

DESCRIPTION

METHOD FOR MANUFACTURING PAD CONDITIONER AND PAD CONDITIONER

Technical Field

[0001] The present invention relates to a method for manufacturing a pad conditioner. More particularly, the present invention relates to a method for manufacturing a pad conditioner for a CMP apparatus used in wafer planarization. Also, the present invention relates to a pad conditioner manufactured by the method.

[0002] This application claims the benefit of Korean Patent Application No. 10-2014-0034834, filed on March 25, 2014, which is hereby incorporated by reference in its entirety into this application.

Background Art

[0003] A CMP apparatus is a tool to achieve flatness of semiconductor wafers.

[0004] As shown in FIG. 1, a CMP apparatus comprises a rotating substrate plate 1, covered by a polishing pad 2, and a carrier 3, for holding a wafer 4 to be polished. While polishing slurry is dropped on the polishing pad, the carrier 3 holding the wafer 4 is pressed and allowed to move in relation to the substrate plate 1 so as to polish the wafer against the polishing pad.

[0005] The ability of a CMP apparatus to uniformly polish wafers is one of the most important properties in realizing high semiconductor wafer flatness. Very important among various factors for enhancing the uniformity of wafer planarization is the surface condition of the polishing pad. Because the pad is subjected to pressure and rapid motion during polishing, its surface is non-uniformly altered during the processing time, while micropores in the pad are clogged with polishing residue, resulting in incapacitation of the pad.

[0006] Hence, when the surface of the pad is transformed, the pad is finely abraded using a conditioner 10 to expose new micropores.

[0007] As shown in FIG. 2, the conditioner 10 comprises a conditioner substrate 11, a plurality of abrasive grains 7 spread on the conditioner substrate 11, and a plating layer 8

for fixing the abrasive grains 7 onto the substrate 7.

[0008] Typical methods of manufacturing such conditioners employ electrodeposition, fusion, or sintering to fix the abrasive grains onto the substrate, the abrasive grains being composed of diamond or the like.

[0009] Because all of the electrodeposition, the fusion, and the sintering processes are conducted in such a way to utilize a mould or to coat the substrate with abrasive grains, they make it difficult to control the intervals between abrasive grains as desired and to spread abrasive grains at designated sites and at uniform protrusion heights.

[0010] (Patent Document 1) Korean Patent Unexamined Application Publication No. 2002-0046471 (issued June 21, 2002, titled "Method for Manufacturing Chemical-Mechanical Polishing Pad Conditioner").

Disclosure

Technical Problem

[0011] An object of the present invention is to provide a method for manufacturing a pad conditioner for a CMP apparatus used in wafer planarization, using a reverse electroplating process, whereby abrasive grains can be formed at a uniform height in a regular pattern on one surface.

Technical Solution

[0012] In order to accomplish the above object, an aspect of the present invention provides a method for manufacturing a pad conditioner, comprising: depositing a photosensitive film on a base substrate, followed by etching to form a plurality of receiving holes in the photosensitive film; inserting abrasive grains into the receiving holes and blanketing a plating layer over the photosensitive film and the abrasive grains; removing the base substrate and then the photosensitive film; and melting a part of the plating layer to expose a part of each of the abrasive grains.

[0013] In one embodiment, the method may further comprise forming an anti-corrosive coat on the upper surface of the plating layer.

[0014] In another embodiment, the plating layer into which the abrasive grains are partially embedded is attached to a conditioner substrate using an adhesive.

[0015] In another embodiment, the receiving holes are as large as, or larger than, the

maximum diameter of the abrasive grains.

[0016] In another embodiment, the upper surface of the plating layer is parallel to that of the base substrate.

[0017] Also, the present invention provides a pad conditioner, manufactured by the method, wherein a plurality of abrasive grains protrudes from the plating layer at a uniform height, and the plating layer has a convex portion at a boundary to the abrasive grains.

[0018] Another aspect of the present invention provides a method for manufacturing a pad conditioner, comprising: depositing a photosensitive film on a base substrate, followed by etching to form a plurality of receiving holes in the photosensitive film; inserting abrasive grains into the receiving holes and then filling the receiving holes by primary plating to form a filling layer; blanketing a plating layer over all of the photosensitive film, the filling layer, and the abrasive grains by secondary plating; and removing the base substrate, the photosensitive film, and the filling layer to expose a part of each of the abrasive grains.

[0019] In one embodiment, the plating layer into which the abrasive grains are partially embedded is attached to a conditioner substrate using an adhesive.

[0020] In another embodiment, the filling layer and the plating layer are made of different respective materials.

[0021] Further, the present invention provides a pad conditioner, manufactured by the method, wherein a plurality of abrasive grains protrudes from the plating layer at a uniform height, and the plating layer has a convex portion at a boundary to the abrasive grains.

[0022] Another aspect of the present invention provides a method for manufacturing a pad conditioner, comprising: depositing a photosensitive film on a base substrate, followed by etching to form a plurality of receiving holes in the photosensitive film; inserting abrasive grains into the receiving holes and then filling the receiving holes by primary plating to form a filling layer; removing the photosensitive film; conducting a secondary plating process to form a support layer for covering the upper surface of the base substrate and a part(portions?) of side-walls of the abrasive grains; blanketing a plating layer over all of the support layer and the abrasive grains by tertiary plating; removing the base substrate, and then the support layer and the filling layer to expose a

part of each of the abrasive grains.

[0023] In one embodiment, the plating layer, into which the abrasive grains are partially embedded, is attached to a conditioner substrate using an adhesive.

[0024] In another embodiment, the support layer and the filling layer are made of the same material.

[0025] In another embodiment, the plating layer is different in material from the support layer and the filling layer.

[0026] Further, the present invention provides a pad conditioner, manufactured by the method, wherein a plurality of abrasive grains protrudes from the plating layer at a uniform height, and the plating layer has a concave portion at a boundary to the abrasive grains.

[0027] In one embodiment, the concave portion is planarized by conducting an additional surface plating process on the plating layer.

Advantageous Effects

[0028] Because a plating layer into which abrasive grains are partially embedded is formed in a reverse electroplating process, the abrasive grains can be spread in a regular pattern and can be made to protrude at a uniform height from the plating layer.

[0029] In addition, the protrusion height of the abrasive grains from the plating layer can be controlled with a photosensitive film.

[0030] Further, the use of photosensitive films enables the arrangement of abrasive grains in various patterns without a mould, thus allowing for the manufacture of various pad conditioners as appropriate.

[0031] Therefore, the method according to the present disclosure can manufacture pad conditioners faster, and thus within a shorter time, compared to conventional methods using a mould. Protruding at a uniform height from the plating layer, the abrasive grains spiked into the pad conditioner can condition the pad homogeneously, and thus improve the stability of a CMP process.

Description of Drawings

[0032] Fig. 1 is a view illustrating a schematic structure of a CMP apparatus.

[0033] Fig. 2 is a view of a conventional pad conditioner.

[0034] Fig. 3 shows cross-sectional views for illustrating a method for manufacturing a pad conditioner in accordance with an embodiment of the present invention.

[0035] Fig. 4 shows cross-sectional views for illustrating a method for manufacturing a pad conditioner in accordance with another embodiment of the present invention.

[0036] Fig. 5 shows cross-sectional views for illustrating a method for manufacturing a pad conditioner in accordance with a further embodiment of the present invention.

<Description of the Reference Numerals in the Drawings>

[0037] 10: Pad conditioner

[0038] 11: Conditioner substrate

[0039] 21: Base substrate

[0040] 23: Photosensitive film

[0041] 25: Receiving holes

[0042] 27: Abrasive grains

[0043] 28: Filling layer

[0044] 29: Support layer

[0045] 31: Plating layer

[0046] 33: Protrusion part

[0047] 34: Convex portion

[0048] 35: Concave portion

Best Mode

[0049] Hereinafter, embodiments of the present invention will be described in detail with reference to the accompanying drawings.

[0050] The present invention addresses a method for manufacturing a pad conditioner, characterized by a reverse electroplating process using a photosensitive film to form a plating layer in which abrasive grains are embedded and thus fixed. The method will be described in the following three modes.

[First Embodiment]

[0051] The method for manufacturing a pad conditioner in accordance with an embodiment of the present invention, as shown in FIG. 3, comprises depositing a photosensitive film 23 on a base substrate 21, followed by an etching process to form a plurality of receiving holes 25 in the photosensitive film 23 (S11), inserting abrasive

grains 27 into the receiving holes 25 and blanketing a plating layer 31 over the photosensitive film 23 and the abrasive grains 27 (S12), removing the base substrate 21 and then the photosensitive film 23 (S13), and melting a part of the plating layer 31 to allow the abrasive grains 27 to remain fixedly embedded in the plating layer 31 (S14).

[0052] The pad conditioner 10 comprises a conditioner substrate 11 onto which the abrasive grains 27 are fixed through the plating layer 31.

[0053] The conditioner substrate 11 is formed of a circular member, and can be rotated by a separate rotating unit, which is engaged to the center of the conditioner substrate 11. Driven by the rotating unit, the conditioner substrate 11 is rotated to condition the pad in order to maintain the surface thereof in a state as close to the initial state thereof as possible.

[0054] In step S11, a photosensitive film 23 is deposited on a base substrate 21.

[0055] The photosensitive film 23 may be attached to the base substrate 21 using an adhesive film. After being interposed between the base substrate 21 and the photosensitive film 23, the adhesive film is melted by heat under pressure to achieve the deposition of the photosensitive film 23 on the base substrate 21.

[0056] Subsequently, the photosensitive film 23 deposited on the base substrate 21 is selectively etched to form spaces for accommodating the abrasive grains 27.

[0057] In a preferred embodiment of the present invention, the etching of the photosensitive film 23 may be achieved by photoetching the photosensitive film 23 with UV light in the presence of a photomask.

[0058] That is, a photomask is prepared to have multiple hexagonal, circular, or rectangular holes therein, and is laid on the photosensitive film 23, followed by exposure to UV. The UV-unexposed regions of the photosensitive film are removed by etching.

[0059] Hence, the photosensitive film 23 is selectively etched to leave multiple hexagonal, circular or rectangular receiving holes 25 therein.

[0060] Preferably, the receiving holes 25 are formed in a regular pattern.

[0061] Also, the receiving holes 25 are preferably as large as or larger than the maximum diameter of the abrasive grains 27. Setting the size of the receiving holes 25 the same as (or larger than?) that of the abrasive grains 27 makes it easy to maintain the homogeneous insertion of the abrasive grains into the receiving holes 25.

[0062] When the receiving holes 25 have a small size, the abrasive grains 27 are

ultimately exposed in a line or point mode.

[0063] That is, the vertexes of the abrasive grains 27 fixedly embedded in the plating layer 31 appear as points or lines. In this case, the abrasive grains 27 are uniformly abraded during the conditioning work, which results in prolonging the half-life of the abrasive grains 27.

[0064] By controlling the pattern of the holes in the photomask, the receiving holes 25 can be formed to have one or more patterns in the photosensitive film 23.

[0065] The base substrate 21 may be a stainless steel substrate. Alternatively, the base substrate may be made of metal, alloy, or ceramic.

[0066] The base substrate 21 may be made of the same material as the conditioner substrate 11, and is used as a support for forming the plating layer 31 in which the abrasive grains 27 are fixedly embedded. In addition, the protrusion height of the abrasive grains 27 from the surface of the plating layer 31 is determined by controlling the thickness of the photosensitive film 23.

[0067] In step S12, the abrasive grains 27 are inserted into the receiving holes 25. One abrasive grain 27 is assigned to each receiving hole 25.

[0068] The thickness of the receiving holes 25 is lower than the height of the abrasive grains 27. Thus, the abrasive grains 27 inserted into the receiving holes 25 protrude out of the photosensitive film 23.

[0069] After the insertion of the abrasive grains 27, a plating layer 31 is blanketed over the photosensitive film 23 and the abrasive grains 27.

[0070] Preferably, the plating layer 31 may be formed of nickel. In addition to being resistant to heat and abrasion, nickel plating gives a metallic sensation to create an attractive appearance, and allows for easy control of thickness, thus making it easy to realize a uniform thickness.

[0071] The abrasive grains 27 are fixed by the plating layer 31. Preferably, the abrasive grains 27 may be diamond particles. Alternatively, various particles such as cubic boron nitride particles, polycrystalline cubic boron nitride particles, hard grains, etc. may be used as the abrasive grains.

[0072] In step S13, the base substrate 21 is removed, followed by etching the photosensitive film 23 that remains after step S11. That is, the entire photosensitive film 23, patterned on the plating layer 31, is removed by etching.

[0073] After removal of the photosensitive film 23 by etching, the resulting structure is turned upside down so as to position the abrasive grains 27 on the plating layer 31.

[0074] Step S13 results in the formation of regularly spaced protrusion parts 33 in which the abrasive grains 27 are embedded.

[0075] The abrasive grains 27 embedded in the protrusion parts 33 are uniform in height.

[0076] In step S14, the plating layer 31 is partially melted to remove the protrusion parts 33, with the resultant external exposure of portions of individual abrasive grains 27. Unnecessary parts of the plating layer 31 are removed by etching to allow portions of the abrasive grains 27 to be exposed externally.

[0077] After step S14, the externally exposed regions of the abrasive grains that are fixedly embedded in the plating layer 31 are uniform in height because the abrasive grains 27 have been supported by the base substrate 21. Thus, the pad can be homogeneously conditioned by the pad conditioner.

[0078] Having a flat lower surface, the plating layer 31 may be fixedly attached to the conditioner substrate 11 using an adhesive. If the lower surface is not flat, polishing work may be conducted to make the bottom flat.

[0079] Using an adhesive, the lower surface of the plating layer 31, in which the abrasive grains 27 are fixedly embedded, is attached to the upper surface of the conditioner substrate 11, with the resultant fixation of the abrasive grains 27 onto the conditioner substrate 11.

[0080] After attachment of the plating layer 31 to the conditioner substrate 11 using an adhesive, finish plating may be conducted. The finish plating may be advantageously conducted with chrome (Cr) in view of corrosion resistance.

[0081] Alternatively, the plating layer 31 may be attached to the conditioner substrate 11 via a metallic binder that is different from the plating layer 31.

[0082] The pad conditioner 10 manufactured by the method, as confirmed in step (S15), comprises a plurality of abrasive grains that uniformly protrude in one or more patterns from the plating layer 31 on the conditioner substrate 11.

[0083] In addition, the regions of the abrasive grains 27 that are externally exposed out of the plating layer 31 are uniform in height.

[0084] At the boundary to the abrasive grains, the surface of the plating layer 31 has a

convex portion 34. This convex portion 34 is formed during the removal of portions a part of the protrusion parts 33 by melting.

[0085] In an embodiment, the abrasive grains 27 are diamond particles, the plating layer 31 is a nickel plating layer, and the conditioner substrate 11 is a stainless steel substrate.

[0086] In the method for manufacturing a pad conditioner according to an embodiment, the plating layer is formed of a single metal, thereby enabling the simplification of the work space and process.

[Second Embodiment]

[0087] The method for manufacturing a pad conditioner in accordance with another embodiment of the present invention, as shown in FIG. 4, comprises depositing a photosensitive film 23 on a base substrate 21, followed by conducting an etching process to form a plurality of receiving holes 25 in the photosensitive film 23 (S21), inserting abrasive grains 27 into the receiving holes 25 and then filling the receiving holes 25 by primary plating to form a filling layer 28 (S22), blanketing a plating layer 31 over all of the photosensitive film 23, the filling layer 28, and the abrasive grains 27 by secondary plating (S23), removing the base substrate 21 and then the photosensitive film 23 (S24), and melting a part of the plating layer 31 to allow the abrasive grains 27 to remain fixedly embedded in the plating layer 31 (S31).

[0088] The second embodiment is different from the first embodiment in that it comprises forming and removing the filling layer 28, without melting a part of the plating layer 31 (S14), so as to uniformly protrude the abrasive grains 27 out of the plating layer 31.

[0089] In step S21, a photosensitive film 23 is deposited on a base substrate 21. Subsequently, the photosensitive film 23 deposited on the base substrate 21 is selectively etched to form spaces for accommodating the abrasive grains 27.

[0090] In a preferred embodiment of the present invention, the etching of the photosensitive film 23 may be achieved by photoetching the photosensitive film 23 with UV light in the presence of a photomask.

[0091] That is, a photomask is prepared to have multiple hexagonal, circular, or rectangular holes therein, and is laid on the photosensitive film 23, followed by exposure to UV. The UV-unexposed regions of the photosensitive film are removed by etching.

[0092] Hence, the photosensitive film 23 is selectively etched, leaving multiple hexagonal, circular or rectangular receiving holes 25 therein. Therefore, multiple receiving holes 25 are formed in the photosensitive film 23.

[0093] The receiving holes 25 are preferably as large as or larger than the maximum diameter of the abrasive grains 27.

[0094] Forming the receiving holes 25 so as to be the same size as that of the abrasive grains 27 makes it easy to maintain the homogeneous insertion of the abrasive grains 27 into the receiving holes 25.

[0095] When the receiving holes 25 have a small size, the abrasive grains 27 are ultimately exposed in a line or point mode.

[0096] That is, the vertexes of the abrasive grains 27 fixedly embedded in the plating layer 31 appear as points or lines. In this case, the abrasive grains 27 are uniformly abraded during the conditioning work, which results in prolonging the half-life of the abrasive grains 27.

[0097] On the other hand, a greater number of abrasive grains 27 is exposed in a surface mode when the size of the receiving holes 25 is larger than the maximum diameter of the abrasive grains 27.

[0098] By controlling the pattern of holes in the photomask, the receiving holes 25 can be formed to have one or more patterns in the photosensitive film 23.

[0099] The base substrate 21 may be a stainless steel substrate.

[00100] A stainless steel substrate can also be applied to the conditioner substrate 11, and is used as a support for forming the plating layer 31 in which the abrasive grains 27 are fixedly embedded. In addition, the protrusion height of the abrasive grains 27 from the surface of the plating layer 31 is determined by controlling the thickness of the photosensitive film 23.

[00101] In step S22, the abrasive grains 27 are inserted into the receiving holes 25. After insertion of the abrasive grains 27, a filling layer 28 is formed by primary plating to fill residual spaces in the receiving holes 25.

[00102] The filling layer 28 is adapted to fix the positions of the abrasive grains 27.

[00103] Preferably, the thickness of the filling layer 28 does not exceed that of the receiving holes 25.

[00104] The filling layer 28 is preferably composed of copper. Because copper is merely selected by virtue of being a different material from that of a plating layer 31 to be described later, the material of the filling layer 28 is not limited to copper.

[00105] The abrasive grains 27 are positionally fixed by the filling layer 28. Preferably, the abrasive grains 27 may be diamond particles.

[00106] In step S23, a plating layer 31 is blanketed over all of the photosensitive film 23, the filling layer 28, and the abrasive grains 27 by secondary plating.

[00107] Preferably, the plating layer 31 may be formed of nickel. In addition to being resistant to heat and abrasion, nickel plating gives a metallic sensation to create an attractive appearance, and allows for easy control of thickness, thus making it easy to realize a uniform thickness.

[00108] In step S24, the base substrate 21 is removed, followed by etching the photosensitive film 23 that remains after step S21, and then the filling layer 28.

[00109] That is, the base substrate 21, the photosensitive film 23, and the filling layer 28 are removed in that order.

[00110] After removal of the filling layer 28, the resulting structure is turned upside down to position the abrasive grains 27 on the plating layer 31.

[00111] Step S24 results in the fixation of protruded abrasive grains 27 at regular intervals into the plating layer 31. The abrasive grains 27 fixed into the plating layer 31 are uniform in height.

[00112] At the boundary of the abrasive grains 27, the surface of the plating layer 31 has a convex portion 31a. This convex portion 31a results from partially filling the receiving holes 25 with the plating layer 31.

[00113] Having a flat lower surface, the plating layer 31 may be fixedly attached to the conditioner substrate 11 using an adhesive. If the lower surface is not flat, polishing work may be conducted to make the bottom flat.

[00114] Through an adhesive, the lower surface of the plating layer 31, in which the abrasive grains 27 are fixedly embedded, is attached to the upper surface of the conditioner substrate 11, with the resultant fixation of the abrasive grains 27 onto the conditioner substrate 11.

[00115] After the attachment of the plating layer 31 to the conditioner substrate 11 using an adhesive, finish plating may be conducted to improve corrosive resistance. For

the finish plating, chrome (Cr) may be advantageously used.

[00116] The pad conditioner 10 manufactured by the method comprises a plurality of abrasive grains that uniformly protrude in one or more patterns from the plating layer 31 on the conditioner substrate 11.

[00117] In addition, the regions of the abrasive grains 27 that are externally exposed out of the plating layer 31 are uniform in height.

[Third Embodiment]

[00118] The method for manufacturing a pad conditioner in accordance with another embodiment of the present invention, as shown in FIG. 5, comprises depositing a photosensitive film 23 on a base substrate 21, followed by conducting an etching process to form a plurality of receiving holes 25 in the photosensitive film 23 (S31), inserting abrasive grains 27 into the receiving holes 25 and then filling the receiving holes 25 by primary plating to form a filling layer 28 (S32), removing the photosensitive film 23 (S33), conducting secondary plating to form a support layer for covering the upper surface of the base substrate 21 and portions side-walls of the abrasive grains 27 (S34), blanketing a plating layer 31 over all of the support layer 29 and the abrasive grains 27 by tertiary plating (S35), removing the base substrate 21 (S36), and removing the support layer 29 and the filling layer 28 to allow the abrasive grains 27 to remain fixedly embedded in the plating layer 31 (S37).

[00119] The third embodiment is different from the first and second embodiments in that it comprises removing the filling layer 28 prior to the formation of the plating layer 31, forming the support layer 29, which extends the filling layer 29, and forming the plating layer for fixing the abrasive grains 27.

[00120] In step S31, a photosensitive film 23 is deposited on a base substrate 21. Subsequently, the photosensitive film 23 deposited on the base substrate 21 is selectively etched to form spaces for accommodating the abrasive grains 27.

[00121] In a preferred embodiment of the present invention, the etching of the photosensitive film 23 may be achieved by photoetching the photosensitive film 23 with UV light in the presence of a photomask.

[00122] That is, a photomask is prepared to have multiple hexagonal, circular, or rectangular holes therein, and is laid on the photosensitive film 23, followed by exposure

to UV. The UV-unexposed regions of the photosensitive film are removed by etching.

[00123] Hence, the photosensitive film 23 is selectively etched so as to leave multiple hexagonal, circular or rectangular receiving holes 25 therein. Therefore, multiple receiving holes 25 are formed in the photosensitive film 23.

[00124] The receiving holes 25 are preferably as large as or larger than the maximum diameter of the abrasive grains 27.

[00125] Forming the receiving holes 25 so as to have the same size as that of the abrasive grains 27 makes it easy to maintain the homogeneous insertion of the abrasive grains 27 into the receiving holes 25.

[00126] When the receiving holes 25 have a small size, the abrasive grains 27 are ultimately exposed in a line or point mode.

[00127] That is, the vertexes of the abrasive grains 27 fixedly embedded in the plating layer 31 appear as points or lines. In this case, the abrasive grains 27 are uniformly abraded during the conditioning work, which results in prolonging the half-life of the abrasive grains 27.

[00128] On the other hand, a greater number of abrasive grains 27 is exposed in a surface mode when the size of the receiving holes 25 is larger than the maximum diameter of the abrasive grains 27.

[00129] By controlling the pattern of holes in the photomask, the receiving holes 25 can be formed to have one or more patterns in the photosensitive film 23.

[00130] The base substrate 21 may be a stainless steel substrate.

[00131] A stainless steel substrate can also be applied to the conditioner substrate 11, and is used as a support for forming the plating layer 31 in which the abrasive grains 27 are fixedly embedded. In addition, the protrusion height of the abrasive grains 27 from the surface of the plating layer 31 is determined by controlling the thickness of the photosensitive film 23.

[00132] In step S32, the abrasive grains 27 are inserted into the receiving holes 25. After insertion of the abrasive grains 27, a filling layer 28 is formed by primary plating to fill residual spaces in the receiving holes 25.

[00133] The filling layer 28 is preferably composed of copper. Because copper is selected by virtue of being a different material from that of a plating layer 31 to be described later, the material of the filling layer 28 is not limited to copper.

[00134] The abrasive grains 27 are positionally fixed by the filling layer 28. Preferably, the abrasive grains 27 may be diamond particles.

[00135] In step S33, the photosensitive film 23 is removed by etching.

[00136] In step S34, a secondary plating process is conducted to form a support layer for covering the upper surface of the base substrate 21 and portions side-walls of the abrasive grains 27.

[00137] The support layer 29 is employed as an extension of the filling layer 28. Preferably, the support layer 29 is made of the same material as the filling layer 28, that is, copper.

[00138] The thickness of the filling layer 28 and support layer 29 determines the protrusion height of the abrasive grains from the surface of the plating layer 31. Accordingly, the support layer 29 is formed to a thickness equal to the desired protrusion height of the abrasive grains 27.

[00139] At the boundary between the abrasive grains 27 and the support layer 29, a higher thickness is detected than at any other region of the support layer 29 because of the double structure in which the support layer 29 overlaps the filling layer 28. The thick boundary causes the formation of a concave portion 35 on a plating layer 31, as will be described later.

[00140] In step S35, a plating layer 31 is blanketed over all of the support layer 29 and the abrasive grains 27 by tertiary plating.

[00141] The plating layer 31 is made of a material that is different from that of the support layer 29.

[00142] Preferably, the plating layer 31 may be formed of nickel. In addition to being resistant to heat and abrasion, nickel plating gives a metallic sensation to create an attractive appearance, and allows for easy control of thickness, thus making it easy to realize a uniform thickness.

[00143] In step S36, the base substrate 21 is removed.

[00144] After removal of the base substrate 21, the resulting structure is turned upside down so as to position the support layer 28 and the filling layer 28 on the plating layer 31.

[00145] In step S37, the support layer 29 and the filling layer 28 are removed by etching. Because they are made of the same material, the support layer 29 and the filling

layer 28 can be removed at the same time by etching.

[00146] Step S37 results in the fixation of protruded abrasive grains 27 at regular intervals into the plating layer 31. The abrasive grains 27 fixed into the plating layer 31 are uniform in height.

[00147] Depending on the state of the lower surface of the plating layer 31 and the extent of protrusion of the abrasive grains 27 fixed into the plating layer 31, an additional plating process may be conducted to extend the plating layer 31. The additional plating may be done with the same material as the plating layer 31 or with a different material so as to improve the durability thereof.

[00148] Having a flat lower surface, the plating layer 31 may be fixedly attached to the conditioner substrate 11 using an adhesive. If the lower surface is not flat, polishing work may be conducted to make the bottom flat.

[00149] Through an adhesive, the lower surface of the plating layer 31, in which the abrasive grains 27 are fixedly embedded, is attached to the upper surface of the conditioner substrate 11, with the resultant fixation of the abrasive grains 27 onto the conditioner substrate 11.

[00150] As described in the third embodiment, the protrusion height of the abrasive grains 27 from the surface of the plating layer 31 can be controlled by adjusting the thickness of the filling layer 28 and the support layer 29.

[00151] The pad conditioner 10 manufactured by the method comprises a plurality of abrasive grains that uniformly protrude in one or more patterns from the plating layer 31 on the conditioner substrate 11. At the boundary to the abrasive grains 27, the plating layer 31 has a concave portion 35 therein.

[00152] The concave portion may be planarized by conducting an additional surface plating process on the plating layer 31.

[00153] In addition, the regions of the abrasive grains 27 that are externally exposed out of the plating layer 31 are uniform in height.

[00154] In the methods according to the first, second, and third embodiments of the present invention, the protrusion height of the abrasive grains 27 from the surface of the plating layer 31 can be controlled by controlling the thickness of the photosensitive film 23 or the thickness of both the filling layer 28 and the support layer 29.

[00155] Moreover, the pattern of the receiving holes 25 is dependent on that of the

holes formed in the photomask, and determines one or more patterns of the abrasive grains 27 protruding out of the plating layer 31.

[00156] The abrasive grains 27 fixed into the plating layer 31 protrude at a uniform height.

[00157] Accordingly, the vertexes of the abrasive grains 27, protruding out of the plating layer 31, are in a plane.

[00158] In addition, the abrasive grains 27 fixed into the plating layer 31 are homogeneous in size and spread at regular intervals.

[00159] As a result, the surface of the pad can be uniformly conditioned when the pad conditioner is applied.

[00160] Meanwhile, the present invention is not limited to the above-described embodiments, and may be changed and modified, without departing from the gist of the present invention, and it should be understood that the technical spirit of such changes and modifications also belong to the scope of the accompanying claims.

CLAIMS

1. A method for manufacturing a pad conditioner, comprising:
 - depositing a photosensitive film on a base substrate, followed by etching to form a plurality of receiving holes in the photosensitive film;
 - inserting abrasive grains into the receiving holes and then filling the receiving holes by primary plating to form a filling layer;
 - blanketing a plating layer over all of the photosensitive film, the filling layer, and the abrasive grains by secondary plating; and
 - removing the base substrate, the photosensitive film, and the filling layer to expose a part of each of the abrasive grains.
2. The method of claim 1, wherein the plating layer into which the abrasive grains are partially embedded is attached to a conditioner substrate using an adhesive.
3. The method of claim 1, wherein the filling layer and the plating layer are made of different respective materials.
4. A pad conditioner, manufactured by the method of claim 1, wherein a plurality of abrasive grains protrudes from the plating layer at a uniform height, and the plating layer has a convex portion at a boundary to the abrasive grains.
5. A method for manufacturing a pad conditioner, comprising:
 - depositing a photosensitive film on a base substrate, followed by etching to form a plurality of receiving holes in the photosensitive film,
 - inserting abrasive grains into the receiving holes and then filling the receiving holes by primary plating to form a filling layer;
 - removing the photosensitive film;
 - conducting a secondary plating process to form a support layer for covering the upper surface of the base substrate and portions side-walls of the abrasive grains;
 - blanketing a plating layer over all the support layer and the abrasive grains by

tertiary plating;

removing the base substrate, and then the support layer and the filling layer to expose a part of each of the abrasive grains.

6. The method of claim 5, wherein the plating layer into which the abrasive grains are partially embedded is attached to a conditioner substrate using an adhesive.

7. The method of claim 5, wherein the support layer and the filling layer are made of a same material.

8. The method of claim 5, wherein the plating layer is different in material from the support layer and the filling layer.