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(54) **CHEMICAL MECHANICAL POLISHING
CONDITIONER**

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(71) Applicants: **Chien-Min Sung**, Tansui (TW);
Wen-Ting Yeh, Taipei (TW)

(57) **ABSTRACT**

(72) Inventors: **Chien-Min Sung**, Tansui (TW);
Wen-Ting Yeh, Taipei (TW)

The present invention (utility model application in Taiwan) relates to a chemical mechanical polishing pad dresser, comprising: a substrate; a bonding layer disposed on the substrate; an electroplating layer disposed on the bonding layer; a fixed template disposed on the electroplating layer having a plurality of apertures; and a plurality of abrasive particles corresponding to and set in the apertures, wherein the plurality of abrasive particles are fixed in the bonding layer and the substrate by means of the electroplating layer. Therefore, the present invention is not only to avoid damaging the abrasive particles due to the high temperature heating in the production process, but also to solve the corrosion problem of the surface of the chemical mechanical polishing pad dresser by the fixed template and the electroplating layer and to solve simultaneously the pollution problem generating on the polished workpieces by using conventional brazing bonding layer; and, the present invention can also provide to adjust the abrasive particles arrangement and protrude rate through the fixed template, so as to enhance the grinding performance and quality of the chemical mechanical polishing pad dresser.

(21) Appl. No.: **14/248,109**

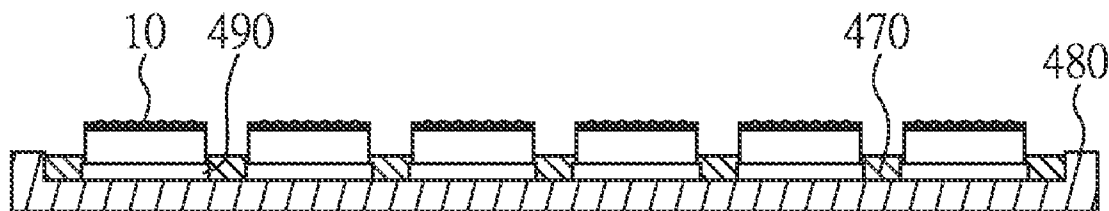
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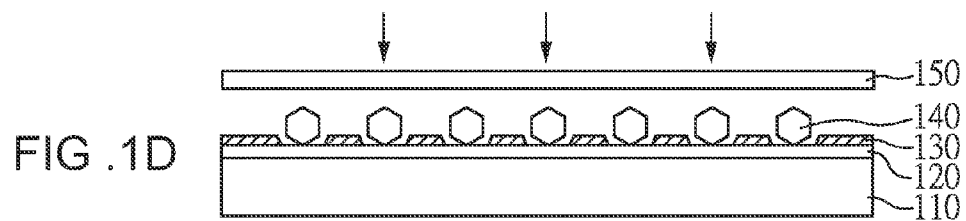
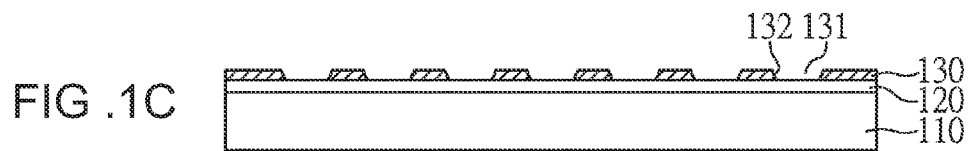
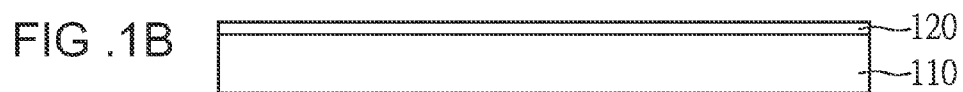
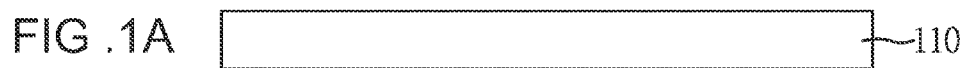
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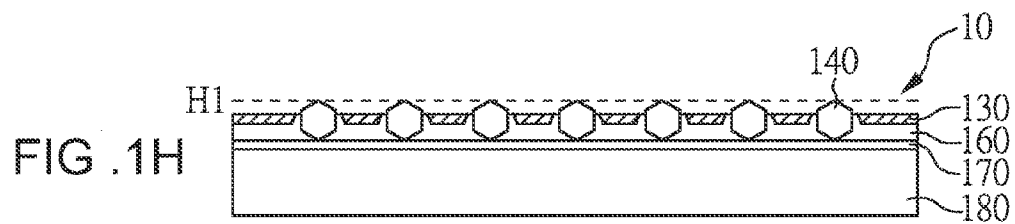
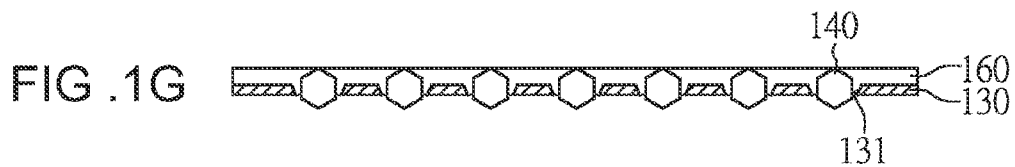
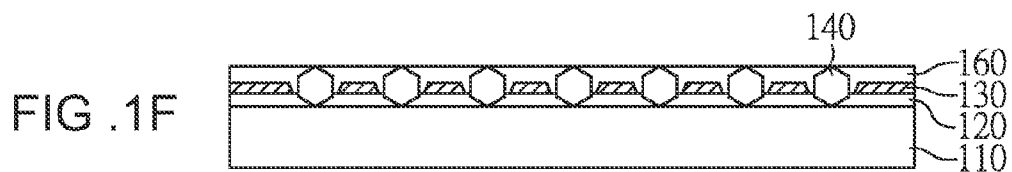
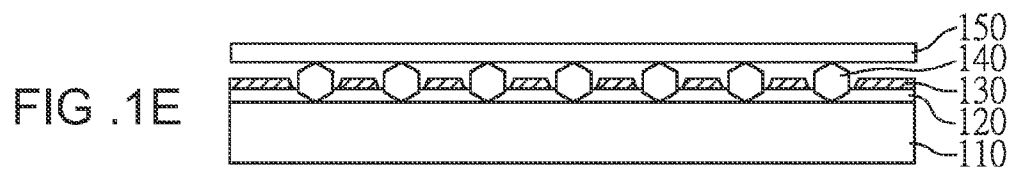
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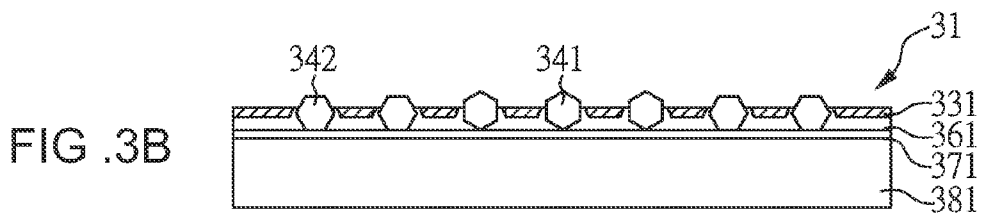
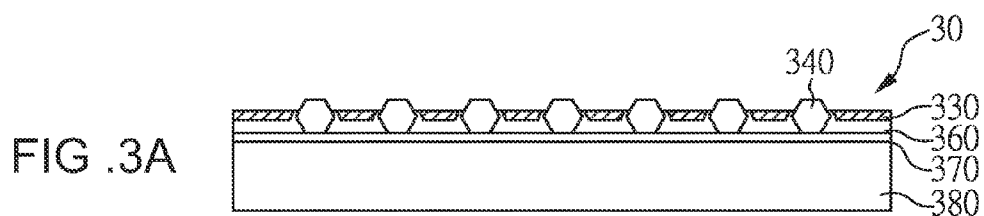
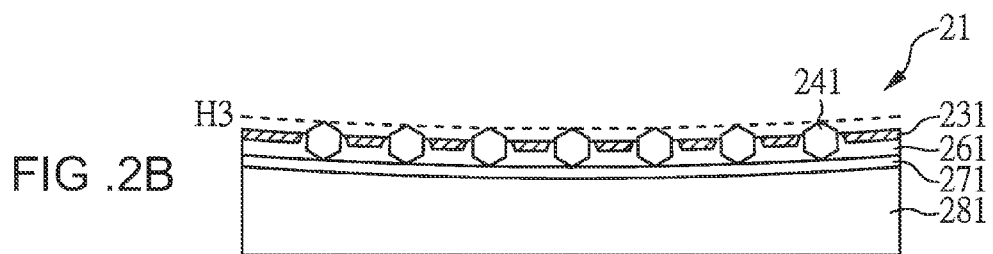
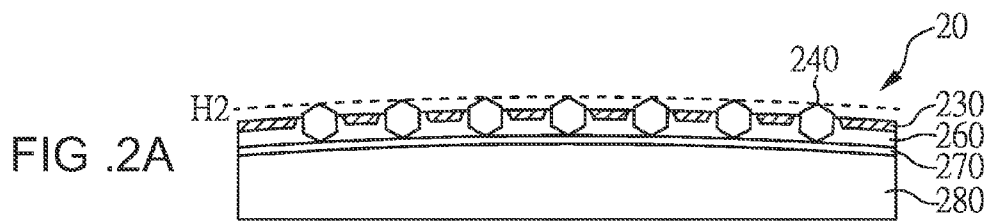
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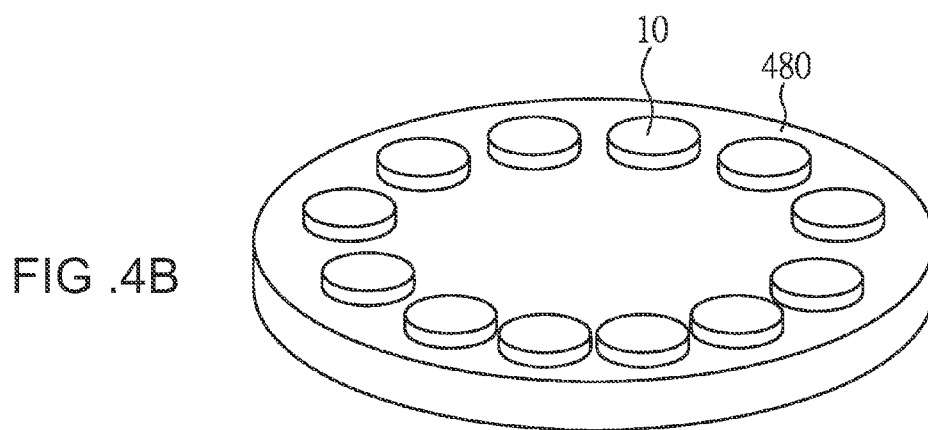
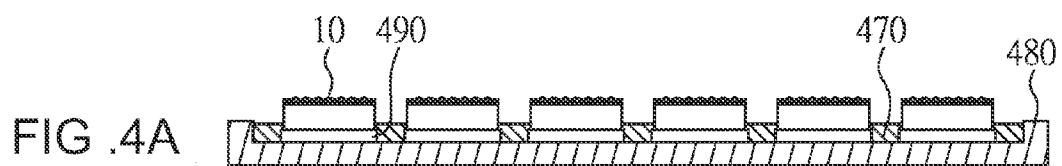
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CHEMICAL MECHANICAL POLISHING CONDITIONER

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefits of the Taiwan Patent Application Serial no. 102206275, filed on Apr. 8, 2012, the subject matter of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention is about a chemical mechanical polishing pad dresser, more particular, to a chemical mechanical polishing pad dresser through having corrosion resistant electroplating.

[0004] 2. Description of Related Art

[0005] Chemical mechanical polishing (CMP) is a common polishing process for a various industries. Using chemical polishing process can polish the surface of a variety kinds of materials, which includes ceramic, silicon, glass, quartz, or a chip of metal, or etc. In addition, with the rapid development of integrated circuits, the chemical mechanical polishing can achieve purpose of a large leveling area, so that it is one of the commonly techniques for the wafer leveling in semiconductor process.

[0006] The chemical-mechanical planarization is processed by transferring the slurry in between the wafer and the polishing pad stably and evenly to soak the polishing pad surface with slurry which containing chemicals (for instance, acid and oxidant) to erode the film on the wafer surface. The myriad nano ceramics abrasive (ex. SiO_2 , Al_2O_3 and CeO_2) in the slurry further pierce and scrape trace film, and simultaneously conduct chemical etching and mechanical grinding to remove the protruding deposit layer on the wafer. The purpose of planarization can be achieved by this polishing the wafer surface.

[0007] A pad dresser, whose function is to polish pad, is a necessary supply for chemical-mechanical planarization. The so-called condition includes shaving the polishing pad surface, removing the accumulation of litter of the polishing pad surface, so as to keep the roughness of the polishing pad surface. In addition, the conditioner can also produce tiny uplift and sunken on the surface, and it is known as the height different of the asperities. Accordingly, the contact area on the polishing pad would be reduced significantly. Once the contact area becomes smaller, the contact pressure becomes greater to make the slurry at the contact point extrusion the protruding part of the wafer and the chemicals (ex: H_2O_2) in the slurry would be oxidation to soften or erode the wafer.

[0008] However, the conventional manufacturing method of the diamond pad dresser such as: brazing, which is typically used to fix the diamond particles on the surface of metal plate by binder. Although it is suitable for conditioning polishing pad, with regard to more sophisticated of chemical mechanical planarization (such as the chemical mechanical planarization process which line width less than 45 nm), scratch, partial dishing, erosion and thickness non-uniformity of the wafer would cause easily in using diamond pad dresser for the polishing pad because the metal plate of diamond pad dresser is too heavy. With the requirement of line width of integrated circuits increasingly reduced, the requirement of the wafer surface planarization will be increased, and thus the

demand pad dresser is also increased, and which can lead to previous diamond conditioner not being able to satisfy the a pre-requirement of the chemical-mechanical planarization process smaller than 45 nm.

[0009] In the prior art, applicant proposed Taiwan patent application number No. 201014680, a grinding tool and a manufacturing method thereof, which comprises a plurality of abrasive particles, a fixed tooling, a substrate and a binding layer. A multitude of holes on the fixing mold contains several grinding particles; the first end and second end of the grinding particle are respectively settled on the bottom and top of the fixing mold; the first distal surface of substrate pushes against the second ends of several grinding particles; the binding layer is combined with several grinding particles, fixing mold, and substrate; the second end of the grinding particle is an end for grinding; the binding layer is embedded in the inner side of fixing mold. Therefore, it is probably not in contact with liquid and corroded during the grinding process. Therefore, it is probably not in contact with liquid and corroded during the grinding process. By utilizing the fixing mold to be combined with grinding particles, it is convenient for controlling the pattern, pitch, and protrusion height of the grinding particles, and fixing the grinding particles more stable so that they are not easy to be released in the process of grinding.

[0010] In addition, applicant proposed another Taiwan patent application number No. 101215212, a chemical mechanical polishing pad dresser, which includes: a substrate, a bonding layer, a fixed template and a plurality of abrasive particles; the bonding layer disposed on the substrate, the fixed template disposed on the bonding layer and having a plurality of through holes, wherein the abrasive particles corresponding to and set in the plurality of through holes and are supported in the bonding layer, and the abrasive particles respectively have a grinding side protruding relative to the surface of the fixed template; wherein, the thermal expansion coefficient of the substrate and the fixed template are higher or lower than the thermal expansion coefficient of the bonding layer. By means of controlling the differences in the thermal expansion coefficient between the substrate, fixed template and bonding layer, the light and thin CMP pad dresser can be utilized, which is not only to eliminate the deformation problem generated through the brazing method after making the substrate to be light and thin, but also to eliminate the problem about shedding and ectopia of the diamond particles, so as to decrease manufacturing cost.

[0011] Additionally, as Japan patent application number No. JP2005219152A provides a method for manufacture dresser, the dresser can prevent the diamond particles separate from the dresser. In such a way, a polishing object is polished so as to decreasing scratch on the polishing object, and the dresser has a longer working life.

[0012] According to the method, the diamond particles each coated with a film formed of a conductive material are arranged in a plurality of through holes formed in a holder from above an upper surface of the holder. Then a surface plate having a recess making contact with the tip of each diamond particle protruding from the through hole of the holder, is arranged on a lower surface of the holder. Further a base member is arranged on the upper surface of the holder, and therefore the diamond particles are firmly sandwiched by the holder and the base member

[0013] The aforementioned design of CMP pad dresser of the patent, which though mentioned to fix the diamond particles through disposed on a template, to avoid shifting of the

diamond particles, however, due to the conventional design CMP pad dresser mainly uses resin or brazing material as the bonding layer for fixing the abrasive particles, so that the resin or brazing bonding layer are easily to be corroded and damaged by the slurry during the polishing process, and result shedding of the diamond particles, and thus the polished object is damaged. On the other hand, in brazing method or resin method for manufacturing CMP pad dresser, because the brazing method or the resin method must harden the abrasive particles by the high temperature heating, and also cause to damage of abrasive particles due to high temperature in hardening process.

[0014] Accordingly, it is necessary to develop a CMP pad dresser, which can avoid damaging abrasive particles due to high temperature in the production process, and improve the surface of CMP pad dresser to be corroded and damaged by the slurry during the polishing process, and avoid the pollution problem that the conventional brazing bonding layer to polished workpieces.

SUMMARY OF THE INVENTION

[0015] A main object of the present invention is to provide a chemical mechanical polishing pad dresser, which is disposed on an electroplating layer through a fixed template. It is not only to utilize the fixed template to protect the electroplating layer, so as to solve the conventional problem that the surface of electroplating polishing pad dresser is corroded by the slurry, but also to solve simultaneously the pollution problem that conventional brazing polishing pad dresser to the polished workpieces during the polishing process.

[0016] In order to achieve the above object, the present invention provides a chemical mechanical polishing pad dresser, comprising: a substrate; a bonding layer disposed on the substrate; an electroplating layer disposed on the bonding layer; a fixed template disposed on the electroplating layer having a plurality of apertures; and a plurality of abrasive particles correspond to and set in the apertures, wherein the plurality of abrasive particles are fixed with the bonding layer and the substrate by the electroplating layer. Therefore, the present invention is not only to utilize the fixed template and the electroplating layer so as to solve the problem that the surface of the chemical mechanical polishing pad dresser is corroded by the slurry, but also to improve simultaneously the pollution problem that conventional brazing bonding layer to polished workpieces. Furthermore, the present invention can adjust the abrasive particles arrangement and protrude rate through the fixed template, so as to enhance the grinding performance and quality of the dresser. On the other hand, because the abrasive particles are fixed between the fixed template and bonding layer by the electroplating method, so that it can avoid damaging the abrasive particles due to the high temperature heating in the production process.

[0017] In the chemical mechanical polishing pad dresser of the present invention, the abrasive particles can be made of various types of abrasive particles; in one aspect, the abrasive particles may be synthetic diamond, natural diamond, polycrystalline diamond, cubic boron nitride, or polycrystalline cubic boron nitride; in another aspect of the present invention, the abrasive particles may be synthetic diamond; in a further another aspect, the abrasive particles may be polycrystalline diamond, but not limited to herein. In addition, in the chemical mechanical polishing pad dresser of the present invention, the particle size of the abrasive particles may be greater than the inner diameter of the apertures of the fixed template, so

that each aperture may receive a particle, so as to avoid dropping the abrasive particles from the apertures and resulting the apertures lacking of abrasive particles to affect the grinding performance and quality of the chemical mechanical polishing pad dresser.

[0018] In the chemical mechanical polishing pad dresser of the present invention, the particle size may be dependent on the particle type or crystal form of particles, or surface roughness required in a polishing process; in one aspect of the present invention, the particle size of the plurality of abrasive particles may be from 100 microns to 600 microns; in another aspect of the present invention, the particle size of the plurality of abrasive particles may be 500 microns, but the present invention is not limited to herein.

[0019] In the chemical mechanical polishing pad dresser of the present invention, the protrude rate that the abrasive particles protrude from the fixed template may be determined by the required of grinding speed or surface roughness of polishing process; in one aspect, the protrude rate that the abrasive particles protrude from the fixed template may be $\frac{1}{5}$ to $\frac{1}{2}$ of the size of the abrasive particles; in another aspect, the protrude rate that the abrasive particles protrude from the fixed template may be $\frac{1}{4}$ to $\frac{1}{3}$ of the size of the abrasive particles. Furthermore, in the chemical mechanical polishing pad dresser of the present invention, the abrasive particles may be adjusted the grinding performance and quality of the polishing pad dresser by a pattern arrangement; in one aspect, the abrasive particles may have a matrix pattern arrangement, a concentric circles arrangement, or a radially arrangement, or etc., in another aspect, the abrasive particles may have a matrix pattern arrangement, but the present invention is not limited to herein.

[0020] In the chemical mechanical polishing pad dresser of the present invention, the fixed template may be determined by the electroplating layer, and having an electronegative so as to deposit and binding to the electroplating layer fixed template and the abrasive particles; in one aspect, the fixed template may be made from nickel metal, silver metal, copper, or alloys thereof, in addition, the electroplating layer may be made from nickel metal, copper metal, chrome metal, or alloys thereof; in another aspect, the fixed template may be made from nickel metal having an electronegative. In addition, in the chemical mechanical polishing pad dresser of the present invention, the thickness of the fixed template may be determined by referring the relative ratio between size of the abrasive particles and the thickness of the electroplating layer; in one aspect, the thickness of the fixed template may be from 50 microns to 300 microns; in another aspect, the thickness of the fixed template may be from 50 microns to 100 microns, the present invention is not limited to herein.

[0021] In the chemical mechanical polishing pad dresser of the present invention, the bonding layer may be made from brazing materials, electroplating materials, a ceramic material or a resin material; in one aspect, the bonding layer may be made from resin material. In addition, in the chemical mechanical polishing pad dresser of the present invention, the thickness of bonding layer may be from 20 microns to 200 microns; preferably, the thickness of bonding layer may be from 50 microns to 100 microns. Furthermore, in the chemical mechanical polishing pad dresser of the present invention, the substrate may be made from stainless steel, but the present invention is not limited to herein.

[0022] In the chemical mechanical polishing pad dresser of the present invention, the highest tip of each abrasive particle

may be connected to form a polishing surface, wherein, the polishing surface may be a plane, a convex plane, or a concave plane according to the surface shape of the substrate; in one aspect, the polishing surface may be a plane shape on a plane of the substrate surface; in another aspect, the polishing surface may be a convex shape in the substrate surface which is convex. In addition, in the chemical mechanical polishing pad dresser of the present invention, the aforementioned polishing surface may be changed according to the direction of the tip of the abrasive particles or the crystal form of abrasive particles; in one aspect, the abrasive particles may be a respectively have an attitude with a tip toward the polishing pad to be dressed, so that the polishing surface may be a plane shape; in another aspect, the abrasive particles located in the central area may be respectively have an attitude with a tip toward for the polishing pad to be dressed, and the abrasive particles located in the surrounding area may be have an attitude with a plane toward for the polishing pad to be dressed, so that the polishing surface may be a convex shape.

[0023] In the chemical mechanical polishing pad dresser of the present invention, the diameter of the substrate may be determined by the area of the polishing process; in one aspect, the diameter of the substrate may be from 5 mm to 250 mm; in another aspect, the diameter of the substrate may be from 80 mm to 120 mm.

[0024] In the chemical mechanical polishing pad dresser of the present invention, it further comprises a base substrate to be disposed on the bottom of the substrate, and wherein an adhesive layer for adjusting thickness is sandwiched between the substrate and the base substrate. In addition, in the aforementioned chemical mechanical polishing pad dresser of the present invention, the surface of base substrate may has a plurality of the substrates, and the diameter of the base substrate may be 4 to 20 times of the diameter of the substrates. In one aspect, the surface of the base substrate may have 4 to 20 substrates, preferably, the surface of the base substrate may have 10 to 12 substrates, and the substrates may be formed of a circular arrangement along outside of the base substrate. In addition, in one aspect, the aforementioned diameter of the substrate may be 10 mm to 20 mm. In another aspect, the diameter of the substrate may be 15 mm, and the diameter of the base substrate may be 100 mm, and the present invention is not limited to herein.

[0025] In the chemical mechanical polishing pad dresser of the present invention, it further comprises a sealing layer, which may be filled in the gap between the substrates, so that the substrate may be fixed to the base substrate to form a modular chemical mechanical polishing pad dresser.

[0026] An another object of the present invention is to provide a method for manufacturing a chemical mechanical polishing pad dresser, which is disposed on the electroplating layer through a fixed template. Therefore, it is not only utilize the fixed template to protect the electroplating layer so as to solve the conventional problem that the surface of electroplating polishing pad dresser is corroded by the slurry, but also to solve simultaneously pollution problems generated on the polished workpieces by using the conventional brazing polishing pad dresser in a polishing process.

[0027] In order to achieve the above object, the present invention provides a method for manufacturing a chemical mechanical polishing pad dresser, which includes: providing a temporary substrate, wherein a temporary adhesive layer may be disposed on the temporary substrate; providing a fixed template, disposed on the temporary adhesive layer, and hav-

ing a plurality of the apertures and inner edges of the plurality of apertures; providing a plurality of the abrasive particles, correspond to and set in the apertures, wherein, the particle size of the abrasive particles may be greater than the apertures, so that each aperture may receive and secure a particle, and a force be applied downward by a lower pressing plate, so that the abrasive particles penetrate to the temporary adhesive layer, and wherein the protrude rate that the abrasive particles protrude from the fixed template can be controlled by the thickness of temporary adhesive; providing an electroplating layer, which can control the fixed template to being an electronegative, so that the electroplating layer is deposited on and fixed to the fixed template and the abrasive particles; removing the temporary substrate and the temporary adhesive, so that the abrasive particles may be revealed from the apertures of the fixed template; providing a substrate and a bonding layer, wherein the bonding layer binds to the surface of the electroplating layer, and the bonding layer relative to fixed template is located another side of the electroplating layer, so as to form a polishing pad dresser.

[0028] In the aforementioned method for manufacturing the chemical mechanical polishing pad dresser of the present invention, it further comprises: providing a base substrate, which may be disposed on the bottom of substrate of the polishing pad dresser, wherein an adhesive layer for adjusting thickness is sandwiched between the substrate and the base substrate. In addition, in the aforementioned method for manufacturing the chemical mechanical polishing pad dresser of the present invention, the surface of the base substrate may have a plurality of polishing pad dresser, and the diameter of the base substrate is 4 to 20 times of the diameter of the substrates.

[0029] In the method for manufacturing the chemical mechanical polishing pad dresser of the present invention, it further comprises a sealing layer filled in the gap between the substrates of aforementioned polishing pad dressers, wherein the substrates of polishing pad dressers are fixed on the base substrate, so as to form a modular chemical mechanical polishing pad dresser.

[0030] Therefore, the chemical mechanical polishing pad dresser may utilize the fixed template to protect the electroplating layer, so as to solve the conventional problem that the surface of electroplating polishing pad dresser is corroded by the slurry, and also to solve simultaneously the pollution problem generated on polished workpieces by the conventional brazing polishing pad dresser in the polishing process. In addition, the abrasive arrangement and protrude rate of abrasive particles may be adjust by the fixed template, so as to enhance the grinding performance and quality of the chemical mechanical polishing pad dresser.

BRIEF DESCRIPTION OF THE DRAWINGS

[0031] FIG. 1A to 1H show manufacturing flow charts of a CMP pad dresser of the present invention;

[0032] FIG. 2A to 2B show the schematic views of a CMP pad dresser of the present invention;

[0033] FIG. 3A to 3B show the schematic views of a CMP pad dresser of the present invention;

[0034] FIG. 4A to 4B show the schematic views of a CMP pad dresser of the present invention;

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0035] Hereafter, examples will be provided to illustrate the embodiments of the present invention. Other advantages and

effects of the invention will become more apparent from the disclosure of the present invention. Other various aspects also may be practiced or applied in the invention, and various modifications and variations can be made without departing from the spirit of the invention based on various concepts and applications.

EXAMPLE 1

[0036] A main object of the present invention is to provide a chemical mechanical polishing pad dresser, which is disposed on an electroplating layer through a fixed template. Therefore, it is not only utilize the fixed template to protect the electroplating layer, so as to solve the conventional problem that the surface of electroplating polishing pad dresser is corroded by the slurry, but also to solve simultaneously the pollution problem generated on polished workpieces by the conventional brazing polishing pad dresser in the polishing process. The FIG. 1A to 1H shows manufacturing flow charts of a CMP pad dresser of the example 1 of the present invention. Please refer to FIG. 1A and 1B, firstly, a temporary substrate **110** is provided, and a temporary adhesive layer **120** is disposed on the temporary substrate **110**, wherein, in the example 1, the temporary substrate **110** may be made of stainless steel or general rigid material, and the temporary adhesive layer **120** may be a tape having adhesive of both side thereof, so as to the template **130** and the abrasive particles **140** are temporarily fixed on the temporary substrate **110**.

[0037] Next, please refer to FIG. 1C, a fixed template **130** is provided, wherein the fixed template **130** is disposed on the temporary adhesive layer **120**, and the fixed template **130** has a plurality of the apertures **131** and inner edges of a plurality of apertures **132**, wherein, in the example 1, the fixed template **130** is made of nickel-metal material, of which thickness is 100 microns, and the abrasive particles **140** is controlled to have a regulation arrangement of a matrix pattern through the apertures **131** of the fixed template **130**; please refer to FIGS. 1D and 1E, a plurality of the abrasive particles **140** is providing, which may correspond to and set in the apertures **131**, wherein, the particle size of the abrasive particles **140** may be greater than the apertures **131**, so that each aperture **131** may receive and secure a particle **140**, and a force is applied downward by a lower pressing plate **150** (show as the FIG. 1D direction of arrow), so that the abrasive particles **140** penetrate to the temporary adhesive layer **120**, and the protrude rate that the abrasive particles **140** protrude from the fixed template **130** is controlled by the thickness of the temporary adhesive **120**, wherein, in the example 1, the abrasive particles is synthetic diamond of which the particle size is 500 μm , and the protrude rate that the abrasive particles protrude from the fixed template may be $\frac{1}{4}$ of the size of the abrasive particles, i.e., about 125 microns.

[0038] Next, please refer to FIG. 1F, an electroplating layer **160** is provided, which may control the fixed template **130** to be an electronegative, so that the electroplating layer **160** is deposite and bonded on the fixed template **130** and the abrasive particles **140**; wherein, in the example 1, the electroplating layer **160** is made of nickel plating material; please refer to FIG. 1G, the temporary substrate **110** and the temporary adhesive **120** are removed, so that the abrasive particles **140** are revealed from the apertures **131** of the fixed template **130**; finally, as shown in FIG. 1H, a substrate **180** and a bonding layer **170** are provided, so that the bonding layer **170** bonds to the surface of electroplating layer **160**, and the bonding layer **170** relative to the fixed template **130** is located in another side

of the electroplating layer **160** so as to form the polishing pad dresser **10**, and the highest tip of each abrasive particle **140** is connected to form a polishing surface H1, wherein, in the example 1, the bonding layer **170** is made of resin adhesive which thickness is 100 μm , the substrate **180** is stainless steel which diameter is 16 mm, and the substrate **180** has a plane surface, so that the polishing surface H1 is a plane shape.

[0039] Accordingly, the example 1 provides a chemical mechanical polishing pad dresser **10**, comprising: a substrate **180**; a bonding layer **170** disposed on the substrate **180**; an electroplating layer **160** disposed on the bonding layer **170**; a fixed template **130** disposed on the electroplating layer **160** having a plurality of apertures **131**; and a plurality of abrasive particles **140** corresponding to and set in the apertures **131**, wherein the plurality of abrasive particles **140** are fixed in the bonding layer **170** and the substrate **180** by means of the electroplating layer **160**. Therefore, the present invention may not only utilize the fixed template and the electroplating layer to solve the problem that the surface of polishing pad dresser is corroded by the slurry, but also improve simultaneously the pollution problem generating on the polished workpieces by using the conventional brazing bonding layer; and the present invention also provide to adjust the abrasive particles arrangement and protrude rate through the fixed template, so as to enhance the grinding performance and quality of the chemical mechanical polishing pad dresser.

EXAMPLE 2 EXAMPLE 3

[0040] FIGS. 2A and 2B show the schematic view of a CMP pad dresser of the example 2 and the example 3 of the present invention. The CMP pad dresser of example 2 and the example 3 are almost the same as the aforementioned example 1, except that the example 1 provides a polishing pad dresser having a polishing surface which is a planar shape, on the contrary, the example 2 and the example 3 provide a polishing pad dresser having a polishing surface which are non-planar shape.

[0041] Please refer to FIG. 2A, a polishing pad dresser **20** is provided, comprising: a substrate **280**; a bonding layer **270** disposed on the substrate **280**; an electroplating layer **260** disposed on the bonding layer **270**; a fixed template **230** disposed on the electroplating layer **260**; and a plurality of abrasive particles **240** corresponding to and set in the apertures of the fixed template **230**, wherein the plurality of abrasive particles **240** are fixed in the bonding layer **270** and the substrate **280** by means of the electroplating layer **260**, and the highest tip of each abrasive particle **240** is connected to form a polishing surface H2. In particular, the aforementioned substrate **280** has a convex surface, so that the polishing surface H2 is a convex shape.

[0042] Please refer to FIG. 2B, a polishing pad dresser **21** is provided, comprising: a substrate **281**; a bonding layer **271** disposed on the substrate **281**; an electroplating layer **261** disposed on the bonding layer **271**; a fixed template **231** disposed on the electroplating layer **261**; and a plurality of abrasive particles **241** corresponding to and set in the apertures of the fixed template **231**, wherein the plurality of abrasive particles **241** are fixed in the bonding layer **271** and the substrate **281** by means of the electroplating layer **261**, the highest tip of each abrasive particle **241** is connected to form a polishing surface H3. Furthermore, the aforementioned substrate **281** has a concave surface, so that the polishing surface H3 is a concave shape. Therefore, the present invention can further adjust the surface shape of the substrate at will

according to the requirement of the polishing process, so that the polishing surface shape is a plane, a convex plane, or a concave plane, so as to control the grinding performance and quality of the chemical mechanical polishing pad dresser.

EXAMPLE 4 AND EXAMPLE 5

[0043] FIG. 3A and FIG. 3B show the schematic view of a CMP pad dresser of the example 4 and the example 5 of the present invention. The CMP pad dresser of the example 4 and the example 5 are almost the same as the aforementioned example 1, except that the example 1 provides the abrasive particles which have respectively an attitude with a tip oriented toward the polishing pad to be dressed, on the contrary, the example 4 and example 5 provide the abrasive particles which have respectively an attitude with a plane oriented toward the polishing pad to be dressed, or the planes of the part of abrasive particles and the tips of the another of abrasive particles are oriented toward the polishing pad to be dressed.

[0044] Please refer to FIG. 3A, a polishing pad dresser 30 is provided, comprising: a substrate 380; a bonding layer 370 disposed on the substrate 380; an electroplating layer 360 disposed on the bonding layer 370; a fixed template 330 disposed on the electroplating layer 360; and a plurality of the abrasive particles 340 corresponding to and set in the apertures of the fixed template 330, wherein the plurality of the abrasive particles 340 are fixed in the bonding layer 370 and the substrate 380 by means of the electroplating layer 360. In addition, the aforementioned abrasive particles 340 have respectively an attitude with a plane oriented toward for the polishing pad to be dressed, so that the polishing surface is a plane shape.

[0045] Please refer to FIG. 3B, a polishing pad dresser 31 is provided, comprising: a substrate 381; a bonding layer 371 disposed on the substrate 381; an electroplating layer 361 disposed on the bonding layer 371; a fixed template 331 disposed on the electroplating layer 361; and a plurality of the abrasive particles 341 corresponding to and set in the apertures of the fixed template 331, wherein the plurality of the abrasive particles 341 are fixed in the bonding layer 371 and the substrate 381 by means of the electroplating layer 361. Furthermore, in the aforementioned polishing pad dresser 31, the central abrasive particles 341 located in the central area may have respectively a tip oriented toward the polishing pad to be dressed, and the periphery abrasive particles 342 located in the surrounding area may have respectively a plane oriented toward the polishing pad to be dressed, so that the polishing surface may be a convex shape. Therefore, the present invention can further adjust the direction of the tip or of the plane of the abrasive particle at will according to the requirement of the polishing process, so that the polishing surface shape is a plane, a convex plane, or a concave plane so as to control the grinding performance and quality of the chemical mechanical polishing pad dresser.

EXAMPLE 6

[0046] FIG. 4A and FIG. 4B show the schematic view and the schematic perspective view of a CMP pad dresser of the present invention. The example 6 provides the CMP pad dresser manufactured by example 1 to be arranged and assembled on a base substrate, so as to form a modular chemical mechanical polishing pad dresser.

[0047] Please refer to the FIG. 4A and FIG. 4B, a modular CMP pad dresser is provided, comprising: providing a base

substrate 480, the base substrate 480 disposed on the bottom of the polishing pad dresser 10 (referring to FIG. 1H), and disposed an adhesive layer 490 for adjusting thickness, wherein the adhesive layer 490 is sandwiched between the substrate and the base substrate. In addition, in aforementioned modular CMP pad dresser, the surface of base substrate 480 may have a plurality of the CMP pad dresser 10, and the diameter of the base substrate 480 may be 4 to 20 times of the diameter of substrates of the CMP pad dressers 10. Wherein, in example 6, the diameter of the substrate 480 is 100 mm, the surface of base substrate 480 may have 12 CMP pad dressers 10, and the diameter of the CMP pad dressers 10 (or the substrate thereof) is 15 mm.

[0048] In aforementioned modular CMP pad dresser, a sealing layer 470 is further comprised, which may filled in the gap of the substrates of the aforementioned CMP pad dressers, so that the substrates of the CMP pad dressers 10 is fixed on the base substrate 480, so as to form a modular chemical mechanical polishing pad dresser.

[0049] The embodiments described above are only to exemplify the present invention but not to limit the scope of the present invention. Any equivalent modification or variation according to the spirit of the present invention is to be also included within the scope of the present invention.

What is claimed is:

1. A chemical mechanical polishing pad dresser, comprising:

- a substrate;
- a bonding layer disposed on the substrate;
- an electroplating layer disposed on the bonding layer;
- a fixed template disposed on the electroplating layer having a plurality of apertures; and
- a plurality of abrasive particles corresponding to and set in the apertures, wherein the plurality of abrasive particles are fixed with the bonding layer and the substrate by the electroplating layer.

2. The chemical mechanical polishing pad dresser as claimed in claim 1, wherein the plurality of abrasive particles are synthetic diamond, natural diamond, polycrystalline diamond, cubic boron nitride, or polycrystalline cubic boron nitride.

3. The chemical mechanical polishing pad dresser as claimed in claim 1, wherein the particle size of the plurality of abrasive particles are greater than the inner diameter of the apertures.

4. The chemical mechanical polishing pad dresser as claimed in claim 1, wherein the size of the plurality of abrasive particles is from 100 microns to 600 microns.

5. The chemical mechanical polishing pad dresser as claimed in claim 1, wherein the protrude rate that the abrasive particles protrude from the fixed template is $\frac{1}{5}$ to $\frac{1}{2}$ of the size of the abrasive plurality of particles.

6. The chemical mechanical polishing pad dresser as claimed in claim 1, wherein the plurality of abrasive particles have a pattern arrangement.

7. The chemical mechanical polishing pad dresser as claimed in claim 1, wherein the fixed template is made from nickel metal, silver metal, copper, or alloys thereof.

8. The chemical mechanical polishing pad dresser as claimed in claim 7, wherein the thickness of the fixed template is from 50 microns to 300 microns.

9. The chemical mechanical polishing pad dresser as claimed in claim 1, wherein the bonding layer is made from brazing materials, electroplating materials, a ceramic material or a resin material.

10. The chemical mechanical polishing pad dresser as claimed in claim 9, wherein the thickness of the bonding layer is from 20 microns to 200 microns.

11. The chemical mechanical polishing pad dresser as claimed in claim 1, wherein the substrate is made from stainless steel.

12. The chemical mechanical polishing pad dresser as claimed in claim 1, wherein the highest tips of the plurality of abrasive particles are connected to form a polishing surface, wherein the polishing surface is a plane, a convex plane, or a concave plane.

13. The chemical mechanical polishing pad dresser as claimed in claim 1, wherein the plurality of abrasive particles respectively have an attitude with a tip oriented toward a polishing pad to be dressed.

14. The chemical mechanical polishing pad dresser as claimed in claim 1, wherein the plurality of abrasive particles located in the central area respectively have an attitude with a tip oriented toward a polishing pad to be dressed, and the

plurality of abrasive particles located in the surrounding area have an attitude with a plane oriented toward the polishing pad to be dressed.

15. The chemical mechanical polishing pad dresser as claimed in claim 1, wherein the diameter of the substrate is from 5 mm to 250 mm.

16. The chemical mechanical polishing pad dresser as claimed in claim 1, further comprising a base substrate disposed on the bottom of the substrate, wherein an adhesive layer for adjusting thickness is sandwiched between the substrate and the base substrate.

17. The chemical mechanical polishing pad dresser as claimed in claim 16, wherein the surface of the base substrate has a plurality of substrates.

18. The chemical mechanical polishing pad dresser as claimed in claim 16, wherein the diameter of the base substrate is 4 to 20 times of the diameter of the substrates.

19. The chemical mechanical polishing pad dresser as claimed in claim 16, further comprising a sealing layer filled in the gap between the substrates, wherein the substrate is fixed to the base substrate.

20. The chemical mechanical polishing pad dresser as claimed in claim 16, wherein the diameter of the substrate is 10 mm to 20 mm.

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