.0mm, and the compression ratio of the lower pad is 10.0%, the pad discarded after use as in Example 1 was used to perform the recycling process, and the grinding was performed at different thicknesses for each Example and Comparative Example.

Thereafter, one side of the double-sided adhesive tape was attached to the lower surface of the recycled polishing pad, and then the lower pad with a thickness of 1.4mm was attached to complete the recycled pad. As the lower layer pad, the same lower pad as the initially used pad was used.

The results were shown in Table 4 below.

Experimental Example 1: Evaluation of Compression Ratio and Polishing Performance of Recycled Polishing Pad

The results of the compression ratio, thickness change rate, Cp value, and polishing performance of the manufactured recycled pad were summarized as follows.

Specifically, each recycled polishing pad was attached to

the CMP device shown in FIG. 1, the polishing performance on the wafer was evaluated, and the results were shown in Tables 1 to 5 below.

<CMP Process Condition>

Polishing table rotation speed (rpm): 120

Carrier rotation speed (rpm): 120

Wafer pressure (psi): 3.0

Slurry flow rate (fumed silica), 240 ml/min

Polishing time (sec): 60

<Method of Measuring Compression Ratio>

In the present invention, the compression ratio refers to a value that indicates the degree to which a volume of an object is likely to change when force is applied to the object. The calculation of the compression ratio in the present invention is as follows.

1) Preparation

Pad specimen size (width × length): 5cm × 5cm

Viscoelasticity measuring instrument (VMS, GNP company)

Maintain constant temperature and humidity (25°C 50%RH)

2) Measurement

- Condition: Measuring Cycle: 2

Loading Time: 30

Unloading Time: 30

- Calculation: First, calculate the compression ratio using L3 and L4 as shown in the graph.

Here, the L3 is an initial thickness of a second cycle when measuring the compression ratio in a viscoelastic device, and the L4 is a thickness at the time during the second 30 second loading.

Specifically, referring to FIG. 5, when repeatedly measuring 1500g of prepared specimen (5×5 cm) in a viscoelastic device, by a loading time of 30 seconds and an unloading time of 30 seconds, respectively, twice, the L3 and L4 are each set as an initial thickness of second cycle and set as the thickness during the second 30 second loading.

This value refers to the second cycle compression amount. Thereafter, the compression ratio is calculated as shown in Equation 3 below.

[Equation 3]

$$\text{Compression ratio}(\%) = (L3-L4) \times 100 / L3$$

[Table 1]

	Total thickness of pad (mm)	Thickness change rate compared to initial (%)	Total pad compression ratio (%)	Cp*	Polishing performance (A/min)	Pad life time (hr)**
Example 1-1	3	11.8	0.95	0.11	2650	25.7
Example 1-2	2.9	14.7	1.1	0.16	2500	-
Example 1-3	2.7	20.6	1.3	0.27	2450	-
Example 1-4	2.5	26.5	2.5	0.66	2300	-
Example 1-5	2.3	32.4	3	0.97	2200	-

Example 1-6	2.1	38.2	3	1.15	2100	-
Comparative Example 1-1	1.8	47.1	4	1.88	800	-

*Cp = Compression ratio × thickness change rate/100

**Pad life time: Usable time when predicting pad usability range based on Cp

[Table 2]

	Total thickness of pad (mm)	Thickness change rate compared to initial (%)	Total pad compression ratio (%)	Cp*	Polishing performance (A/min)	Pad life time (hr)
Example 2-1	2.4	20.0	0.9	0.18	2800	22.9
Example 2-2	2.2	26.7	1.51	0.40	2700	-
Example 2-3	2	33.3	2	0.67	2500	-
Example 2-4	1.8	40.0	2.2	0.88	2300	-
Example 2-5	1.6	46.7	2.3	1.07	2100	-
Comparative Example 2-1	1.2	60	2.5	1.44	700	-

[Table 3]

	Total thickness of pad (mm)	Thickness change rate compared to initial (%)	Total pad compression ratio (%)	Cp*	Polishing performance (A/min)	Pad life time (hr)
Example 3-1	3.3	8.6	6	0.51	2300	8.6
Example 3-2	3.2	5.7	7	0.40	2100	-
Example 3-3	3	14.3	8	1.14	2000	-
Comparative Example 3-1	2.5	28.6	9	2.57	2300	-

[Table 4]

	Total thickness of pad (mm)	Thickness change rate compared to initial (%)	Compression ratio (%)	Cp*	Polishing performance (A/min)	Pad life time (hr)
Example 4-1	2.9	3.3	3.5	0.12	2500	14.3

Example 4-2	2.7	10.0	4	0.40	2300	-
Example 4-3	2.5	16.7	4.8	0.80	2200	-
Example 4-4	2.4	20.0	5.5	1.10	2100	-
Comparative Example 4-1	2.3	23.3	6.3	1.47	1800	-

From the experimental results in Tables 1 to 4 above, it could be confirmed that the polishing performance of a certain level or higher may be secured when each polishing pad sample is ground and recycled to a certain thickness that satisfies the Cp value in the certain range of 0.10 to 1.3.

However, in the case of Comparative Examples 1-1 to 4-1, it was confirmed that the polishing performance was not secured and it was not easy to use as the recycled pad.

In addition, in the case of Example 1 listed in Table 1, the time taken to start using Example 1-1, which is used as an actual recycled pad, and to use the pad of Example 1-6, which is the last level of pad that can be used as a pad, was defined as the pad life time. Through this, the time during which the recycled pad could actually be used was predicted. To calculate specifically, when calculating based on the pad wear rate of 35 μm/hr, it was possible to predict that approximately 25.7 hours of use would be possible through the calculation of 0.9*1000/35.

Similarly, in the case of Example 2 shown in Table 2, a result of calculating the pad life time using the pad of Example 2-1 until the pad of Example 2-5 was used, it was predicted that approximately 22.9 hours of use would be possible by the

calculation of 0.8*1000/35.

Similarly, in the case of Example 3 shown in Table 3, a result of calculating the pad life time using the pad of Example 3-1 until the pad of Example 3-3 was used, it was predicted that approximately 8.6 hours of use would be possible by the calculation of 0.3*1000/35.

Similarly, in the case of Example 4 shown in Table 4, a result of calculating the pad life time using the pad of Example 4-1 until the pad of Example 4-4 was used, it was predicted that approximately 14.3 hours of use would be possible by the calculation of 0.5*1000/35.

In the case of the recycled pad, a use time of at least 20 hours or more should be secured. In cases where the compression ratio of the lower pad satisfies the range of 1 to 8% as in Example 1 or Example 2, a sufficient use time of more than 20 hours is secured. On the other hand, in the case of Example 3 or Example 4, where the compression ratio of the lower pad exceeds 8%, it was confirmed that the use time of the recycled pad was low, which significantly reduced the utility of the recycled pad.

[Description of reference numerals]

11: Upper pad 12: First adhesive layer

13: Lower pad 14: Second adhesive layer

15, 17: Groove 100: Waste polishing pad

200: Recycled polishing pad

【CLAIMS】

【Claim 1】

A polishing pad, comprising:

an upper pad on which a groove is formed and a lower pad located below the upper pad,

wherein the polishing pad has a Cp value of 0.10 to 1.3, represented by Equation 1 below.

[Equation 1]

Cp = Compression ratio × Thickness change rate/100

【Claim 2】

The polishing pad of claim 1, wherein a thickness of the polishing pad is 2.0 to 3.0 mm.

【Claim 3】

The polishing pad of claim 2, wherein a thickness of the upper pad is 0.6 to 1.7 mm.

【Claim 4】

The polishing pad of claim 2, wherein a thickness of the lower pad is 0.7 to 1.4 mm.

【Claim 5】

The polishing pad of claim 1, wherein the upper pad is made of a porous polyurethane material.

【Claim 6】

The polishing pad of claim 1, wherein the lower layer pad is any one or more of a polyurethane foam lower layer pad, an impregnated felt lower layer pad, a microporous polyurethane lower layer pad, a sintered urethane lower layer pad, or a

polyolefin foam lower layer pad.

【Claim 7】

The polishing pad of claim 1, wherein the lower pad has a compression ratio of 1 to 8%.

【Claim 8】

The polishing pad of claim 1, wherein the thickness change rate in the Equation 1 is a ratio of a current thickness to a thickness of an initially manufactured polishing pad.

【Claim 9】

The polishing pad of claim 1, wherein the polishing pad has a polishing performance of 2,000 to 2,650 A/min.

【Claim 10】

The polishing pad of claim 1, wherein the polishing pad is a recycled polishing pad that is used by recycling a waste polishing pad.