(54) Title: POLISHING PAD, POLISHING PAD TILE AND METHOD OF MANUFACTURING THE POLISHING PAD

(57) Abstract: Disclosed is a polishing pad which is employed in CMP processes such as silicon wafers, plate glass for displays, and a method of manufacturing the polishing pad. The polishing pad comprises a polishing layer (1), and a fastener mounting layer (2) attached to a back side of the polishing layer (1), wherein coupling holes (4) are performed from a surface of the polishing layer to a back side of the fastener mounting layer such that the polishing pad is fixed to a platen (J) by fasteners (F) inserted in the holes. The present invention adopts a fastener such as a bolt instead of an adhesive to attach a polishing pad to a platen, resulting in excellent adhesion therebetween and effectively preventing deterioration in polishing performance caused by lack of adhesion between the polishing pad and the platen and/or generation of scratch failures during a polishing process even by a worker substantially not highly skilled in the art.
Description

POLISHING PAD, POLISHING PAD TILE AND METHOD OF MANUFACTURING THE POLISHING PAD

Technical Field

The present invention relates to a polishing pad and a polishing pad tile which is effectively employed in chemical mechanical polishing (hereinafter referred to as "CMP") processes and, more specifically, CMP planarization of planar materials such as silicon wafers for integrated circuit chips or the like, plate glass for displays or other substrates and, in addition, which is preferably applied in texture processing of a magnetic recording medium that requires high accuracy surface finishing treatment, as well as a method of manufacturing the polishing pad.

Background Art

Silicon wafers are generally processed or polished using a chemical mechanical polishing (CMP) apparatus, which includes a lower board having a circular rotational plate equipped with a polishing pad, an upper board to closely adhere a silicon wafer to the polishing pad, and a device to feed slurry on the polishing pad.

A CMP process includes pushing a semiconductor wafer, on which an integrated circuit is formed, in an opposite direction to a driven polishing pad such that oxides including Si based deposits are removed from the wafer, and producing a planar surface with high smoothness on the wafer. During the CMP process, the wafer and an interface of the polishing pad is coated with deionized water and/or a chemically active reagent as well as a polishing solution.

With regard to polishing pads used in conventional CMP methods, Japanese Patent Laid-Open No. 2005-330621 disclosed a method for fabrication of a polishing pad with a planar surface obtained by heat treating the surface of a pad A, which is made of a non-woven fabric comprising staple fibers impregnated with polyurethane resin as an elastomer, at a temperature higher than a softening point of polyurethane resin, as illustrated in Fig. 6 thereof.

Such a polishing pad is usually fixed to a polishing platen using a holding material for fixing the polishing pad, so as to be used in a CMP process.

Japanese Patent Laid-Open No. 2003-238916 disclosed a holding material for fixing a polishing pad with a cross-sectional structure as illustrated in Fig. 7 thereof.

Referring to Fig. 7 in the above document 2003-238916, the holding material comprises a base material film B1 with a heat-sensitive adhesive layer B2 at one side,
which is adhered to a polishing pad A, and another heat-sensitive adhesive layer B3 at the other side, which is attached to a polishing platen.

Referring to Fig. 6 in the above document 2005-330621, when the polishing pad A is fixed to the platen using the adhesive material illustrated in Fig. 7, the polishing pad A is susceptible to bubble penetration to a rear side of the pad depending on workers skilled in the art and may be irregularly attached to the platen. Also, a polishing slurry may easily penetrate into an adhesive layer of the polishing pad irregularly attached to the platen and the penetrated slurry may cause the base material film B1 as the adhesive layer to be stripped and, additionally, the polishing pad to be shifted or shear strained during a polishing process. As a result, a lifetime of a polishing pad is shortened and a polished product may have deterioration in quality such as increased scratches and reduced polishing planarity. In addition, since skill of a worker significantly affects attachment conditions of a polishing pad to a platen, a process of fixing the polishing pad to the platen must be performed by a person with a high level of technical skill so as to maintain a favorable attachment condition.

According to the conventional methods described above, only one polishing pad is fixed to each platen and, therefore, the polishing pad size must be increased as a wafer to be polished has increased diameter.

For this reason, the conventional methods have difficulty in manufacture of a large size polishing pad.

In order to solve the problem of requiring complicated processes due to an increase in size of a polishing pad as described above, Korean Patent Registration No. 0485846 disclosed a mosaic type polishing pad fabricated by preparing polishing pad tiles, which are similar to separate pieces of a polishing pad, and using a holding material (that is, adhesive) illustrated in Fig. 4 of the above document 0485846 to assemble and attach the polishing pad tiles to the platen.

However, although this method can overcome the problem of fabricating a large size polishing pad, the polishing pad tiles are adhered on the platen using an adhesive, thus causing weak adhesion therebetween. Moreover, there is another problem in that attachment conditions of a polishing pad to a platen are significantly dependent on skills of workers, and thus, the process of fixing the polishing pad to the platen must be performed by a person with a high level of technical skill to maintain a favorable attachment condition, such that this issue cannot be solved.

Disclosure of Invention
Technical Problem

Accordingly, the present invention is directed to solve the problems described above in regard to conventional methods and an object of the present invention is to provide a polishing pad capable of being fixed to a platen by a fastener such as a bolt instead of using an adhesive, thereby effectively preventing deterioration in polishing performance and increased failure caused by lack of adhesion between the polishing pad and the platen during a polishing process, and a method of manufacturing the polishing pad.

Another object of the present invention is to provide a polishing pad tile capable of being fixed to a platen by a fastener such as a bolt instead of using an adhesive, thereby effectively preventing deterioration in polishing performance and increased failure caused by lack of adhesion between the polishing pad and the platen during a polishing process.

A still further object of the present invention is to provide a mosaic type polishing pad comprising polishing pad tiles to be assembled on a platen by a fastener while ensuring a space between the adjacent tiles.

Technical Solution

In order to accomplish the above objects, the present invention provides a polishing pad comprising a polishing layer 1, and a fastener mounting layer 2 attached to a back side of the polishing layer 1, wherein coupling bores 4 are perforated from a surface of the polishing layer to a back side of the fastener mounting layer such that the polishing pad is fixed to a platen J by fasteners F inserted in the bores.

In addition, the present invention provides a polishing pad tile comprising a polishing layer 1, and a fastener mounting layer 2 attached to a back side of the polishing layer 1, wherein coupling bores 4 are perforated from a surface of the polishing layer to a back side of the fastener mounting layer such that the polishing pad is fixed to a platen J by fasteners F inserted in the bores.

Further, the present invention provides a polishing pad tile comprising: a polishing layer 1, and a fastener mounting layer 2 which is provided at a back side of the polishing layer 1 and has protrusions 2a protruded at lower both sides of the fastener mounting layer 2 to be extended over the polishing layer 1 and to support a fastener F, wherein the polishing pad tile is fixed to a platen J by the fastener F supported by the protrusions 2a.

Advantageous Effects
The present invention adopts a fastener such as a bolt instead of an adhesive to attach a polishing pad to a platen, resulting in excellent adhesion therebetween and effectively preventing deterioration in polishing performance caused by lack of adhesion between the polishing pad and the platen and/or generation of scratch failures during a polishing process.

The polishing pad according to the present invention has superior planarity because of a strong bonding between the polishing pad and a high planarity rigid layer at a rear side of the polishing pad and, in addition, a fastener is used to fix the polishing pad to a platen so that the polishing pad can exhibit excellent polishing results and provide uniformly polished products even by a person substantially not skilled in the art if the polishing pad is attached or detached from the platen according to a work standard.

A mosaic type pad according to the present invention which comprises polishing pad tiles attached to a platen using a fastener instead of an adhesive has superior adhesion therebetween. Consequently, the present invention can solve fundamental problems of conventional polishing pads in that the polishing pad suffers invasion of a grinding liquid and causes an adhesive layer of the pad to be stripped, which in turn, causes the polishing pad to be shifted and/or shear strained, thus leading to non-uniform polishing and a shortened lifetime of the polishing pad.

As for a tile type polishing pad, compared to common pads that require alternative drainage holes for a grinding liquid to exhaust grinding residues as well as the grinding liquid, the inventive tile type polishing pad has a number of spaces between adjacent tiles, through which the grinding liquid and residues actively drain out.

Accordingly, the polishing pad of the present invention has excellent polishing performance and can preferably prevent polishing failure and/or generation of scratches during a polishing process.

**Brief Description of the Drawings**

The above objects, features and advantages of the present invention will become more apparent to those skilled in the related art in conjunction with the accompanying drawings. In the drawings:

- Fig. 1 is a top view illustrating a polishing pad of the present invention;
- Figs. 2 and 3 are cross-sectional views illustrating a coupling bore 4 in the polishing pad shown in Fig. 1 taken in longitudinal and transverse directions, respectively;
- Figs. 4 and 5 are cross-sectional views illustrating the polishing pad shown in Fig. 1, which is attached to a platen;
- Fig. 6 is a top view illustrating construction of a mosaic polishing pad comprising
polishing pad tiles which are attached to a platen;

[29] Figs. 7 and 8 are cross-sectional views illustrating polishing pad tiles according to an exemplary embodiment of the present invention;

[30] Figs. 9 and 10 are cross-sectional views illustrating the polishing pad tiles shown in Figs. 7 and 8, which are attached to a platen;

[31] Fig. 11 is a cross-sectional view illustrating a polishing pad tile according to another exemplary embodiment of the present invention;

[32] Fig. 12 is a cross-sectional view illustrating the polishing pad tile shown in Fig. 11, which is attached in plural to a platen;

[33] Fig. 13 is a cross-sectional view schematically illustrating a conventional polishing pad; and

[34] Fig. 14 is a cross-sectional view illustrating a holding material for fixing a conventional polishing pad.

[35] [Description of symbols for major parts in drawings]

[36] P: polishing pad J: platen F: fastener

[37] 1: polishing layer 2: fastener mounting layer

[38] 3: additional resin layer 4: coupling bore for fastener

[39] 2a: protrusion of fastener mounting layer

[40] A: pad impregnated with polyurethane resin

[41] B: holding material for grasping polishing pad

[42] B1: base film of holding material for grasping polishing pad

[43] B2: heat sensitive adhesive layer of holding material for grasping polishing pad

[44] B3: pressure sensitive adhesive layer of holding material for grasping polishing pad

**Best Mode for Carrying Out the Invention**

[45] The present invention will be more apparent from the following detailed description with accompanying drawings.

[46] As shown in Fig. 1 to 3, a polishing pad according to the present invention comprises a polishing layer 1, and a fastener mounting layer 2 attached to a back side of the polishing layer 1. Herein, coupling bores 4 are perforated from a surface of the polishing layer to a back side of the fastener mounting layer such that the polishing pad is fixed to a platen J by fasteners F inserted in the bores.

[47] Fig. 1 is a top view illustrating a polishing pad of the present invention, and Figs. 2 and 3 are cross-sectional views illustrating a coupling bore 4 in the polishing pad shown in Fig. 1 taken in longitudinal and transverse directions of the polishing pad, respectively.
A polishing layer 1 may comprise at least one selected from a pad including a non-woven fabric impregnated with elastomer, a pad consisting of only elastomer, and a pad including a non-woven fabric impregnated with elastomer and an elastomer layer laminated on the fabric.

However, structures and/or types of the polishing layer 1 used herein are not particularly limited.

A fastener mounting layer 2 may comprise a hard resin layer or a metallic sheet.

The hard resin layer type fastener mounting layer 2 may have a hardness ranging from 40 to 100 measured using a durometer type D hardness meter.

The durometer type D hardness meter is GS-702 model G hardness meter manufactured by Teclock and the hardness is measured according to ASTM D 2240 A.

A hard resin layer for fabrication of the fastener mounting layer 2 may comprise polyurethane resin, polypropylene resin, polyester resin, polyamide resin, melamine resin, epoxy resin, etc.

The metallic sheet for fabrication of the fastener mounting layer is preferably made of a corrosion-resistance material such as stainless steel, titanium and so on.

If the hard resin layer in the fastener mounting layer 2 has a hardness of less than 40, the fastener mounting layer may have a problem that it cannot support the fastener F such as a bolt.

According to the present invention, the fastener mounting layer 2 is preferably fabricated using a hard resin layer with a high hardness and/or a metallic sheet so that it enables a polishing pad to be easily attached to or detached from a platen and a polished product to exhibit uniform polishing effect independent from types of polishing apparatus.

The fastener mounting layer 2 preferably has a thickness of 2 to 10mm.

If the thickness of the fastener mounting layer is less than 2mm, using a fastener F may cause micro-deformation of a polishing pad when attached to the platen. On the other hand, if the thickness exceeds 10mm, the polishing pad is too heavy and may cause a problem in handling the same.

Referring to Fig. 3, an additional hard resin layer 3 may be inserted between the polishing layer 1 and the fastener mounting layer 2.

Preferably, the fastener F is a bolt, etc.

Preferably, the additional hard resin layer 3 includes at least one selected from polyurethane resin, polypropylene resin, polytetrafluoroethylene resin, polyester resin, polyamide resin, melamine resin and epoxy resin.
The additional hard resin layer 3 may have a hardness ranging from 40 to 100 measured using a durometer type D hardness meter.

The durometer type D hardness meter is GS-702 model G hardness meter manufactured by Teclock and the hardness is measured according to ASTM D 2240 A.

The polishing pad of the present invention is fabricated by a method comprising the steps of: preparing a polishing layer 1, attaching fastener mounting layer 2 at a rear side of the polishing layer 1, and sequentially punching the polishing layer 1 and the fastener mounting layer 2 so as to form coupling bores 4 for inserting fasteners.

Herein, the polishing pad may further comprise an additional hard resin layer 3 between the polishing layer 1 and the fastener mounting layer 2.

Preferably, the polishing layer 1 is firstly planarized before the punching step of the fastener mounting layer 2 attached to the back side of the polishing layer 1.

In order to completely bond the polishing layer 1 to the fastener mounting layer 2 and to prevent the polishing layer from being stripped, a heat sensitive adhesive layer and/or a thermally curable resin is preferably used.

When the heat sensitive adhesive layer is used to bond the polishing layer 1 to the fastener mounting layer 2, the fastener mounting layer 2 may be firstly prepared before bonding the adhesive layer. The fastener mounting layer 2 may have a thickness of 2 to 10mm in final product. It is preferable that the initial thickness of prepared fastener mounting layer ranges from 1 to 5mm sufficient to perform buffing or cutting of both sides, resulting in a planarized layer.

Using a two-component curable resin may bond the polishing layer 1 to the fastener mounting layer 2 wherein the fastener mounting layer 2 may have a thickness of 2 to 10mm in final product. Also, it is preferable that the initial thickness of prepared fastener mounting layer ranges from 1 to 5mm sufficient to perform buffing or cutting of both sides, resulting in a planarized layer.

As to bonding of the polishing layer 1 to the fastener mounting layer 2, the fastener mounting layer 2 may be fabricated after a thermally curable or UV curable resin is applied to the back side of the polishing layer 1 to prepare the additional hard resin layer 3. Herein, the bonding of the polishing layer to the fastener mounting layer may be carried out using any one of a heat sensitive adhesive layer, a pressure sensitive adhesive layer, a two-component curable resin, etc.

Additionally, the fastener mounting layer 2 provided at a back side of the polishing layer 1 is preferably subjected to punching after the polishing layer is completely bonded to the fastener mounting layer 2.
Referring to Figs. 4 and 5, a polishing pad P of the present invention is fixed to a platen J by a fastener F such as a bolt.

Figs. 4 and 5 are cross-sectional views illustrating the polishing pad shown in Fig. 1, which is attached to the platen.

Since a fastener such as a bolt used herein replaces a conventional adhesive in attachment of the polishing pad to the platen, the polishing pad can exhibit improved adhesion to the platen and effectively solve problems of conventional methods including, for example, deterioration in polishing performance caused by lack of adhesion between the polishing pad and the platen and/or generation of scratches during a polishing process. Moreover, the polishing pad can maintain improved coupling conditions even by a worker substantially not highly skilled in the art.

Referring to Figs. 7 and 8, a tile type polishing pad comprises a polishing layer 1, and a fastener mounting layer 2 attached to a back side of the polishing layer 1, wherein coupling bores 4 are perforated from a surface of the polishing layer 1 to a back side of the fastener mounting layer 2 such that the polishing pad is fixed to a platen J by a fastener F inserted in the bores 4.

According to the present invention, a number of polishing pad tiles are used as polishing pad pieces to fabricate a mosaic type polishing pad and are attached to a platen to form the polishing pad in a mosaic design.

As illustrated in Fig. 6 and Figs. 9 and 10, the mosaic polishing pad of the present invention is fabricated by assembling a number of polishing pad tiles P on a platen J by a fastener F while forming spaces between adjacent tiles.

Fig. 6 is a top view illustrating construction of a mosaic type polishing pad comprising polishing pad tiles which are attached to a platen, Figs. 7 and 8 are cross-sectional views illustrating polishing pad tiles according to an exemplary embodiment of the present invention, and Figs. 9 and 10 are cross-sectional views illustrating the polishing pad tiles shown in Figs. 7 and 8, which are attached to a platen.

The polishing layer 1 is at least one selected from a pad including a non-woven fabric impregnated with elastomer, a pad consisting only of elastomer, and a pad including a non-woven fabric impregnated with elastomer and an elastomer layer laminated on the fabric.

However, structures and/or types of the polishing layer 1 used herein are not particularly limited.

A fastener mounting layer 2 may comprise a hard resin layer or a metallic sheet.

The hard resin layer type fastener mounting layer 2 may have a hardness ranging
from 40 to 100 measured using a durometer type D hardness meter.

[83] The durometer type D hardness meter is GS-702 model G hardness meter manufactured by Teclock and the hardness is measured according to ASTM D 2240 A.

[84] A hard resin layer for fabrication of the fastener mounting layer 2 may comprise polyurethane resin, polypropylene resin, polyester resin, polyamide resin, melamine resin, epoxy resin, etc.

[85] The metallic sheet for fabrication of the fastener mounting layer is preferably made of a corrosion-resistance material such as stainless steel, titanium and so on.

[86] If the hard resin layer in the fastener mounting layer 2 has a hardness of less than 40, the fastener mounting layer may have a problem that it can not support the fastener F such as a bolt.

[87] According to the present invention, the fastener mounting layer 2 is preferably fabricated using a hard resin layer with a high hardness and/or a metallic sheet so that it enables a polishing pad to be easily attached to or detached from a platen and a polished product to exhibit uniform polishing effect independent from types of polishing apparatus.

[88] The fastener mounting layer 2 preferably has a thickness of 2 to 10mm.

[89] If the thickness of the fastener mounting layer is less than 2mm, using a fastener F may cause micro-deformation of a polishing pad when attached to the platen. On the other hand, if the thickness exceeds 10mm, the polishing pad is too heavy and may cause a problem in handling the same.

[90] Referring to Fig. 8, an additional hard resin layer 3 may be inserted between the polishing layer 1 and the fastener mounting layer 2.

[91] Preferably, the fastener F is a bolt, etc.

[92] Preferably, the additional hard resin layer 3 includes at least one selected from polyurethane resin, polypropylene resin, polytetrafluoroethylene resin, polyester resin, polyamide resin, melamine resin and epoxy resin.

[93] The additional hard resin layer 3 may have a hardness ranging from 40 to 100 measured using a durometer type D hardness meter.

[94] The durometer type D hardness meter is GS-702 model G hardness meter manufactured by Teclock and the hardness is measured according to ASTM D 2240 A.

[95] The polishing pad tile of the present invention is fabricated by a method comprising the steps of: preparing a polishing layer 1, attaching fastener mounting layer 2 at a rear side of the polishing layer 1, and sequentially punching the polishing layer 1 and the fastener mounting layer 2 so as to form coupling bores 4 for inserting fasteners.
[96] Herein, the polishing pad tile may further comprise an additional hard resin layer 3 between the polishing layer 1 and the fastener mounting layer 2.

[97] Preferably, the polishing layer 1 is firstly planarized before the punching step of the fastener mounting layer 2 attached to the back side of the polishing layer 1.

[98] In order to completely bond the polishing layer 1 to the fastener mounting layer 2 and to prevent the polishing layer from being stripped, a heat sensitive adhesive layer and/or a thermally curable resin is preferably used.

[99] When the heat sensitive adhesive layer is used to bond the polishing layer 1 to the fastener mounting layer 2, the fastener mounting layer 2 may be firstly prepared before bonding the adhesive layer. The fastener mounting layer 2 may have a thickness of 2 to 10mm in final product. It is preferable that the initial thickness of prepared fastener mounting layer ranges from 1 to 5mm sufficient to perform buffing or cutting of both sides, resulting in a planarized layer.

[100] Using a two-component curable resin may bond the polishing layer 1 to the fastener mounting layer 2 wherein the fastener mounting layer 2 may have a thickness of 2 to 10mm in final product. Also, it is preferable that the initial thickness of prepared fastener mounting layer ranges from 1 to 5mm sufficient to perform buffing or cutting of both sides, resulting in a planarized layer.

[101] As to bonding of the polishing layer 1 to the fastener mounting layer 2, the fastener mounting layer 2 may be fabricated after a thermally curable or UV curable resin is applied to the back side of the polishing layer 1 to prepare the additional hard resin layer 3. Herein, the bonding of the polishing layer to the fastener mounting layer may be carried out using any one of a heat sensitive adhesive layer, a pressure sensitive adhesive layer, a two-component curable resin, etc.

[102] As to bonding of the polishing layer 1 to the fastener mounting layer 2, the fastener mounting layer 2 may be fabricated after the fastener mounting layer 2 is completely attached to the back side of the polishing layer 1.

[103] The polishing pad tiles P of the present invention are assembled on a platen J in a mosaic mode by fasteners F such as bolts to form a mosaic polishing pad, as illustrated in Fig. 6 and Figs. 9 and 10.

[104] Spaces are formed between the assembled polishing pad tiles P, thereby improving fluidity of a grinding liquid and noticeably enhance polishing performance of the polishing pad.

[105] Figs. 9 and 10 are cross-sectional views illustrating the polishing pad tiles shown in Figs. 7 and 8, which are attached to a platen.
As shown in Figs. 11 and 12, another polishing pad tile of the present invention comprises a polishing layer 1, and a fastener mounting layer 2 which is provided at a back side of the polishing layer 1 and has protrusions 2a protruded at lower both sides of the fastener mounting layer 2 to be extended over the polishing layer 1 and to support a fastener F, wherein the polishing pad tile is fixed to a platen J by the fastener F supported by the protrusions 2a.

Referring to Fig. 12, the mosaic type polishing pad according to the present invention is fabricated by assembling a number of polishing pad tiles P on a platen J by fasteners F.

Fig. 11 is a cross-sectional view illustrating a polishing pad tile according to another exemplary embodiment of the present invention, and Fig. 12 is a cross-sectional view illustrating the polishing pad tile shown in Fig. 11, which is attached in plural to a platen.

The polishing layer 1 comprises at least one selected from a pad including a non-woven fabric impregnated with elastomer, a pad consisting of only elastomer, and a pad including a non-woven fabric impregnated with elastomer and an elastomer layer laminated on the fabric.

However, structures and/or types of the polishing layer 1 used herein are not particularly limited.

Preferably, the fastener F is a bolt, etc.

A fastener mounting layer 2 may comprise a hard resin layer or a metallic sheet.

The hard resin layer type fastener mounting layer 2 may have a hardness ranging from 40 to 100 measured using a durometer type D hardness meter.

The durometer type D hardness meter is GS-702 model G hardness meter manufactured by Teclock and the hardness is measured according to ASTM D 2240 A.

A hard resin layer for fabrication of the fastener mounting layer 2 may comprise polyurethane resin, polypropylene resin, polyester resin, polyamide resin, melamine resin, epoxy resin, etc.

The metallic sheet for fabrication of the fastener mounting layer 2 is preferably made of a corrosion-resistance material such as stainless steel, titanium and so on.

If the hard resin layer in the fastener mounting layer 2 has a hardness of less than 40, the fastener mounting layer may have a problem that it cannot support the fastener F such as a bolt.

According to the present invention, the fastener mounting layer 2 is preferably fabricated using a hard resin layer with a high hardness and/or a metallic sheet so that
it enables a polishing pad to be easily attached to or detached from a platen and a polished product to exhibit uniform polishing effect independent from types of polishing apparatus.

[119] The fastener mounting layer 2 preferably has a thickness of 2 to 10mm.

[120] If the thickness of the fastener mounting layer is less than 2mm, using a fastener F may cause micro-deformation of a polishing pad when attached to the platen. On the other hand, if the thickness exceeds 10mm, the polishing pad is too heavy and may cause a problem in handling the same.

[121] The polishing pad tiles P of the present invention are assembled on a platen J in a mosaic mode by fasteners F such as bolts or metal frames for mounting the polishing pad tiles, as illustrated in Fig. 12.

[122] Spaces are formed between the assembled polishing pad tiles P, thereby improving fluidity of a grinding liquid and noticeably enhance polishing performance of the polishing pad.

[123] Fig. 12 is a cross-sectional view illustrating the polishing pad tile shown in Fig. 11, which are attached to a platen.

[124] The mosaic type polishing pad according to present invention may be fabricated in a circular, arc or polygonal shape and a plurality of polishing pad tiles are attached to the platen using a fastener instead of an adhesive, thus improving adhesion therebetween and generating spaces between adjacent tiles.

[125] Consequently, the present invention can exhibit excellent polishing performance and effectively prevent polishing failure and generation of scratches during a polishing process.

[126] Surface roughness and scratching occurrence of a silicon wafer after polishing were evaluated as follows:

[127] **Average surface roughness of silicon wafer**

[128] Using an atomic force microscope, an average surface roughness of a silicon wafer was measured. Three-dimensional surface curvature of a sample was observed by JSPM-5200 model microscope available from JEOL Ltd., which uses an attractive and repulsive force acting between a cantilever and atoms in a surface of the sample and provides atomic resolution imaging of the surface, so as to determine the surface roughness.

[129] More particularly, 3 to 5 samples were taken from up and down, right and left side distances 1 to 5cm, respectively, apart from the center of a polished silicon wafer. Each of the samples was subjected to scanning in an area of 10μm×10μm to obtain Ra
result. An arithmetic mean average was calculated from the obtained Ra results for all samples and this average was defined as an average surface roughness.

Scratching occurrence (%)  

Two 8-inch silicon wafers were polished using a polishing pad and scratch failures generated were summed. Applying the number of scratch failures to the following equation to estimate a scratching occurrence of the silicon wafer:

\[
\text{Scratching occurrence (\%)} = \left( \frac{\text{number of scratch failures}}{\text{8-inch, two wafers}} \right) \times 100
\]

Wherein, provided that the number of scratches is defined as 100 where it is more than 100, i.e., the maximum number of scratches is 100.

The scratch is observed and determined by those skilled in the art through visible detection. For unclear parts having difficulty in visible detection, they may be determined by additional measurement methods using an optical microscope equipped with a dark field light and installed with image analysis software.

A trench or groove with a relative ratio of lengths in a length direction to a width direction of above 10:1 is considered as the scratch.

Exemplary embodiments of the present invention will be described in more detail in conjunction with examples and a comparative example, which are only given for the purpose of illustration and are not to be construed as limiting the scope of the invention.

EXAMPLE 1

A polyamide filament with monofilament fineness of 1 was cut into 50mm to produce staple fibers. These staple fibers were subjected to carding and cross-wrapping processing to fabricate a web. A non-woven fabric was produced by needle punching the web.

Next, the prepared non-woven fabric was impregnated with 40 wt.% of polyurethane resin to weight of the fabric, followed by wet curing to form a polishing layer 1.

Following this, while controlling a hardness of polyethylene resin to 60 using a durometer type D hardness meter, the resin was formed into a plate with a thickness of 5mm by any conventional method for fabrication of plastic sheet. Passing both sides of the formed plate through a hot roller at 300°C and a distance of 4mm, a uniform fastener mounting layer 2 for a fastener was formed.

After uniformly applying a two-component curable resin to the prepared polishing layer 1, the polishing layer was bonded to the fastener mounting layer 2.

Buffing a back side of the fastener mounting layer 2 and punching the polishing layer 1 and the fastener mounting layer 2 to form coupling bores 4, resulted in a complete
polishing pad.

The resultant polishing pad was fixed to a platen by bolts having holes to receive bolts. Two sheets of 8-inch silicon wafers were polished with the polishing pad under conditions defined as follows.

**Polishing conditions:**

- Polisher: Poli-500 polisher available from GNP Technology Corp.
- Polishing time: 10 minutes
- Download force: $250g/cm^2$ (3.5psi) at surface of wafer
- Speed of platen: 120 rpm
- Speed of wafer carrier: 120 rpm
- Flow rate of slurry: 700 ml/min
- Slurry type: Nalco 2371, silica based slurry diluted with DIW at a ratio of 1:15

The polished silicon wafer was subjected to measurement of average surface roughness and scratch occurrence. The results are shown in Table 1.

**Example 2**

The same process and procedure as described in Example 1 were repeated to produce a polishing pad, except that an additional resin layer 3 made of thermally curable polyether urethane resin was inserted between the polishing layer 1 and the fastener mounting layer 2 prepared the same as described in Example 1. The resultant polishing pad was fixed to a platen by bolts. Two sheets of 8-inch silicon wafers were polished with the polishing pad according to the same polishing process as described in Example 1.

As for the polished silicon wafers, surface roughness and scratching occurrence were evaluated and the results are shown in Table 1.

**Comparative Example 1**

Instead of a sea-island type complex fiber used in Example 1, carding and cross-wrapping processing polyamide staple fibers with a monofilament fineness of 3 denier resulted in a laminate web. A non-woven fabric was produced by needle punching the web.

Next, the prepared non-woven fabric was impregnated with 40 wt.% of polyurethane resin to weight of the fabric, followed by wet curing to form a pad A impregnated with polyurethane resin.

Subsequently, passing the formed pad A through a hot roller at 300°C resulted in a complete polishing pad having a cross section illustrated in Fig. 13.

As illustrated in Fig. 14, a holding material B for grasping the polishing pad, which
comprises a heat sensitive adhesive layer B2 and a pressure sensitive adhesive layer B3 attached to both sides of a base film B1, was used to attach the polishing pad to a platen. Two sheets of 8-inch silicon wafers were polished with the polishing pad under the same conditions as described in Example 1.

[161] As for the polished silicon wafers, average surface roughness and scratching occurrence were evaluated and the results are shown in Table 1.

[162] Table 1

<table>
<thead>
<tr>
<th>Item</th>
<th>Example 1</th>
<th>Example 2</th>
<th>Comparative Example 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average surface roughness of the polished wafer (Å)</td>
<td>13.78</td>
<td>13.76</td>
<td>14.25</td>
</tr>
<tr>
<td>Scratching occurrence (%)</td>
<td>0.10</td>
<td>0.11</td>
<td>0.17</td>
</tr>
</tbody>
</table>

[163] From the results, it was found that each of polishing pads in Examples 1 and 2 exhibited excellent adhesion between the polishing pad and the platen and superior scratching occurrence and polishing performance (as determined by average surface roughness of the polished wafer) compared to that of Comparative Example 1.

[164] EXAMPLE 3

[165] A polyamide filament with monofilament fineness of 1 was cut into 50mm to produce staple fibers. These staple fibers were subjected to carding and cross-wrapping processing to fabricate a web. A non-woven fabric was produced by needle punching the web.

[166] Next, the prepared non-woven fabric was impregnated with 40 wt.% of polyurethane resin to weight of the fabric, followed by wet curing to form a polishing layer 1.

[167] Following this, while controlling a hardness of polyethylene resin to 70 using a durometer type D hardness meter, the resin was formed into a plate with a thickness of 5mm by any conventional method for fabrication of plastic sheet. Passing both sides of the formed plate through a hot roller at 300°C and a distance of 4mm, a uniform fastener mounting layer 2 for a fastener was formed.
[168] After uniformly applying a two-component curable resin to the prepared polishing layer 1, the polishing layer was bonded to the fastener mounting layer 2.

[169] Next, buffing a back side of the fastener mounting layer 2 and punching the polishing layer 1 and the fastener mounting layer 2 to form coupling bores 4, followed by cutting both the layers into cubic pieces each having a size of 10cm×10cm, resulted in complete polishing pad tiles having coupling bores 4.

[170] The resultant polishing pad tiles were fixed to a platen by bolts in a mosaic mode to generate spaces between adjacent tiles. Two sheets of 8-inch silicon wafers were polished with the polishing pad tiles under conditions defined as follows.

[171] Polishing conditions:

- Polisher: Poli-500 polisher available from GNP Technology Corp.
- Polishing time: 10 minutes
- Download force: 250g/cm² (3.5psi) at surface of wafer
- Speed of platen: 120 rpm
- Speed of wafer carrier: 120 rpm
- Flow rate of slurry: 700 ml/min
- Slurry type: Nalco 2371, silica based slurry diluted with DIW at a ratio of 1:15

[179] The polished silicon wafer was subjected to measurement of average surface roughness and scratch occurrence. The results are shown in TABLE 2.

[180] **EXAMPLE 4**

[181] The same process and procedure as described in Example 1 were repeated to produce a polishing pad, except that an additional resin layer 3 made of thermally curable polyether urethane resin was inserted between the polishing layer 1 and the fastener mounting layer 2 prepared the same as described in Example 1. The resultant polishing pad was fixed to a platen in a mosaic mode by bolts. Two sheets of 8-inch silicon wafers were polished with the polishing pad according to the same polishing process as described in Example 1.

[182] As for the polished silicon wafers, surface roughness and scratching occurrence were evaluated and the results are shown in Table 2.

[183] **COMPARATIVE EXAMPLE 2**

[184] Instead of a sea-island type complex fiber used in Example 3, carding and cross-wrapping processing polyamide staple fibers with a monofilament fineness of 3.5 denier resulted in a laminate web. A non-woven fabric was produced by needle punching the web.

[185] Next, the prepared non-woven fabric was impregnated with 45 wt.% of polyurethane
resin to weight of the fabric, followed by wet curing to form a pad A impregnated with polyurethane resin.

[186] Subsequently, passing the formed pad A through a hot roller at 300°C resulted in a complete polishing pad having a cross section illustrated in Fig. 13.

[187] As illustrated in Fig. 14, a holding material B for grasping the polishing pad, which comprises a heat sensitive adhesive layer B2 and a pressure sensitive adhesive layer B3 attached to both sides of a base film B1, was used to attach the polishing pad to a platen. Two sheets of 8-inch silicon wafers were polished with the polishing pad under the same conditions as described in Example 1.

[188] As for the polished silicon wafers, average surface roughness and scratching occurrence were evaluated and the results are shown in Table 2.

[189] Table 2

[Table 2]

Results of physical properties measurement for polished wafer

<table>
<thead>
<tr>
<th>Item</th>
<th>Example 3</th>
<th>Example 4</th>
<th>Comparative Example 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average surface roughness of the polished wafer (Å)</td>
<td>13.78</td>
<td>13.76</td>
<td>14.30</td>
</tr>
<tr>
<td>Scratching occurrence (%)</td>
<td>0.10</td>
<td>0.11</td>
<td>0.18</td>
</tr>
</tbody>
</table>

[190] From the results, it was found that each of polishing pads in Examples 3 and 4 exhibited excellent adhesion between the polishing pad and the platen and superior scratching occurrence and polishing performance (as determined by average surface roughness of the polished wafer) compared to that of Comparative Example 2.

[191] **EXAMPLE 5**

[192] A polyamide filament with monofilament fineness of 1 was cut into 50mm to produce staple fibers. These staple fibers were subjected to carding and cross-wrapper processing to fabricate a web. A non-woven fabric was produced by needle punching the web.

[193] Next, the prepared non-woven fabric was impregnated with 40 wt.% of polyurethane resin to weight of the fabric, followed by wet curing to form a polishing layer 1.
Following this, while controlling a hardness of polyethylene resin to 60 using a durometer type D hardness meter, the resin was formed into a plate with a thickness of 5mm by any conventional method for fabrication of plastic sheet. Passing both sides of the formed plate through a hot roller at 300°C and a distance of 4mm, a uniform fastener mounting layer 2 for a fastener was formed.

After uniformly applying a two-component curable resin to the prepared polishing layer 1, the polishing layer was bonded to the fastener mounting layer 2.

Next, buffing a back side of the fastener mounting layer 2, followed by cutting the layer into cubic pieces each having a size of 10cm x 10cm, and forming the layer which has a cross section as shown in Fig. 11, resulted in complete polishing pad tiles having protrusions 2a.

The resultant polishing pad tiles were fixed to a platen by bolts in a mosaic mode to generate spaces between adjacent tiles. Two sheets of 8-inch silicon wafers were polished with the polishing pad tiles under conditions defined as follows.

**Polishing conditions:**

- Polisher: Poli-500 polisher available from GNP Technology Corp.
- Polishing time: 10 minutes
- Download force: 250g/cm² (3.5psi) at surface of wafer
- Speed of platen: 120 rpm
- Speed of wafer carrier: 120 rpm
- Flow rate of slurry: 700 ml/min
- Slurry type: Nalco 2371, silica based slurry diluted with DIW at a ratio of 1:15

The polished silicon wafer was subjected to measurement of average surface roughness and scratch occurrence. The results are shown in TABLE 3.

**COMPARATIVE EXAMPLE 3**

Instead of a sea-island type complex fiber used in Example 5, carding and cross-wrapping processing polyamide staple fibers with a monofilament fineness of 3.3 denier resulted in a laminate web. A non-woven fabric was produced by needle punching the web.

Next, the prepared non-woven fabric was impregnated with 35 wt.% of polyurethane resin to weight of the fabric, followed by wet curing to form a pad A impregnated with polyurethane resin.

Subsequently, passing the formed pad A through a hot roller at 300°C resulted in a complete polishing pad having a cross section illustrated in Fig. 13.

As illustrated in Fig. 14, a holding material B for grasping the polishing pad, which
comprises a heat sensitive adhesive layer B2 and a pressure sensitive adhesive layer B3 attached to both sides of a base film B1, was used to attach the polishing pad to a platen. Two sheets of 8-inch silicon wafers were polished with the polishing pad under the same conditions as described in Example 1.

[212] As for the polished silicon wafers, average surface roughness and scratching occurrence were evaluated and the results are shown in Table 3.

[213] Table 3
[Table 3]

Results of physical properties measurement for polished wafer

<table>
<thead>
<tr>
<th>Item</th>
<th>Example 5</th>
<th>Comparative Example 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average surface roughness of the polished wafer (Å)</td>
<td>13.78</td>
<td>14.28</td>
</tr>
<tr>
<td>Scratching occurrence (%)</td>
<td>0.10</td>
<td>0.16</td>
</tr>
</tbody>
</table>

[214] From the results, it was found that each of polishing pads in Example 5 exhibited excellent adhesion between the polishing pad and the platen and superior scratching occurrence and polishing performance (as determined by average surface roughness of the polished wafer) compared to that of Comparative Example 3.

**Industrial Applicability**

[215] As is apparent from the description disclosed above, the polishing pad according to the present invention is effectively used as a polishing pad for texture processing of magnetic recording media and/or for a CMP process of silicon wafers.

[216] While the present invention has been described with reference to the accompanying drawings and exemplary embodiments, it will be understood by those skilled in the art that various modifications and variations may be made therein without departing from the scope of the present invention as defined by the appended claims.
Claims

[1] A polishing pad comprising: a polishing layer 1, and a fastener mounting layer 2 attached to a back side of the polishing layer 1, wherein coupling bores 4 are perforated from a surface of the polishing layer to a back side of the fastener mounting layer such that the polishing pad is fixed to a platen J by fasteners F inserted in the bores.

[2] The polishing pad according to claim 1, wherein the polishing layer 1 is at least one selected from a pad including a non-woven fabric impregnated with elastomer, a pad consisting only of elastomer, and a pad including a non-woven fabric impregnated with elastomer and an elastomer layer laminated on the fabric.

[3] The polishing pad according to claim 1, wherein the fastener mounting layer includes at least one selected from a hard resin layer and a metallic sheet.

[4] The polishing pad according to claim 3, wherein the hard resin layer has a hardness of 40 to 100 measured by a durometer type D hardness meter.

[5] The polishing pad according to claim 3, wherein the hard resin layer includes at least one selected from a group consisting of polyurethane resin, polypropylene resin, polytetrafluoroethylene resin, polyester resin, polyamide resin, melamine resin and epoxy resin.

[6] The polishing pad according to claim 1, further comprising an additional hard resin layer 3 between the polishing layer 1 and the fastener mounting layer 2.

[7] The polishing pad according to claim 1, wherein the fastener mounting layer 2 has a thickness of 2 to 10mm.

[8] The polishing pad according to claim 6, wherein the additional hard resin layer 3 has a hardness of 40 to 100 measured by a durometer type D hardness meter.

[9] The polishing pad according to claim 6, wherein the additional hard resin layer 3 includes at least one selected from polyurethane resin, polypropylene resin, polytetrafluoroethylene resin, polyester resin, polyamide resin, melamine resin and epoxy resin.

[10] The polishing pad according to claim 1, wherein the fastener F is a bolt.

[11] A method for fabrication of a polishing pad comprising the steps of: preparing a polishing layer 1, attaching fastener mounting layer 2 at a rear side of the polishing layer 1, and sequentially punching the polishing layer 1 and the fastener mounting layer so as to form coupling bores 4 for inserting fasteners.
The method according to claim 11, wherein the polishing layer 1 is at least one selected from a pad including a non-woven fabric impregnated with elastomer, a pad consisting only of elastomer, and a pad including a non-woven fabric impregnated with elastomer and an elastomer layer laminated on the fabric.

The method according to claim 11, wherein the polishing layer 1 is firstly planarized before the punching step of the fastener mounting layer 2 attached to the back side of the polishing layer 1.

A polishing pad tile comprising: a polishing layer 1, and a fastener mounting layer 2 attached to a back side of the polishing layer 1, wherein coupling bores 4 are perforated from a surface of the polishing layer to a back side of the fastener mounting layer such that the polishing pad tile is fixed to a platen J by fasteners F inserted in the bores.

A mosaic type polishing pad having a number of polishing pad tiles P, wherein each of the polishing pad tiles comprises: a polishing layer 1, and a fastener mounting layer 2 attached to a back side of the polishing layer 1, wherein a coupling bore 4 is perforated from a surface of the polishing layer to a back side of the fastener mounting layer such that the polishing pad tile is fixed to a platen J by a fastener F inserted in the bore.

The mosaic type polishing pad according to claim 15, wherein the assembled polishing pad tiles P have spaces therebetween.

A polishing pad tile comprising: a polishing layer 1, and a fastener mounting layer 2 which is provided at a back side of the polishing layer 1 and has protrusions 2a protruded at lower both sides of the fastener mounting layer 2 to be extended over the polishing layer 1 and to support a fastener F, wherein the polishing pad tile is fixed to a platen J by the fastener F supported by the protrusions 2a.

The polishing pad tile according to claim 17, wherein the polishing layer 1 is at least one selected from a pad including a non-woven fabric impregnated with elastomer, a pad consisting only of elastomer, and a pad including a non-woven fabric impregnated with elastomer and an elastomer layer laminated on the fabric.

The polishing pad tile according to claim 17, wherein the fastener mounting layer includes at least one selected from a hard resin layer and a metallic sheet.

The polishing pad tile according to claim 17, wherein the fastener F is a bolt.

The polishing pad tile according to claim 17, wherein the fastener mounting layer includes at least one selected from a hard resin layer and a metallic sheet.
layer 2 has a thickness of 2 to 10mm.

[22] The polishing pad tile according to claim 19, wherein the hard resin layer has a hardness of 40 to 100 measured by a durometer type D hardness meter.

[23] The polishing pad tile according to claim 19, wherein the hard resin layer includes at least one selected from polyurethane resin, polypropylene resin, polytetrafluoroethylene resin, polyester resin, polyamide resin, melamine resin and epoxy resin.

[24] A mosaic type polishing pad comprising: a polishing layer 1, and a fastener mounting layer 2 which is provided at a back side of the polishing layer 1 and has protrusions 2a protruded at lower both sides of the fastener mounting layer 2 to be extended over the polishing layer 1 and to support a fastener F, wherein the polishing pad tile P is fixed to a platen J by the fastener F.

[25] The mosaic type polishing pad according to claim 24, wherein the assembled polishing pad tiles P have spaces therebetween.