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(54) **APPARATUS FOR CHEMICAL MECHANICAL POLISHING**

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(57) **ABSTRACT**

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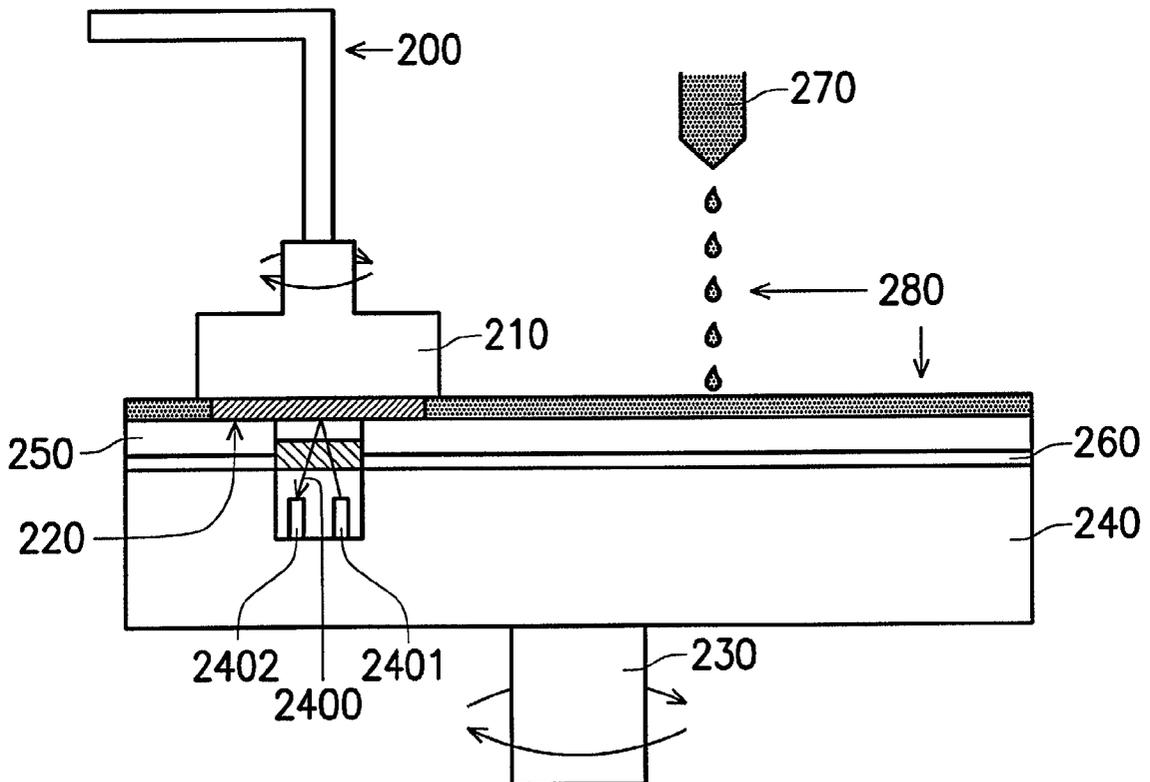
The present invention provides a chemical mechanical polishing apparatus for polishing a wafer. The chemical mechanical polishing apparatus comprises a platen, a polishing pad, a transparent element (transparent window), a slurry providing system, and a rotating carrier. The platen comprises a light source for projecting a light and a light detector for detecting the light reflected by the wafer. The polishing pad has a first opening on the platen. The transparent element is detachably located on the first opening to admit light. The slurry providing system provides slurry to the surface of the polishing pad. The rotating carrier holds the wafer and contacts the surface of the wafer with the slurry and the polishing pad to carry out the chemical mechanical polishing process.

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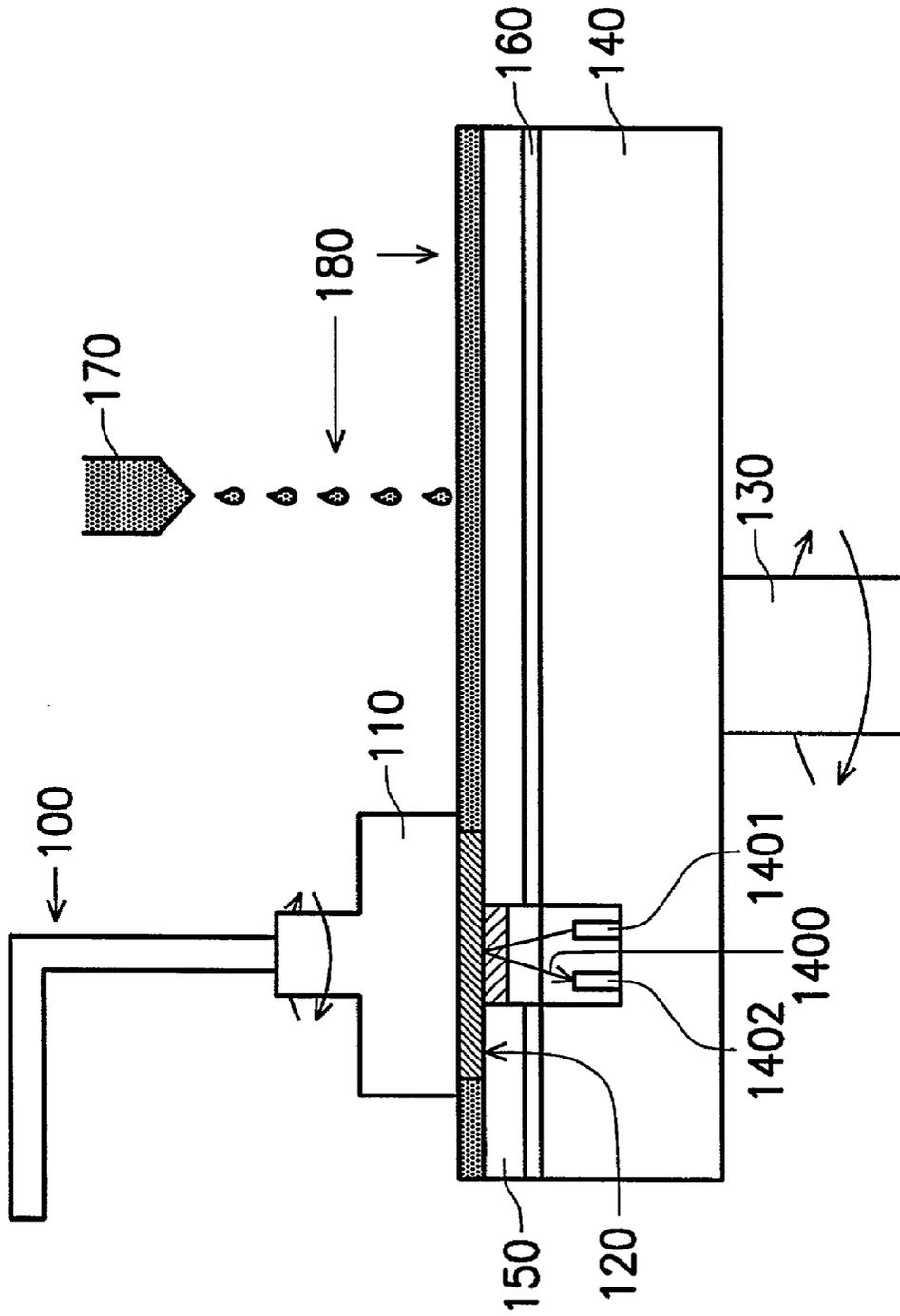


FIG. 1 (PRIOR ART)

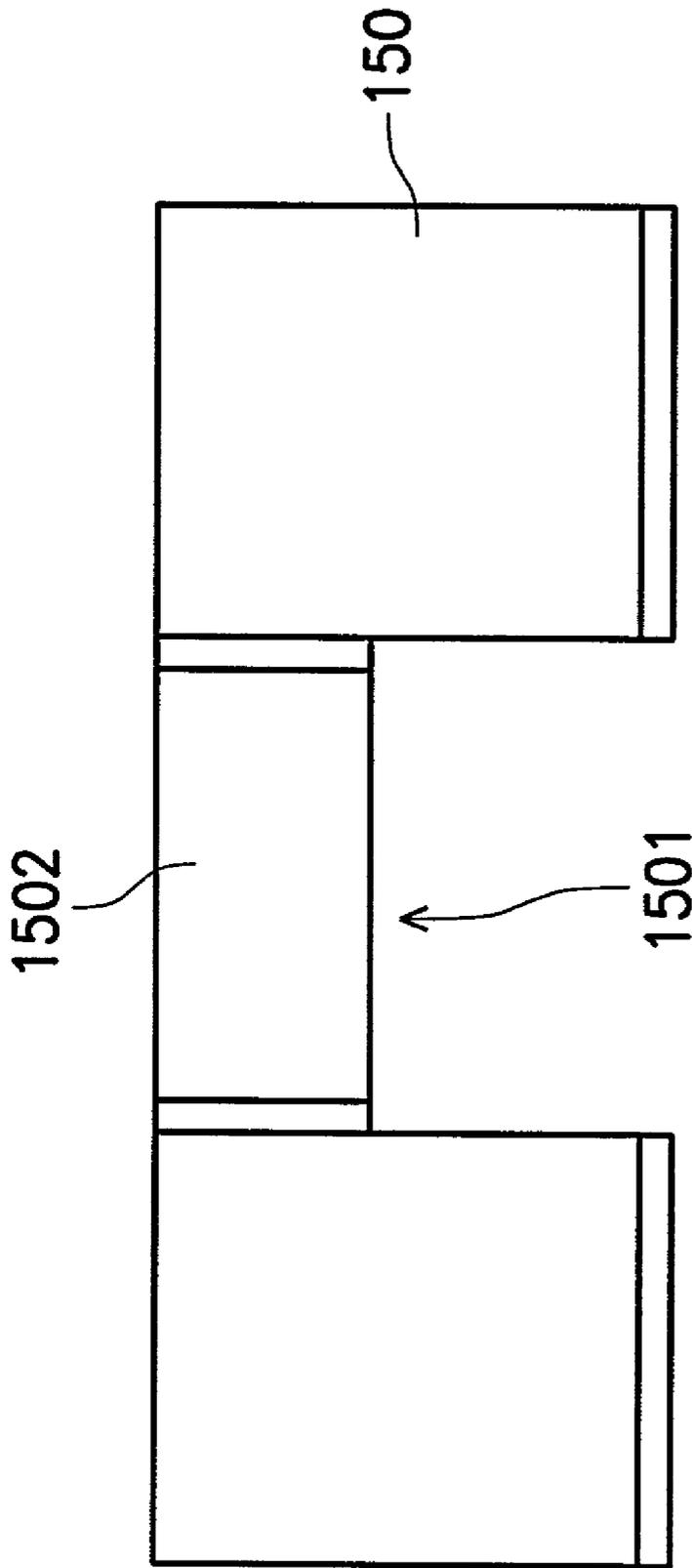


FIG. 2 (PRIOR ART)

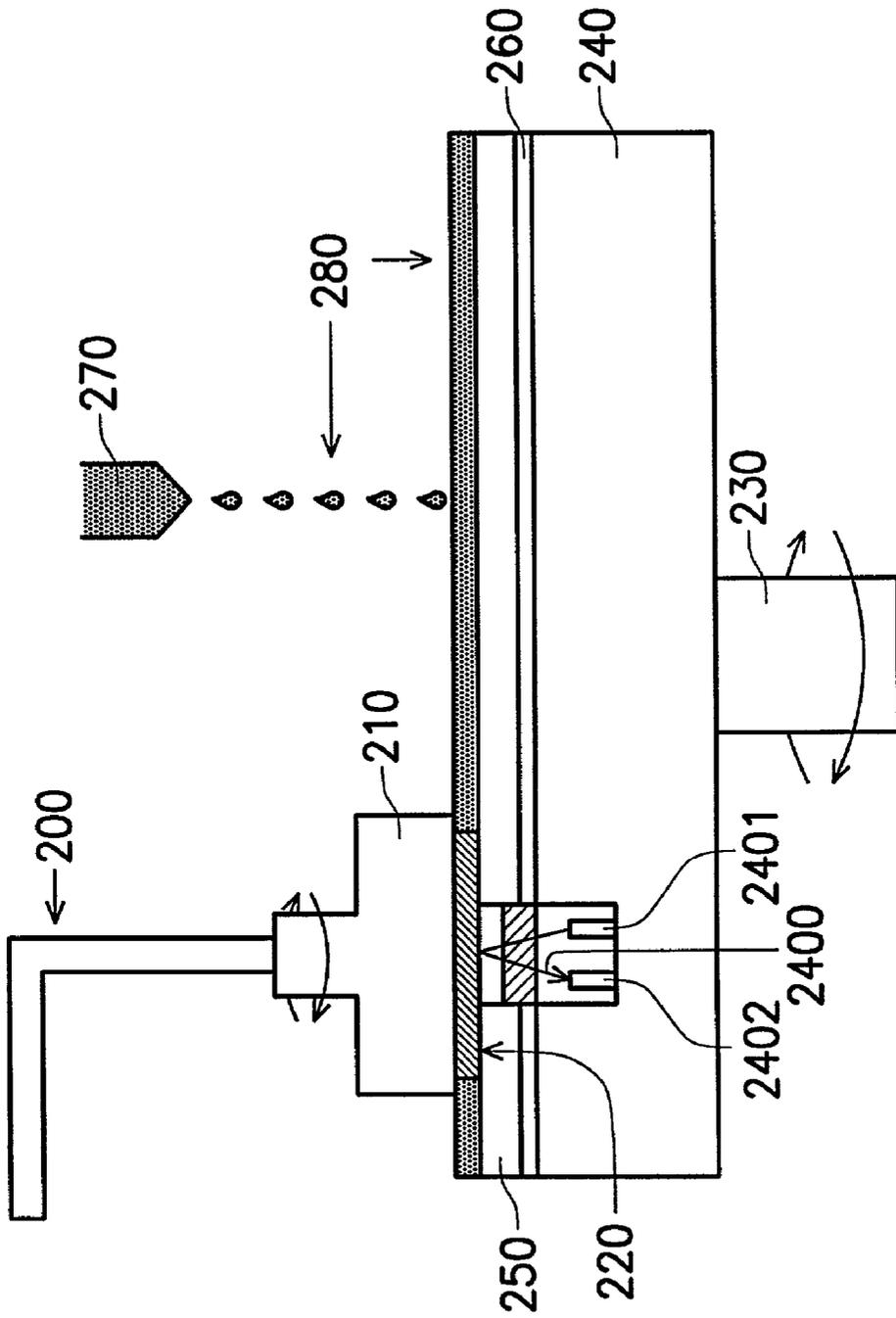


FIG. 3

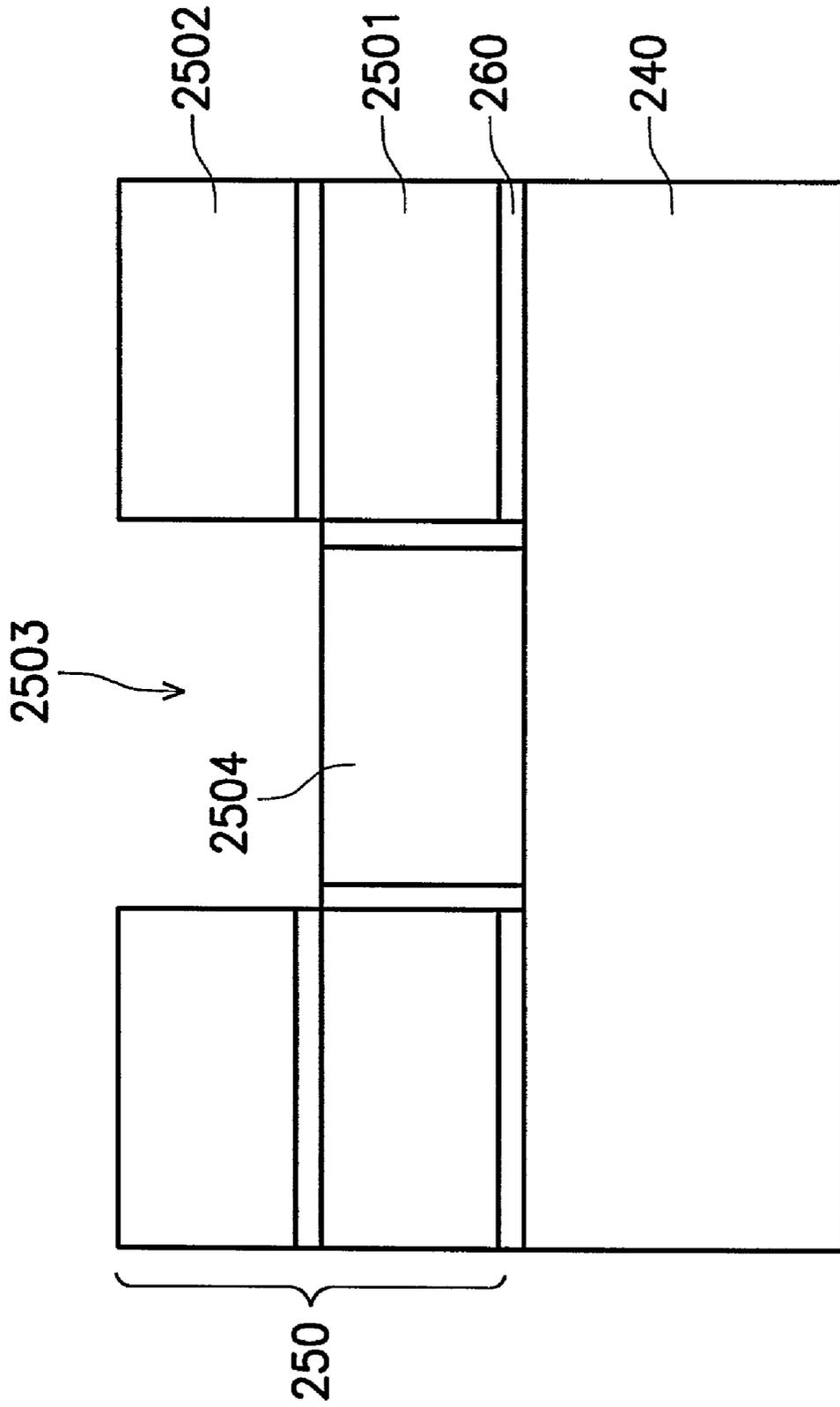


FIG. 4

APPARATUS FOR CHEMICAL MECHANICAL POLISHING

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates in general to a chemical mechanical polishing apparatus (CMP apparatus). In particular, the present invention relates to an in-situ type chemical mechanical polishing apparatus for detecting the polishing endpoint.

[0003] 2. Description of the Related Art

[0004] At present, chemical mechanical polishing (CMP) is the only way to realize a true global planarization in the manufacture of integrated circuits. A semiconductor substrate is bathed or rinsed in polishing slurry while an elastomeric pad is pressed against the substrate and rotated so that the slurry particles are pressed against the substrate under load. The lateral motion of the pad causes the slurry particles to move across the substrate surface, resulting in chemical and mechanical removal of the substrate surface.

[0005] FIG. 1 shows a section view of the conventional CMP apparatus. The type of the CMP apparatus is an in-situ detecting end point type CMP apparatus.

[0006] A rotating carrier 110 comprising a transmission shaft 100 is used for holding and rotating a wafer 120. A platen 140 rotates by a spindle 130. In addition, the platen 140 comprises a light source 1401 for projecting a laser beam 1400 and a light detector 1402 for detecting the laser beam 1400 reflected by the wafer 120. The polishing end point is detected by detecting the laser beam 1400 reflected by the wafer 120. The material of the platen 140 is transparent, therefore the laser beam 1400 can be projected to the outside of the platen 140.

[0007] FIG. 2 shows a section view of the conventional polishing pad. The pad 150 is fixed on the platen 140 by glue 160. The pad 150 comprises an opening 1501 for installing a transparent window 1502, whereby the laser beam 1400 can pass the pad 150 through the transparent window 1502.

[0008] In FIG. 1, slurry 180 is provided on the surface of the pad 150 by a slurry providing system 170. The wafer 120 is bathed or rinsed in polishing slurry 180 while the polishing pad 150 is pressed against the wafer 120 and rotated so that the slurry particles 180 are pressed against the wafer 120.

[0009] In addition, the conventional in-situ type CMP apparatus's detection of the polishing endpoint is by determining the optical characteristics of the laser beam 1400 reflected by the wafer 120. The structure and operation of the conventional in-situ type CMP apparatus is described in U.S. Pat. No. 5,559,428.

[0010] However, when the polishing pad 150 is idle for a long time, the transparent window 1502 is blurred due to water permeating, resulting in a mistaken determination of the polishing endpoint. Since the conventional CMP apparatus's transparent window 1502 is fixed to the opening of the pad 150, to solve the problem, the pad 150 must be changed despite its remaining usability, which raises the cost of process. Moreover, during changing of the pad 150, the whole CMP system must be shut down and engineers must

set up the pad on the CMP apparatus accurately. Therefore, the efficiency of the process is compromised.

SUMMARY OF THE INVENTION

[0011] The object of the present invention is to provide a CMP apparatus having a transparent window detachably located on the pad. When the transparent window is blurred due to water permeating, only the blurred transparent window need be changed without changing the whole polishing pad. Moreover, the location of the transparent window according to the present invention is closer to the platen than the conventional in-situ type CMP apparatus, so the probability of water permeating decrease. Therefore, the situation of transparent window being blurred is improved.

[0012] To achieve the above-mentioned object, the present invention provides a chemical mechanical polishing apparatus for polishing a wafer. The chemical mechanical polishing apparatus comprises a platen, a polishing pad, a transparent element (transparent window), a slurry providing system, and a rotating carrier. The platen comprises a light source for projecting a light and a light detector for detecting the light reflected by the wafer. The polishing pad has a first opening on the platen. The transparent element is detachably located on the first opening to admit light. The slurry providing system provides slurry to the surface of the polishing pad. The rotating carrier holds the wafer, and contacting the surface of the wafer with the slurry and the polishing pad to carry out the chemical mechanical polishing process.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The present invention will become more fully understood from the detailed description given hereinbelow and the accompanying drawings, given by way of illustration only and thus not intended to be limitative of the present invention.

[0014] FIG. 1 shows a section view of the conventional CMP apparatus.

[0015] FIG. 2 shows a section view of the conventional polishing pad.

[0016] FIG. 3 shows a section view of the CMP apparatus according to the embodiment of the present invention.

[0017] FIG. 4 shows a section view of the polishing pad according to the embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0018] FIG. 3 shows a section view of the CMP apparatus according to the embodiment of the present invention. The type of the CMP apparatus is an in-situ detecting end point type CMP apparatus.

[0019] A rotating carrier 210 comprising a transmission shaft 200 is used for holding and rotating a wafer 220. A platen 240 rotates by a spindle 230. In addition, the platen 240 comprises a light source 2401 for projecting a laser beam 2400 and a light detector 2402 for detecting the laser beam 2400 reflected by the wafer 220. The polishing end point is detected by detecting the laser beam 2400 reflected

by the wafer **220**. The material of the platen **240** is transparent, therefore the laser beam **2400** can be projected to the outside of the platen **240**.

[0020] FIG. 4 shows a section view of the polishing pad according to the embodiment of the present invention. The pad **250** is fixed on the platen **240** by glue **260**. The pad **250** comprises a first substrate **2501** and a second substrate **2502**. The first substrate **2501** comprises an opening and is located on the platen **240**, the material type of the first substrate **2501** is suba IV. The second substrate **2502** comprises another opening **2503** and is located on the first substrate **2501**, the material type of the second substrate **2502** is IC-1000. In addition, the openings of the first substrate **2501** and the second substrate **2502** overlap, and the transparent window **2504** is deposited on the opening of the first substrate **2501**. The transparent window **2504** in the present invention can be removed from the first substrate **2501** by the user when blurred. The user can then reinstall a new transparent window **2504** to the substrate.

[0021] In FIG. 3, slurry **280** is provided on the surface of the pad **250** by a slurry providing system **270**. The wafer **220** is bathed or rinsed in polishing slurry **280** while the polishing pad **250** is pressed against the wafer **220** and rotated so that the slurry particles **280** are pressed against the wafer **220**.

[0022] In addition, the in-situ type CMP apparatus's detection of the polishing endpoint is by determining the optical characteristics of the laser beam **2400** reflected by the wafer **220**.

[0023] When the polishing pad **250** is idle for a long time, the transparent window **2502** is blurred due to water permeating, resulting in a mistaken determination of the polishing endpoint. The user needs only remove the transparent window **2502** from the first substrate **2501** and wipe down the wetness on the platen, then paste a new transparent window **2502** onto the first substrate **2501**, rather than replacing the entire polishing pad. Moreover, the location of the transparent window according to the present invention is closer to the platen than the conventional in-situ type CMP apparatus, so the probability of water permeating decreases.

[0024] Accordingly, the invention not only simplifies the pad changing procedure and decreases maintenance time, but also decreases the cost of the process and human resources. Furthermore, the present invention solves the problems of polishing endpoint misdetermination due to water permeating and improves the effectiveness of the polishing operation.

[0025] The foregoing description of the preferred embodiments of this invention has been presented for purposes of

illustration and description. Obvious modifications or variations are possible in light of the above teaching. The embodiments were chosen and described to provide the best illustration of the principles of this invention and its practical application to thereby enable those skilled in the art to utilize the invention in various embodiments and with various modifications as are suited to the particular use contemplated. All such modifications and variations are within the scope of the present invention as determined by the appended claims when interpreted in accordance with the breadth to which they are fairly, legally, and equitably entitled.

What is claimed is:

1. A chemical mechanical polishing apparatus for polishing a wafer, comprising:

a platen, comprising a light source for projecting a light and a light detector for detecting the light reflected by the wafer;

a polishing pad having a first opening on the platen;

a transparent element detachably located on the first opening for admitting light;

a slurry providing system, which provides a slurry to the surface of the polishing pad; and

a rotating carrier for holding the wafer and contacting the surface of the wafer with the slurry and the polishing pad to carry out the chemical mechanical polishing process.

2. The chemical mechanical polishing apparatus as claimed in claim 1, wherein the light is a laser beam.

3. The chemical mechanical polishing apparatus as claimed in claim 1, wherein the polishing pad comprises:

a first substrate having a second opening on the platen; and

a second substrate installed on the first substrate and having a third opening, wherein the second opening and the third opening constitute the first opening.

4. The chemical mechanical polishing apparatus as claimed in claim 3, wherein the material type of the first substrate is suba IV.

5. The chemical mechanical polishing apparatus as claimed in claim 1, wherein the material type of the second substrate is IC-1000.

6. The chemical mechanical polishing apparatus as claimed in claim 1, wherein the transparent element is installed on the second opening.

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