US 20120190276A1

(19) United States

(12) Patent Application Publication

(10) Pub. No.: US 2012/0190276 A1

(43) Pub. Date: Jul. 26, 2012

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(54) POLISHING PAD AND METHODS FOR MANUFACTURING AND USING THE SAME

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(21) Appl. No.: **13/274,831**

(22) Filed: **Oct. 17, 2011**

(30) **Foreign Application Priority Data**

Jan. 20, 2011 (CN) 201110023424.6

Publication Classification

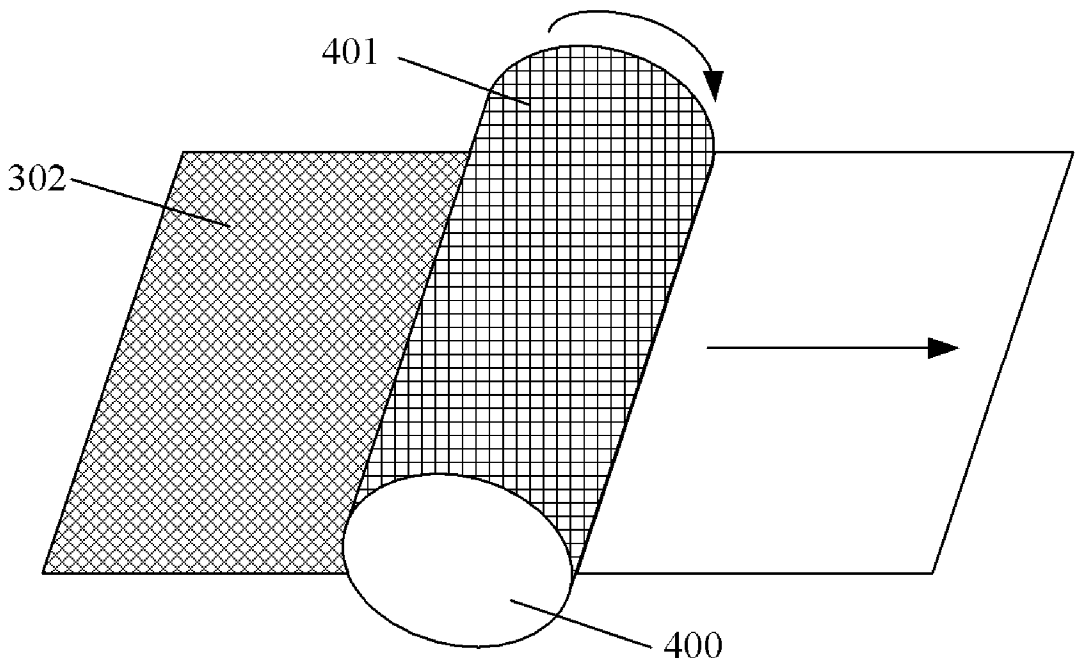
(51) **Int. Cl.**

B24B 1/00	(2006.01)
B24D 18/00	(2006.01)
B24D 3/28	(2006.01)
B24D 11/00	(2006.01)

(52) **U.S. Cl.** **451/41**; 451/530; 51/298

(57) **ABSTRACT**

This invention provides a polishing pad, which includes a substrate and a plurality of discrete abrasive blocks fixed on the substrate, wherein the abrasive blocks are of at least two kinds of heights. This invention would not reduce the polishing rate dramatically during the process for polishing a wafer by using the polishing pad in the long run. Therefore a thickness of the wafer to be polished is able to be controlled accurately, thereby improving the effect and yield of polishing the wafer. The present invention further provides a method for manufacturing the polishing pad. The polishing pad according to this invention is manufactured conveniently by using this method. Correspondingly, a method for using the polishing pad is also provided in this invention.



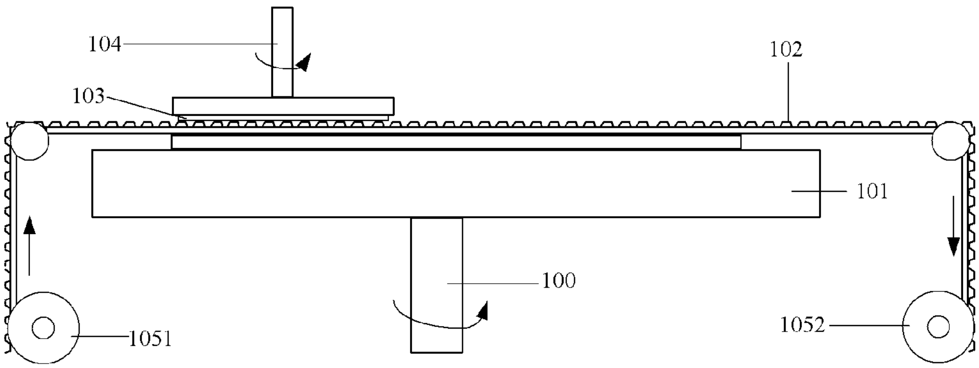


Fig. 1 (prior art)

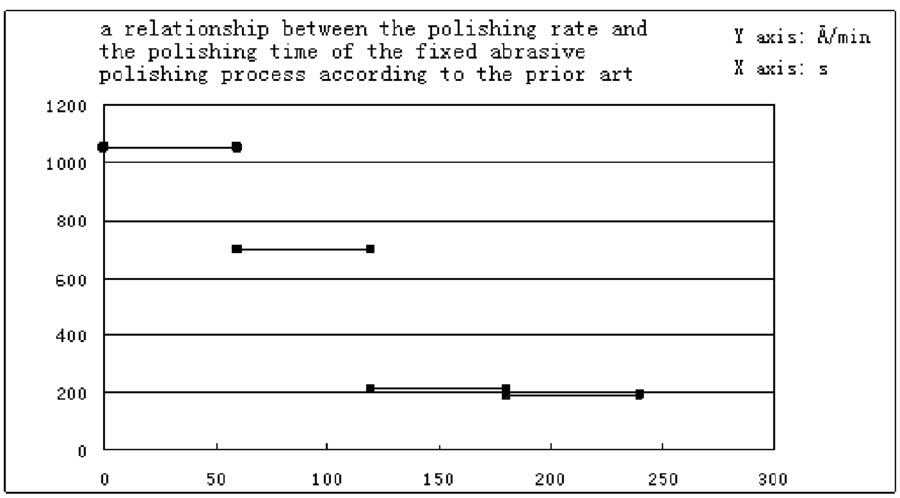


Fig. 2 (prior art)

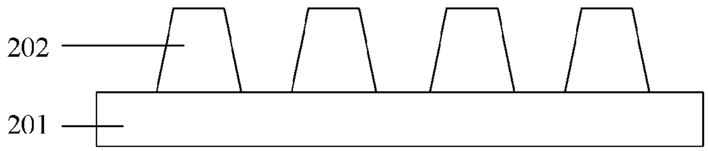


Fig. 3 (prior art)

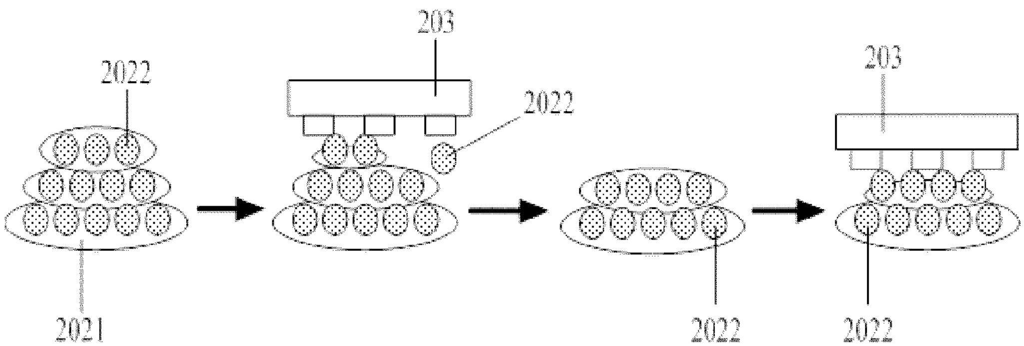


Fig. 4 (prior art)

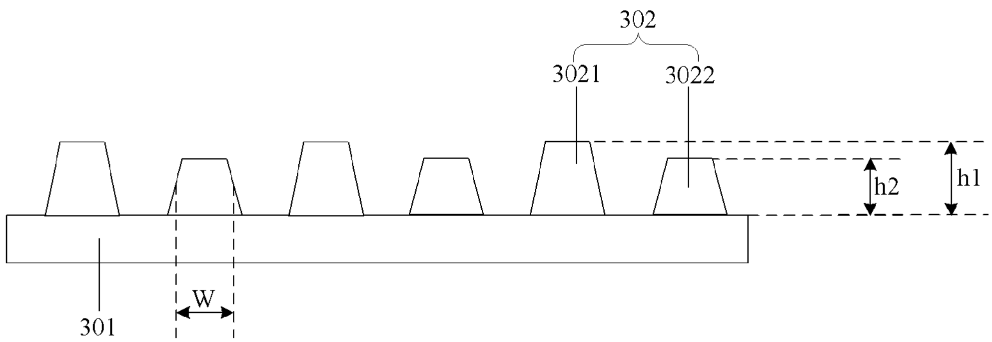


Fig.5

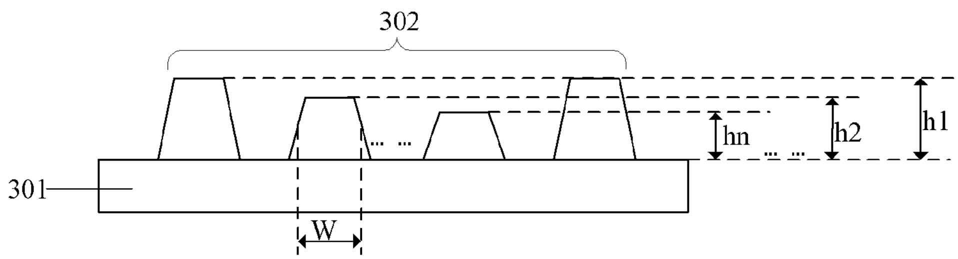


Fig.6

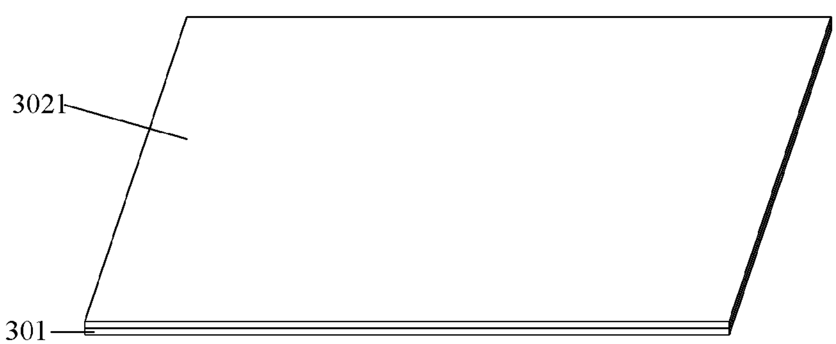


Fig.7

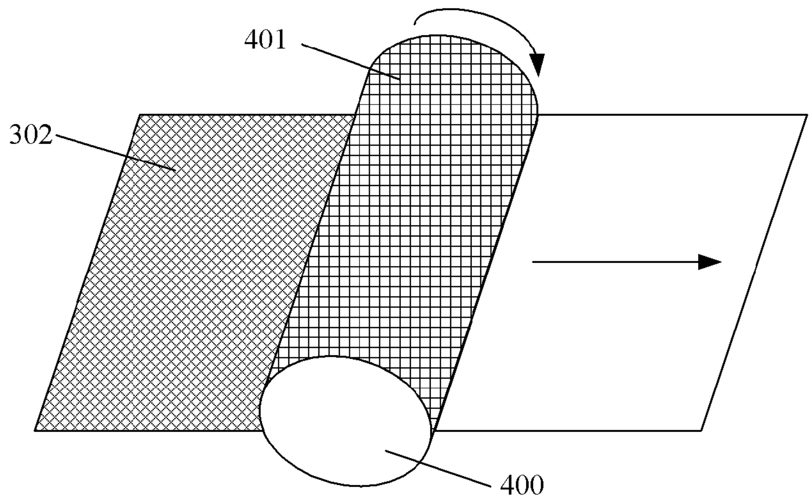


Fig.8

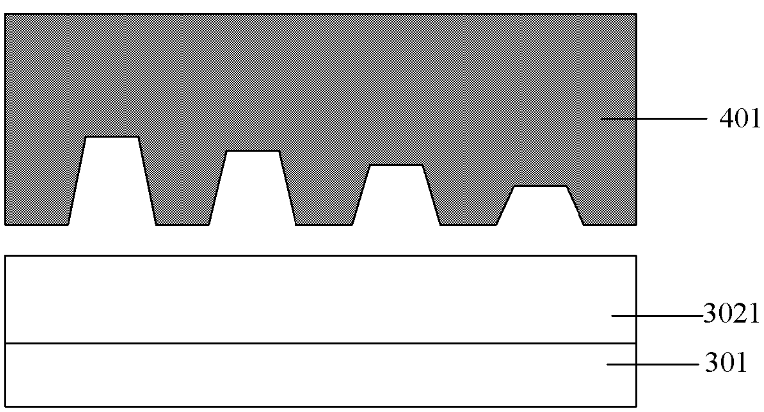


Fig.9

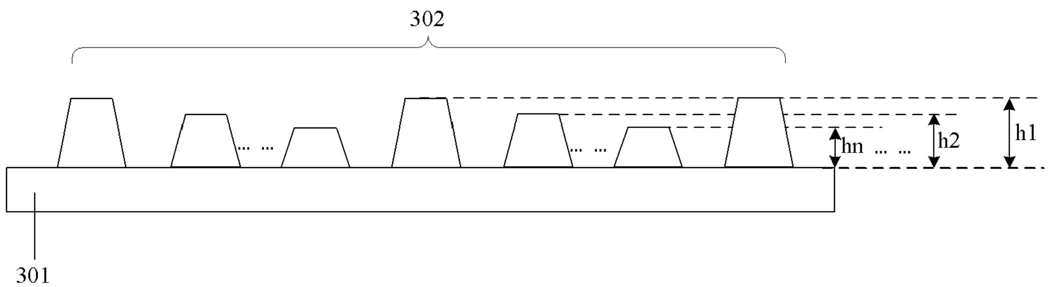

302
hn
h2
h1
301

Fig.10

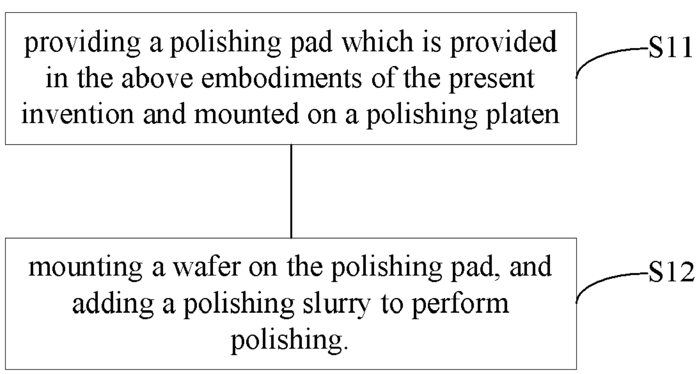

providing a polishing pad which is provided in the above embodiments of the present invention and mounted on a polishing platen
S11
mounting a wafer on the polishing pad, and adding a polishing slurry to perform polishing.
S12

Fig.11

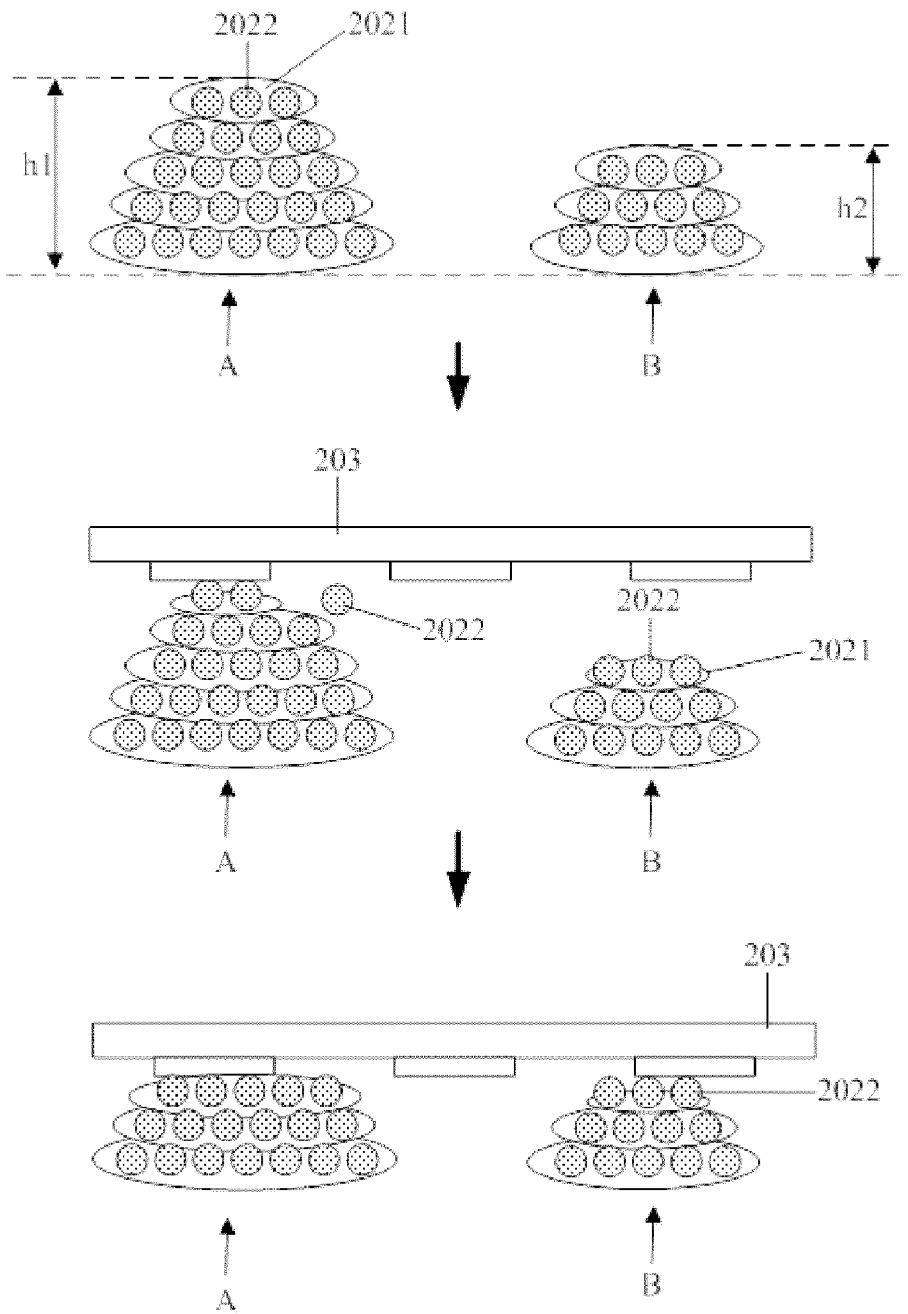


Fig.12

POLISHING PAD AND METHODS FOR MANUFACTURING AND USING THE SAME

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims the priority of Chinese Patent Application No. 201110023424.6, entitled "Polishing Pad and Methods for Manufacturing and Using the same", and filed on Jan. 20, 2011, the entire disclosure of which is incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present invention relates generally to semiconductor manufacturing process, and more particularly to a polishing pad and methods for manufacturing and using the same.

BACKGROUND OF THE INVENTION

[0003] In semiconductor manufacturing process, it is quite important for a device capable of being miniaturized and highly integrated to have a smooth wafer surface. Generally speaking, chemical mechanical polishing (CMP) is used as a conventional process for planarizing a wafer surface. A polishing slurry is added between the wafer surface and a polishing pad. By the effects of mechanical force and the chemical reaction generated between the wafer surface and the polishing slurry, the wafer surface is planarized. In the conventional CMP process, the polishing slurry distributes randomly on the polishing pad, which induces lots of negative problems such as an uneven density, a poor polishing result, a low utilization ratio of the slurry, and environmental pollution caused by wasted polishing slurry. Therefore, the conventional CMP process tends to be replaced with a fixed abrasive polishing process.

[0004] In the fixed abrasive polishing process, abrasives are fixed on a polishing pad so as to form a fixed abrasive polishing pad having a surface with a regular concave-convex shape, which is disclosed in US patent Publication NO. 20020049027.

[0005] Afterwards, the polishing pad is mounted on a polishing platen, and a wafer which is going to be polished is mounted on a polishing face of the polishing pad. FIG. **1** is a cross-sectional view of an apparatus used in a fixed abrasive polishing process according to the prior art. Referring to FIG. **1**, an inputting roller **1051** together with an outputting roller **1052** transports a polishing pad **102** to a polishing platen **101**, and a surface of the polishing pad **102** is moistened by abrasives. A wafer **103** is fixed to a polishing head **104**, and a surface of the wafer is contacted with the surface of the polishing pad **102**. After starting a driving power, the polishing platen **101** is driven to rotate by the rotation of a bearing **100**. The wafer **103** is driven to rotate by the rotating of the polishing head **104** and moves relative to the polishing pad **102**, which makes the surface of the wafer **103** rub against the surface of the polishing pad **102** and polished.

[0006] However, the polishing rate is continuously becoming slower as the polishing process is going on. Thus the polishing rate varies greatly in the process of fixed abrasive polishing. Referring to FIG. **2**, the polishing rate descends rapidly from about 1050 Å/min within the first 60 s to about 190 Å/min within a time period from 180 s to 240 s. A thickness of the wafer to be polished is difficult to be controlled accurately because the polishing rate drops rapidly, which causes over-polishing or insufficient polishing leading to wafer damaged.

SUMMARY OF THE INVENTION

[0007] Embodiments of the present invention provide a polishing pad and methods for manufacturing and using the same, to obviate the disadvantage associated with a prior art that a polishing rate can not be kept stable, which causes over or insufficient polishing leading to wafer damaged.

[0008] One embodiment of the present invention provides a polishing pad, including: a substrate; and

[0009] a plurality of discrete abrasive blocks fixed on the substrate, wherein the abrasive blocks are of at least two kinds of heights.

[0010] Optionally, the heights of the abrasive blocks are ranging from about 10 μm to about 50 μm.

[0011] Optionally, a height difference between any two kinds of the abrasive blocks is at least from about 3 μm to about 5 μm.

[0012] Optionally, the abrasive blocks have 2 to 20 kinds of heights.

[0013] Optionally, a width of the abrasive blocks is from about 50 μm to about 200 μm.

[0014] Another embodiment of the present invention provides a method for manufacturing a polishing pad, including:

[0015] forming a mixture by mixing a plurality of abrasive particles and organic polymers;

[0016] coating a substrate with the mixture;

[0017] compressing the mixture with a mould so as to form abrasive blocks which are of at least two kinds of heights, the mould has a pattern comprising a plurality of gravures which are of at least two kinds of depths and matched with the abrasive blocks; and

[0018] fixing the abrasive blocks on the substrate.

[0019] Optionally, the abrasive particles may include one or more materials selected from cerium dioxide, silicon dioxide, adamas, zirconium oxide, aluminum oxide, and silicon nitride.

[0020] Optionally, the abrasive blocks have 2 to 20 kinds of heights.

[0021] Optionally, the heights of the abrasive blocks are ranging from about 10 μm to about 50 μm.

[0022] Optionally, the abrasive blocks are arranged from highest to lowest height, from lowest to highest height, or alternating high and low height on the substrate.

[0023] Optionally, a height difference between any two kinds of the abrasive blocks is at least from about 3 μm to about 5 μm.

[0024] Still another embodiment of the present invention provides a method for using the polishing pad, including:

[0025] providing a polishing pad having a plurality of abrasive blocks which are of at least two kinds of heights; and

[0026] mounting a wafer on the polishing pad, and adding a polishing slurry to perform polishing.

[0027] Compared with the prior art, this invention has the following advantages:

[0028] The polishing pad according to the embodiments of the present invention has a plurality of abrasive blocks fixed thereon which are of at least two kinds of heights. When polishing a wafer, the height of the abrasive blocks having the biggest height is lowered by polishing exhaustion, which degrades the polishing rate. Afterwards, the abrasive blocks having the second biggest height can complement the polishing efficacy, thereby stabilizing the polishing rate, which facilitates to control a thickness of the wafer to be polished accurately and to improve the effect and yield of polishing.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] FIG. **1** is a cross-sectional view of an apparatus used in a fixed abrasive polishing process according to the prior art;

[0030] FIG. **2** is a schematic diagram illustrating a relationship between the polishing rate and the polishing time of the fixed abrasive polishing process according to the prior art;

[0031] FIG. **3** and FIG. **4** are schematic diagrams illustrating a reason for the variation of the polishing rate according to the prior art;

[0032] FIG. **5** and FIG. **6** are cross-sectional views of a polishing pad according to a first and second embodiments of the present invention;

[0033] FIG. **7** to FIG. **10** are schematic diagrams illustrating a method for manufacturing a polishing pad according to a third embodiment of the present invention;

[0034] FIG. **11** is a flow chart of a method for using the polishing pad to perform polishing according to a fourth embodiment of the present invention; and

[0035] FIG. **12** is a schematic diagram illustrating a method for using the polishing pad to perform polishing according to the fourth embodiment of the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0036] In a fixed abrasive polishing process of a prior art, as shown in FIG. **3**, a polishing pad includes a substrate and an abrasive layer. The abrasive layer is fixed on the substrate **201**, which includes a plurality of three-dimensional abrasive blocks **202** which may be a mixture of compressed abrasive particles and resin adhesives and have a specific shape. The abrasive particles are surrounded within the resin adhesives. All of the abrasive blocks **202** are of the same height. In other words, the abrasive blocks **202** have one height. As shown in FIG. **4**, during the polishing process, resin adhesives **2021** are dissolved in a polishing slurry. Therefore, abrasive particles **2022** at the uppermost layer are exposed and contact with the surface of a wafer **203**, which participate in polishing the wafer **203**. With the polishing process going on, the resin adhesives **2021** further continue dissolving, and the abrasive particles **2022** at the uppermost layer are gradually dissociated from the resin adhesives **2021** by the polishing force, which lowers the height of the abrasive blocks **202**. Meanwhile, due to lack of soak time, the resin adhesives **2021** surrounding the abrasive particles **2022** in a next layer fail to be dissolved timely in the polishing slurry, which causes the abrasive particles **2022** in the next layer are not exposed completely. Therefore, a portion of the abrasive particles **2022** in the next layer fail to participate in the polishing process, which reduces the polishing rate of the wafer. Because of the variation of the polishing rate, a thickness of the wafer to be polished is difficult to be controlled accurately, which causes over-polishing or insufficient polishing, resulting in a decreased yield.

[0037] In order to resolve the problems described above, an embodiment of the present invention provides a polishing pad, which includes a substrate and a plurality of abrasive block arrays fixed on the substrate, wherein the abrasive block arrays are of at least two kinds of heights.

[0038] The polishing pad according to the embodiment of the present invention has a plurality of abrasive blocks fixed thereon which are of at least two kinds of heights. At the beginning of the polishing process, the abrasive blocks having the first height participate in polishing. With the polishing process going on, the height of the abrasive blocks having the first height which participate in polishing is lowered. The resin adhesives in a next layer are not dissolved timely in the polishing slurry, which causes the abrasive particles surrounded by the resin adhesives fail to participate in polishing, resulting in degrading the polishing efficacy of the abrasive blocks having the first height gradually. Meanwhile, the abrasive blocks having the second height are soaked in the polishing slurry for some time, so that the abrasive particles may be exposed to participate in polishing. Therefore, the polishing rate may not be reduced, but be kept at a stable level substantially, whereby a thickness of the wafer to be polished is controlled accurately, the quality for polishing the wafer is ensured, and the yield of the wafer is improved.

[0039] Hereunder, the present invention will be described in detail with reference to embodiments, in conjunction with the accompanying drawings.

[0040] FIG. **5** is a cross-sectional view of a polishing pad according to a first embodiment of the present invention. Referring to FIG. **5**, the polishing pad includes a substrate **301** and a plurality of abrasive blocks **302** fixed on the substrate **301**. The abrasive blocks **302** are of two kinds of heights, which include abrasive blocks **3021** having a first height h_1 and abrasive blocks **3022** having a second height h_2. The first height h_1 is from about 3 μm to about 5 μm greater than the second height h_2. The first height h_1 and the second height h_2 may be ranging from about 10 μm to about 50 μm, preferably, the first height h_1 may be about 30 μm. A width of the abrasive blocks **302** having the first height h_1 and the second height h_2 may be from about 50 μm to about 200 μm, preferably, the width may be about 100 μm

[0041] In this embodiment, the abrasive blocks **302** having different heights may be arranged from highest to lowest height, from lowest to highest height, or alternating high and low height on the substrate **301**, or arranged according to actual requirements.

[0042] In this embodiment, the width W of the abrasive block indicates an average width of a cross-sectional profile of the abrasive block. For example, as for a cylindrical abrasive block, the width W is a diameter of section of the cylinder. As for a trapeziform abrasive block, the width W is a length connecting midpoints at both sides of the trapezium formed by a cross-sectional profile of the trapezoid abrasive block. Similarly, as for a pyramidal abrasive block, the width W is a length connecting midpoints at both sides of the pyramid formed by a cross-sectional profile of the pyramidal abrasive block. The width W of the abrasive blocks aims to ensure a sufficient polishing rate which ranges from about 50 μm to about 200 μm. Preferably, the width may be about 100 μm.

[0043] In this embodiment, an interval between the abrasive blocks may be from about 50 μm to about 400 μm, preferably, the interval may be about 200 μm, which aims to ensure a chemical solution to flow sufficiently within the abrasive blocks.

[0044] In this embodiment, the substrate **301** may be a rigid substrate, such as a substrate including organic glass (PMMA), polyvinyl chloride (PVC), polycarbonate (PC), or polyethylene terephathalate (PET). Optionally, the substrate

301 may be of a certain resilience, which includes polyurethane, polyolefin, phenylethylene, polyester, polyamide, or black damping cloth. Optionally, the substrate 301 may be a multilayer substrate which is formed by combining a rigid substrate with a resilient substrate.

[0045] In this embodiment, the abrasive blocks **302** include a mixture of abrasive particles and resin adhesives which are compressed to form a three-dimensional structure having a specific shape. The abrasive particles may include one or more materials selected from silicon dioxide, cerium dioxide, aluminium oxide, silicon carbide, boron carbide, zirconium oxide, adamas, and the like. Preferably, the abrasive particles include cerium dioxide. A particle size of the abrasive particles ranges from about 50 nm to about 1000 nm. The resin adhesives may include one or more organic resins selected from phenolic resin, urea formaldehyde resin, melamine—formaldehyde resin, acrylic polyurethane, acrylic epoxy resin, ethyleneunion unsaturated compound, vinyl ether, epoxy resin, and the like. The shape of the abrasive blocks **302** may be cylinder, hemisphere, pyramid, trapezium, and the like. Preferably, the abrasive blocks **302** are trapezium-shaped, a cross sectional area of which decreases gradually along the height from the substrate. The abrasive blocks **302** are regularly fixed on the substrate **301** so as to form a regular topography of abrasive block arrays.

[0046] The aforementioned abrasive particles and resin adhesives are mixed according to a certain proportion to form a mixture, which coats the substrate **301** uniformly. The mixture is compressed by a mould which has a corresponding pattern so as to form an array of abrasive blocks **302** having a specific shape, then the abrasive blocks **302** are solidified by thermal energy or radiant energy. The proportion for mixing the abrasive particles and resin adhesives may be configured in accordance with practical use. Optionally, a percentage by weight of the abrasive particles and resin adhesives may be 1:2. As a matter of fact, a curing agent, an initiating agent, or a catalytic agent may be added into the mixture of the abrasive particles and the resin adhesives so as to speed up the solidification effect of the mixture of the abrasive particles and the resin adhesives.

[0047] In order to improve the mixture effect of the abrasive particles and the resin adhesives, a surface modification process may be performed to the abrasive particles. The abrasive particles include inorganic materials, most of which have hydrophilic surface, and are incompatible with organic polymer. As a result, the abrasive particles are distributed nonuniformly in the resin adhesives and the adhesive force between the abrasive particles and the resin adhesives is weak. The surface modification process for the abrasive particles may be mechanical—chemical modification, such as, high energy ball-milling, stirring-milling, high speed cutting, high frequency ultrasound. The abrasive particles with fresh surfaces after the surface modification process are exposed. Because of a large amount of dangling bond contained in the fresh surface, plus local high temperature during the surface modification process, the abrasive particles react chemically with surface modification agent, thereby achieving surface modification for the abrasive particles.

[0048] FIG. **6** is a cross-sectional view of a polishing pad according to a second embodiment of the present invention. Referring to FIG. **6**, a polishing pad includes a substrate **301** and a plurality of abrasive blocks **302** fixed on the substrate **301**. The abrasive blocks **302** are of more than two kinds of heights, which include a first height h_1, a second height h_2, . . . , a n^{th} height h_n (n is a natural number from 3 to 20). The height h_n of the abrasive blocks **302** may be ranging from about 10 μm to about 50 μm. A height difference between any two kinds of the abrasive blocks **302** is at least from about 3 μm to about 5 μm. In other words, the absolute value of the difference between the height h_n and the height h_i (i is not equal to n, and i is a natural number from 3 to 20) is from about 3 μm to about 5 μm. A width W of the abrasive blocks **302** may be from about 50 μm to about 200 μm.

[0049] In this embodiment, the substrate **301** includes materials as described in the first embodiment. The materials and shapes of the abrasive blocks **302**, and the proportion of abrasive particles and resin adhesives are still as described in the first embodiment, which are not described herein.

[0050] In this embodiment, the abrasive blocks **302** are of more than two kinds of heights. In other words, the heights of the abrasive blocks **302** include a first height h_1, a second height h_2, . . . , a n^{th} height h_n (n is a natural number from 3 to 20). The height of the abrasive blocks **302** may be ranging from about 10 μm to about 50 μm. A height difference between two of the abrasive blocks **302** having different heights is at least from about 3 μm to about 5 μm. The abrasive blocks **302** may be arranged from highest to lowest height, from lowest to highest height, or alternating high and low height on the substrate **301** so as to form a regular topography of abrasive block arrays.

[0051] In this embodiment, a width W of the abrasive block **302** may be from about 50 μm to about 200 μm. The width W of the abrasive block indicates an average width of a cross-sectional profile of the abrasive block. For example, as for a cylindrical abrasive block, the width W is a diameter of section of the cylinder. As for a trapeziform abrasive block, the width W is a length connecting midpoints at both sides of the trapezium formed by a cross-sectional profile of the trapezoid abrasive block. Similarly, as for a pyramidal abrasive block, the width W is a length connecting midpoints at both sides of the pyramid formed by a cross-sectional profile of the pyramidal abrasive block. The width W of the abrasive blocks aims to ensure a sufficient polishing rate which ranges from about 50 μm to about 200 μm. Preferably, the width may be about 100 μm.

[0052] In this embodiment, an interval between the abrasive blocks may be from about 50 μm to about 400 μm, preferably, the interval may be about 200 μm, which aims to ensure a chemical solution to flow sufficiently within the abrasive blocks.

[0053] The polishing pad according to the embodiment of the present invention has a plurality of abrasive block arrays which are of at least two kinds of heights. At the beginning of polishing a wafer, the abrasive block arrays having the first height participate in polishing. With the polishing process going on, the height of the abrasive block arrays which participate in polishing earlier is lowered. The resin adhesives in a next layer of the abrasive blocks having the first height are not dissolved in the polishing slurry, which causes the abrasive particles surrounded by the resin adhesives fail to participate in polishing. Meanwhile, the abrasive block arrays having the second height are soaked in the polishing slurry for some time, so that the abrasive particles may be exposed to participate in polishing. Therefore, the polishing rate may not be reduced, but be kept at a stable level substantially, whereby a thickness of the wafer to be polished is controlled accurately, the quality for polishing the wafer is ensured, and the yield of the wafer is improved.

[0054] FIG. **7** to FIG. **10** schematic diagrams illustrating a method for manufacturing a polishing pad according to a third embodiment of the present invention. Referring to FIG. **7**, a substrate **301** is provided, and coated uniformly with a mixture **3021** comprising a plurality of abrasive particles and resin adhesives.

[0055] In this embodiment, the substrate **301** may be a rigid substrate, such as a substrate comprising organic glass (PMMA), polyvinyl chloride (PVC), polycarbonate (PC), polyethylene terephathalate (PET), and the like. Optionally, the substrate **301** may be a resilient substrate, which includes polyurethane, polyolefin, phenylethylene, polyester, polyamide, black damping cloth, and the like. Optionally, the substrate **301** may be a multilayer substrate which is formed by combining the rigid substrate with the resilient substrate.

[0056] In this embodiment, the abrasive particles may include one or more materials selected from silicon dioxide, cerium dioxide, aluminium oxide, silicon carbide, boron carbide, zirconium oxide, adamas, and the like. Preferably, the abrasive particles include cerium dioxide. A particle size of the abrasive particles ranges from about 50 nm to about 1000 nm. Preferably, the particle size is 500 nm. In order to mix the abrasive particles adequately with the resin adhesives, a mechanical—chemical modification process may be performed to the abrasive particles so that the surface of the abrasive particles is of lipophilic property. The mechanical—chemical modification process performed to the abrasive particles may be high energy ball-milling, stirring-milling, high speed cutting, high frequency ultrasound, and the like. The abrasive particles with fresh surface after the surface modification process are exposed. Because of a large amount of dangling bond contained in the fresh surface, and local high temperature during the surface modification process, the abrasive particles react chemically with surface modification agents, thereby achieving surface modification for the abrasive particles which are likely to mix with the resin adhesives.

[0057] The resin adhesives may include one or more organic resins selected from phenolic resin, urea formaldehyde resin, melamine—formaldehyde resin, acrylic polyurethane, acrylic epoxy resin, ethyleneunion unsaturated compound, vinyl ether, epoxy resin, and the like. The proportion for mixing the abrasive particles and resin adhesives may be configured in accordance with practical use. Optionally, a percentage by weight of the abrasive particles and resin adhesives may be 1:2. As a matter of fact, a curing agent, an initiating agent, or a catalytic agent may be added into the mixture **3021** so as to enhance a molding effect of the abrasive block arrays.

[0058] Referring to FIG. **8**, a molding roller **400** having a pattern **401** of abrasive blocks formed thereon is rolled in a clockwise direction, and compress the mixture **3021** comprising the abrasive particles and resin adhesives fixed on the polishing pad, so as to form an array of regular abrasive blocks **302**. The pattern **401** includes a plurality of gravures which may be cylindrical, hemispherical, pyramidal, trapezoidal, and the like, preferably, is trapezoidal. A cross sectional area of the trapezoidal gravure decreases along the depth gradually, whereby the molding roller **400** is easy to be demolded after compression. The topography of the abrasive blocks **302** is determined by the pattern **401**.

[0059] Referring to FIG. **9**, the pattern **401** formed on the surface of the molding roller **400** includes a plurality of regular gravures which are of at least two kinds of depths. After the molding roller **400** is rolled, the mixture **3021** comprising the abrasive particles and resin adhesives is compressed to form the abrasive blocks **302** having two kinds of heights corresponding to the two kinds of depths of the pattern **401**.

[0060] In this embodiment, a surface of the molding roller **400** may be coated with a demolding coating, which facilitates the mixture **3021** to peel off the molding roller **400** after compression. In terms of the material of the molding roller **400**, the demolding coating may include hard carbide, nitride, boride, silicon resin, fluorochemicals, and the like.

[0061] Referring to FIG. **10**, the abrasive blocks **302** after compression are treated with energy source, so that the abrasive blocks **302** are solidified and fixed on the substrate **301**. The energy source includes thermal energy and radiant energy, such as electron beam, ultraviolet light, and the like. Chemical reaction occurs in the resin adhesives in the mixture **3021** by the treatment of the thermal energy or the irradiation of the radiant energy, whereby the abrasive blocks **302** are solidified and fixed on the substrate **301**. The molding abrasive blocks **302** are of at least two kinds of heights, which include a first height h_1, a second height h_2, . . . , a n^{th} height h_n (n is a natural number from 2 to 20).

[0062] In this embodiment, a bottom of each of the abrasive blocks **302** may be connected with each other, or fixed on the substrate **301** separately. Preferably, the bottoms of the abrasive blocks **302** are connected with each other to form the abrasive block arrays. The adhesive force of the abrasive blocks **302** to the substrate **301** is enhanced due to the interconnected bottoms. Therefore, the abrasive blocks are difficult to peel off during the polishing process, which improves the polishing effect.

[0063] Still a fourth embodiment of the present invention provides a method for using the polishing pad, which includes: step **S11**, providing a polishing pad which is provided in the above embodiments of the present invention and mounted on a polishing platen; step **S12**, mounting a wafer on the polishing pad, and adding a polishing slurry to perform polishing.

[0064] Hereunder, the present invention will be described in detail with reference to the fourth embodiment, in conjunction with the accompanying drawings.

[0065] In the step **S11**, a polishing pad having a plurality of abrasive blocks is provided, wherein the abrasive blocks are of at least two kinds of heights.

[0066] In this embodiment, the abrasive blocks **302** are of at least two kinds of heights. As shown in FIG. **6**, the heights of the abrasive blocks **302** include a first height h_1, a second height h_2, . . . , a n^{th} height h_n (n is a natural number from 2 to 20).

[0067] The height of the abrasive blocks **302** may be ranging from about 10 μm to about 50 μm. A height difference between any two kinds of the abrasive blocks **302** is at least from about 3 μm to about 5 μm. The abrasive blocks **302** may be arranged from highest to lowest height, from lowest to highest height, or alternating high and low height on the substrate **301** so as to form a regular topography of abrasive blocks having different heights.

[0068] In this embodiment, a polishing pad **102** is transported to a polishing platen **101** by an inputting roller **1051** together with an outputting roller **1052**, as shown in FIG. **1**.

[0069] In the step **S12**, a wafer is mounted on the polishing pad with a polishing slurry added to perform polishing.

[0070] In this embodiment, because the abrasive blocks **302** fixed on the substrate are of at least two kinds of heights, the polishing rate of the wafer is able to be kept stable during the polishing process. As shown in FIG. **12**, a process for polishing the wafer by using the polishing pad having a plurality of abrasive blocks which are of two kinds of heights is described. The polishing pad has a plurality of abrasive blocks (marked with A in FIG. **12**) which are of a first height h_1, and a plurality of abrasive blocks (marked with B in FIG. **12**) which are of a second height h_2. The first height h_1 is the biggest height. When polishing a wafer **203** by using the polishing pad, the abrasive blocks A which are of the first height h_1 contact with a surface of the wafer **203**. Because the resin adhesives **2021** at the uppermost layer of the abrasive blocks A are dissolved in the polishing slurry. The abrasive particles **2022** at the uppermost layer are exposed and participate in polishing the wafer **203**. With the polishing process going on, the abrasive particles **2022** of the abrasive blocks A having the first height h_1 are gradually dissociated from the resin adhesives **2021** by the polishing force, which reduces the height of the abrasive blocks A. When the height is reduced to a certain degree, the resin adhesives **2021** at the next layer have no enough time to dissolve, which causes the abrasive particles **2022** fail to be exposed completely. The polishing efficacy of the abrasive blocks A having the first height h_1 is degraded greatly.

[0071] When the polishing efficacy of the abrasive blocks A having the first height h_1 is degraded, the abrasive blocks B having the second height h_2 are soaked in the polishing slurry for some time, so that the resin adhesives **2021** at the uppermost layer of the abrasive blocks B are dissolved and the abrasive particles **2022** are exposed. Therefore the abrasive blocks B having the second height h_2 are able to participate in polishing the surface of the wafer **203**, which keeps the polishing rate stable.

[0072] The polishing pad according to the present invention ensures a stable polishing efficacy of the abrasive block arrays during a polishing process. Therefore, the polishing rate of the wafer may not be reduced as the polishing process is going on, but be kept at a stable level substantially, whereby a thickness of the wafer to be polished is controlled accurately, the polishing quality of the wafer is ensured, and the yield of the wafer is improved.

[0073] Although the present invention has been disclosed above with reference to preferred embodiments thereof, it should be understood that the invention is presented by way of example only, and not limitation. Those skilled in the art can modify and vary the embodiments without departing from the spirit and scope of the present invention.

What is claimed is:

1. A polishing pad, comprising:

a substrate; and

a plurality of discrete abrasive blocks fixed on the substrate, wherein the plurality of abrasive blocks comprises abrasive blocks of at least two different heights.

2. The polishing pad according to claim **1**, wherein each of the different heights of the abrasive blocks is in a range from about 10 μm to about 50 μm.

3. The polishing pad according to claim **1**, wherein a height difference between any two different heights of the abrasive blocks is at least from about 3 μm to about 5 μm.

4. The polishing pad according to claim **1**, wherein the plurality of abrasive blocks comprise 2 to 20 different heights.

5. The polishing pad according to claim **1**, wherein a width of the abrasive blocks is from about 50 μm to about 200 μm.

6. A method for manufacturing a polishing pad, comprising:

preparing a mixture by mixing a plurality of abrasive particles and organic polymers;

coating a substrate with the mixture;

compressing the mixture with a mold so as to form a plurality of discrete abrasive blocks on the substrate, wherein the plurality of abrasive blocks comprise abrasive blocks of at least two different heights, and the mold has a corresponding pattern so as to form the abrasive blocks; and

fixing the discrete abrasive blocks on the substrate.

7. The method according to claim **6**, wherein the abrasive particles comprise one or more materials selected from the group consisting of cerium dioxide, silicon dioxide, adamas, zirconium oxide, aluminum oxide, and silicon nitride.

8. The method according to claim **6**, wherein the abrasive blocks have 2 to 20 different heights.

9. The method according to claim **6**, wherein each of the different heights of the abrasive blocks is in a range from about 10 μm to about 50 μm.

10. The method according to claim **6**, wherein the abrasive blocks are arranged in order of height from highest to lowest height or from lowest to highest height, or are arranged alternating high and low height on the substrate.

11. The method according to claim **6**, wherein a height difference between any two different heights of the abrasive blocks is at least from about 3 μm to about 5 μm.

12. A method for polishing a wafer with the polishing pad of claim **1**, comprising:

providing the polishing pad having a plurality of different heights of abrasive blocks fixed thereon; and

bringing a wafer into contact with the polishing pad; and

adding a polishing slurry to perform polishing.

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