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(54) **MULTI-STEP CONDITIONING PROCESS**

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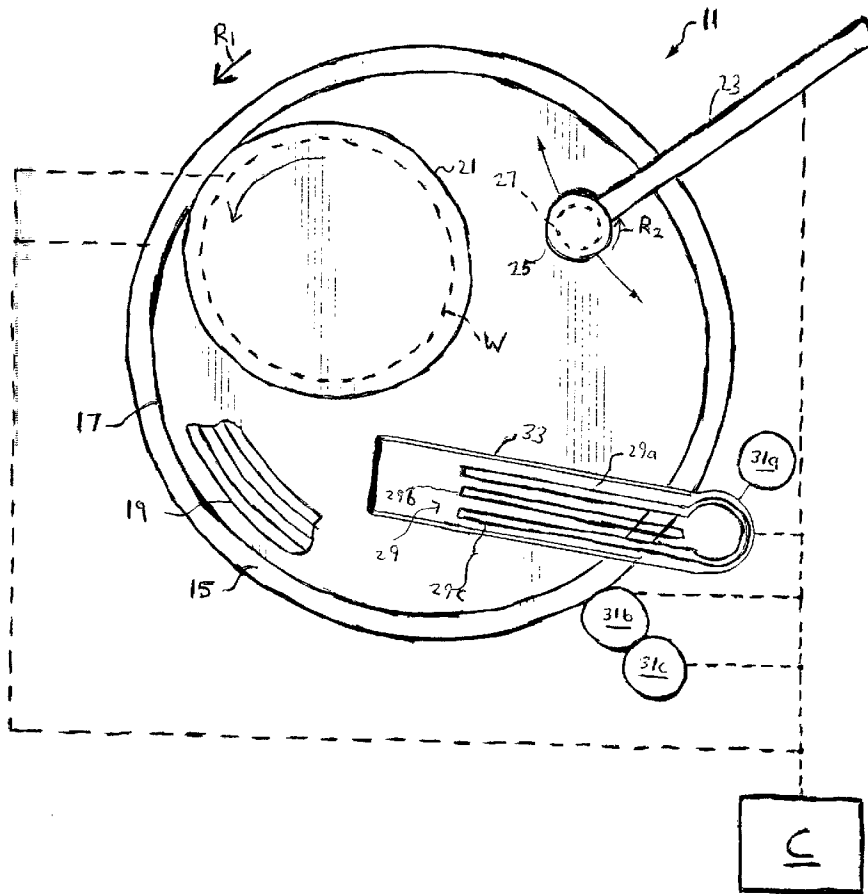
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(57) **ABSTRACT**

Methods and apparatuses are provided that may remove the build up of polishing by products from the polishing pad without the reduction in throughput associated with conventional ex-situ conditioning. The conditioning method comprises holding a wafer against a polishing pad with a 0 psi force, and applying a conditioning fluid to the polishing pad while holding the wafer against the polishing pad with a 0 psi force. Thereafter the conditioning fluid may be rinsed from the polishing pad or may remain on the polishing pad while polishing is commenced. The polishing apparatus has a controller programmed to perform the conditioning method.



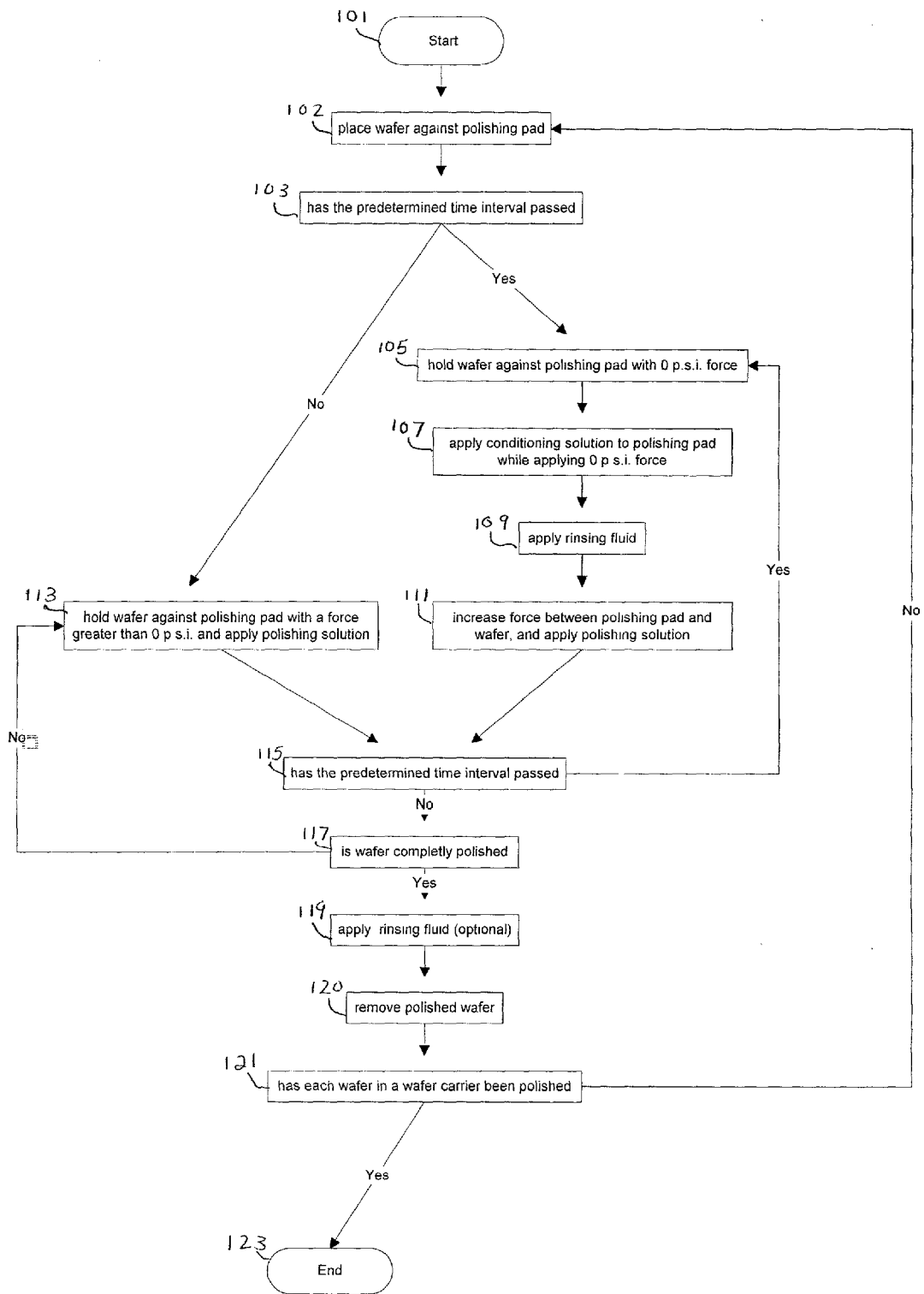


FIG. 1

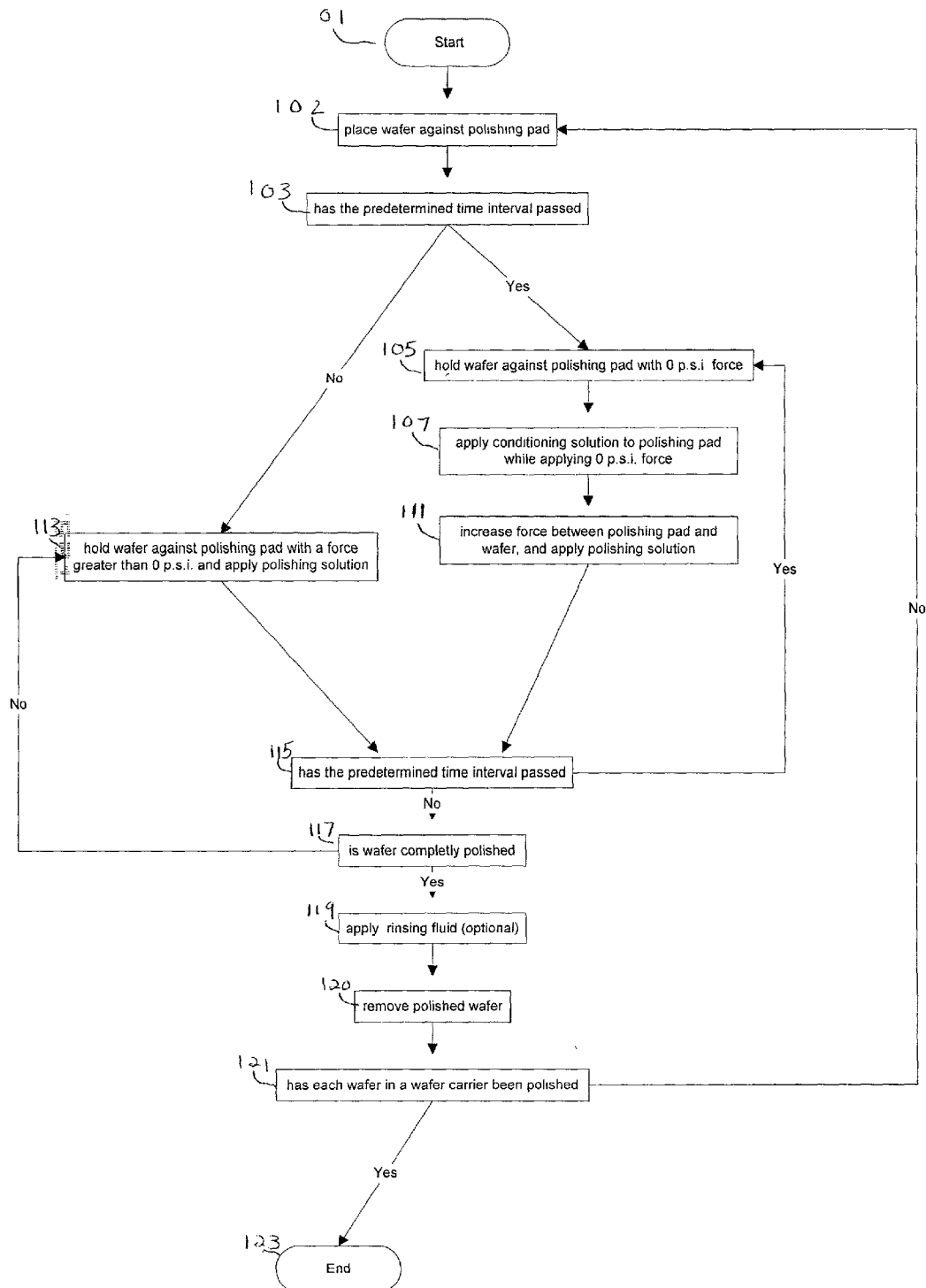


FIG. 2

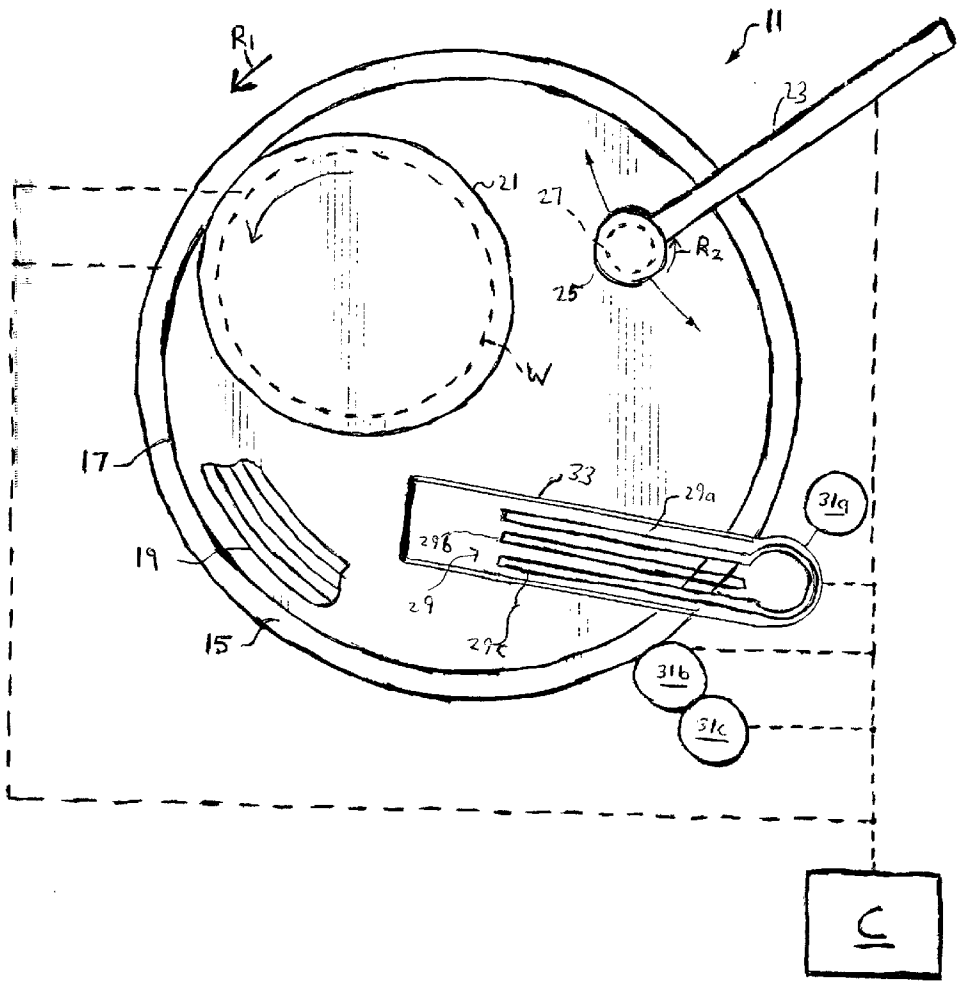


FIG. 3

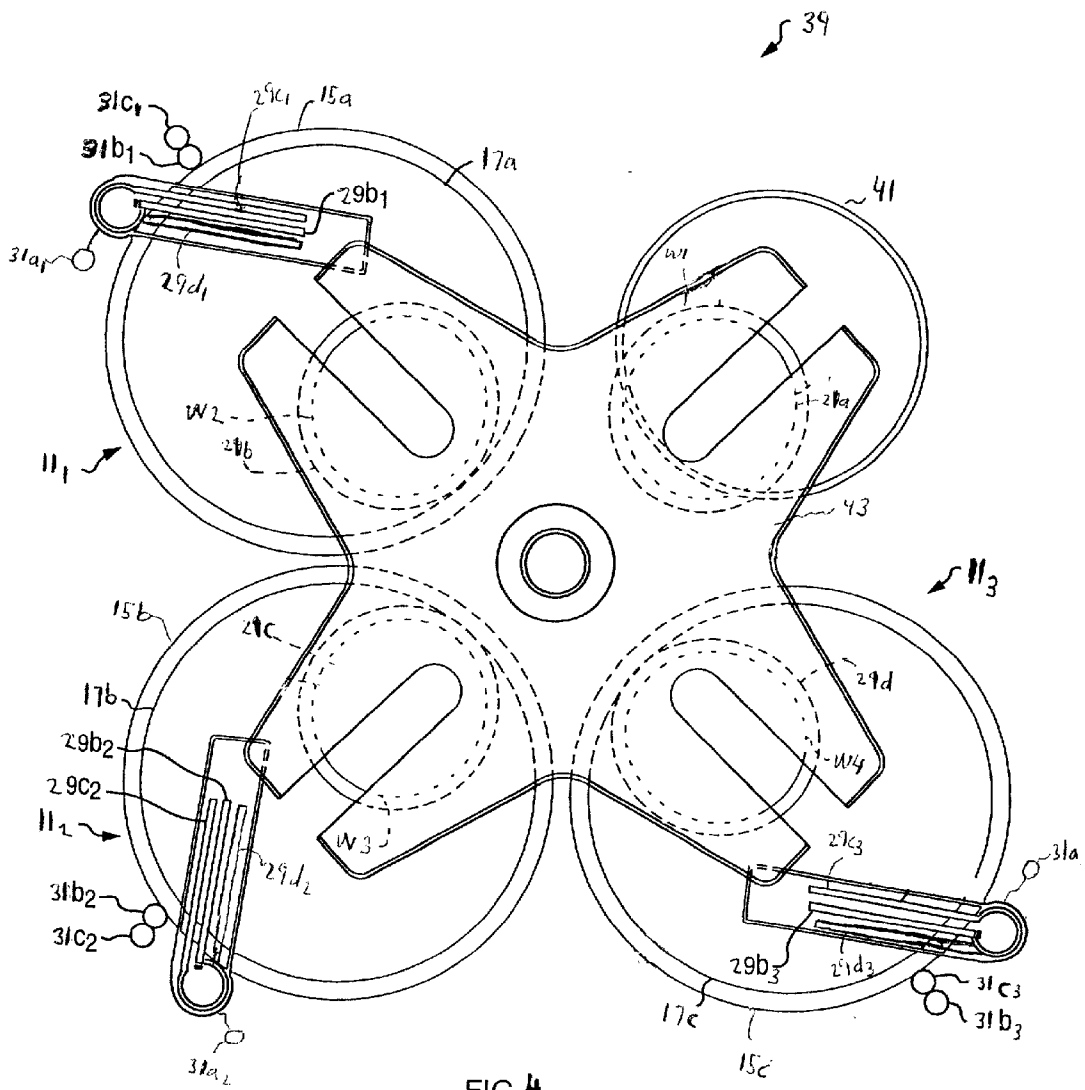


FIG. 4

MULTI-STEP CONDITIONING PROCESS

FIELD OF THE INVENTION

[0001] The present invention relates to a method and apparatus configured to polish and/or planarize semiconductor wafers and the thin films formed thereon. More particularly, the present invention relates to conditioning a polishing pad.

BACKGROUND OF THE INVENTION

[0002] In the semiconductor industry, semiconductor wafers are planarized using a chemical mechanical polishing apparatus that presses the wafer surface against an abrasive pad. As polishing continues, the surface of the pad may become compacted and lose its abrasive quality. Such compaction reduces the quality and efficiency of the polishing process.

[0003] To extend the useful life of the pad, a device known as a pad conditioner that roughens or "conditions" the polishing pad surface is employed in-situ, while the polishing pad polishes a wafer; and/or ex-situ, after wafer polishing is complete. During ex-situ conditioning, a wafer is conventionally moved away from the polishing pad. A typical pad conditioner comprises a diamond surface that roughens the polishing pad surface by pressing thereagainst. Although roughening of the polishing pad surface, whether performed using either in-situ or ex-situ conditioning, typically ensures adequate abrasion (e.g., due to polishing fluid saturation of the roughened surface) conventional ex-situ conditioning tends to reduce system throughput as additional time is required for moving the wafer into and out of contact with the polishing pad.

[0004] Accordingly, an improved method and apparatus is needed that may condition a polishing pad without the reduction in throughput associated with conventional ex-situ conditioning.

SUMMARY OF THE INVENTION

[0005] The present inventors have discovered that polishing of wafers having certain material layers (e.g., copper layers) deposited thereon results in the build up of materials on the polishing pad, which may not be removable via conventional in situ conditioning methods. Hence an ex-situ conditioning process becomes necessary. Conventional polishing tools, however, are programmed to perform either in situ or ex-situ conditioning. Further, as previously stated, conventional ex-situ conditioning tends to reduce system throughput as additional time is required for moving the wafer into and out of contact with the polishing pad.

[0006] Accordingly the present invention provides methods and apparatuses that may prevent materials from building up on a polishing pad or may remove the build up of polishing byproducts from the polishing pad and may do so without the reduction in throughput associated with conventional ex-situ conditioning.

[0007] In a first aspect, the inventive method comprises conditioning a polishing pad by holding a wafer against the polishing pad with a 0 psi force, applying a conditioning solution to the polishing pad while holding the wafer against the polishing pad with a 0 psi force, applying a rinsing fluid to the polishing pad, increasing the force between the wafer

and the polishing pad, and applying a polishing solution to the polishing pad so as to polish the wafer.

[0008] In a second aspect, the inventive method comprises determining whether a predetermined interval has passed, and if so, conditioning the polishing pad prior to resuming polishing. More specifically the method comprises holding a wafer against a polishing pad with a 0 psi force, applying a conditioning fluid to the polishing pad while holding the wafer against the polishing pad with a 0 psi force, applying a rinsing fluid to the polishing pad, increasing the force between the wafer and the polishing pad; and applying a polishing solution to the polishing pad so as to polish the wafer.

[0009] In a further aspect the inventive conditioning method is modified to omit the rinsing step, so that the polishing solution dilutes the conditioning fluid, either partially or completely. A conditioning arm may be scanned along the polishing pad during any part of the above aspects.

[0010] The inventive apparatus may comprise a polishing pad, a wafer holder coupled to the polishing pad and configured to hold a wafer in contact with the polishing pad, a conditioning arm configured to condition the polishing pad, at least one supply line configured to supply a fluid to the polishing pad so as to remove built up material from the polishing pad, and a controller coupled to the at least one supply line and to the wafer holder, the controller having a program configured to direct the wafer holder to hold the wafer against the polishing pad with a 0 psi force and further configured to direct the at least one supply line to supply a conditioning fluid to the polishing pad while the wafer holder holds the wafer against the polishing pad with a 0 psi force.

[0011] Other features and advantages of the present invention will become more fully apparent from the following detailed description of the preferred embodiments, the appended claims and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] FIG. 1 is a flowchart of a first aspect of an inventive conditioning method that may be employed in any conventional polishing device;

[0013] FIG. 2 is a flowchart of a second aspect of an inventive conditioning method, which is similar to the first aspect of the inventive conditioning method, but which eliminates the rinse step of the first aspect;

[0014] FIG. 3 is a schematic top plan view of an inventive polishing apparatus that may perform the inventive conditioning method; and

[0015] FIG. 4 is a top plan view of a system configured to polish wafers.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0016] An inventive conditioning method and an inventive polishing apparatus are provided that either may prevent materials from building up on a polishing pad or may remove built up materials from a polishing pad without the reduction in throughput associated with conventional ex-situ conditioning. FIG. 1 is a flowchart of a first aspect of an inventive conditioning method 100a that may be employed

in any conventional polishing device, whether horizontally or vertically oriented, etc. Referring to the flowchart of FIG. 1, the inventive conditioning method **100a** starts at step **101**. In step **102**, a wafer is placed against a polishing pad.

[**0017**] In step **103**, the polishing device determines whether the polishing pad requires conditioning so as to prevent materials from building up on the polishing pad or so as to remove built up materials from the polishing pad. For example, the polishing device may determine whether a predetermined time interval for conditioning a polishing pad has passed. In this aspect, a polishing pad is conditioned at a predetermined interval (e.g., after every 5 minutes of polishing or after every 5 wafers are polished, etc.). In one aspect, the polishing device may set a timer based on the predetermined time interval. When the timer reaches zero, the polishing pad is conditioned as described below. Alternatively, the polishing device may employ any other method to determine whether the polishing pad requires conditioning. For example, the polishing pad may be conditioned either before and/or after each wafer is polished, when the built up materials on the polishing pad reaches a predetermined level, etc.

[**0018**] If in step **103**, the predetermined time interval for conditioning the polishing pad has passed, the inventive conditioning method **100a** proceeds with steps **105**; otherwise, if the predetermined time interval has not passed, the inventive conditioning method **100a** proceeds with step **113** (described below).

[**0019**] In step **105**, a wafer is held against a polishing pad with a 0 psi force. The wafer may comprise a material layer (e.g., a copper layer) deposited thereon, which may result in the build up of materials during polishing that may not be removable merely via in-situ conditioning methods. In step **107**, a conditioning fluid is supplied to the polishing pad while the wafer is held against the polishing pad with a 0 psi force. In one aspect, the conditioning fluid is supplied at a flow rate of between about 50 to 1,000 mL per minute for a period of between about 1 to 60 seconds. In one particular aspect, a flow rate of 200 mL per minute for 15 seconds is employed. The conditioning fluid reacts with the polishing pad so as to prevent materials from building up on the polishing pad and/or so as to remove built up materials from the polishing pad. Whether material has built up on the polishing pad depends on how frequent the polishing pad is conditioned. If the polishing pad is conditioned frequently, the conditioning fluid may prevent materials from building up on the polishing pad.

[**0020**] The conditioning fluid may comprise Applied Materials' ElectraClean, solutions capable of removing CuOx by-products, solutions capable of removing copper compounds, carboxylic salts, ammonium compounds, amine based solutions such as Tetramethyl Ammonium Hydroxide (TMAH), etc. ElectraClean™ solution may comprise 61% deionized water, 25.9% citric acid, 3.1% ammonium hydroxide (each concentration being in wt % (wt/wt)). When ElectraClean™ is used in a polishing device, the dilution ratio may be 3 parts deionized water to 1 part ElectraClean™. Higher concentrates of ElectraClean™ may be used to decrease the duration of pad cleaning (if desired).

[**0021**] In step **109**, the flow of conditioning fluid stops and a rinsing fluid (e.g., a high pressure deionized water spray) is supplied to the polishing pad so as to remove the condi-

tioning fluid from the polishing pad. Studies have shown that the conditioning fluid may undesirably affect polishing solution behavior so as to affect the polishing rate. For example, ElectraClean™ may undesirably affect EP-C5001 (a polishing slurry marketed by Cabot, Inc.), such as by changing the rate or removal profile of polishing. Alternatively, with certain polishing solutions (such as EP-C5003), it may be desirable to eliminate the rinse step (step **109**) and to allow the conditioning fluid to mix with the polishing solution as further described below in FIG. 2.

[**0022**] In step **111**, the polishing pad increases the downward force (e.g., to 1-7 psi) applied to the wafer, and a polishing solution (e.g., an abrasive slurry) is distributed across the polishing pad so as to abrade and polish the wafer. The inventive conditioning method **100a** proceeds to step **115**. In one aspect, a downward force of 3 psi is applied to the wafer in step **111**. The polishing solution may comprise Klebosol 1501, marketed by Rodel, Inc., EP-C5001™ marketed by Cabot, Inc., EP-C5003™ marketed by Cabot, Inc. diluted with 2.5% wt/vol Hydrogen Peroxide or with another oxidizing agent. In aspects that employ EP-C5003™ marketed by Cabot, Inc., a downward force of 6 psi may be applied to the wafer in step **111**.

[**0023**] Assuming the predetermined time interval has not passed in step **103**, in step **113**, the wafer is held against the polishing pad with a force greater than 0 psi (e.g., 1-7 psi), and the polishing solution is distributed across the polishing pad so as to abrade and polish the wafer.

[**0024**] In one aspect, the polishing device comprises a wafer support that has an outer retainer ring that extends around the circumference of a wafer supported thereby and a central membrane that extends along a wafer's backside. In step **111** and in step **113** of such aspects, the outer retainer ring of the wafer support may be placed under pressure on the polishing pad and the polishing solution may be distributed across the polishing pad while the wafer is held off of the polishing pad by the central membrane of the wafer support. Thereafter, the wafer is placed onto the polishing pad under the desired pressure via the central membrane. By placing the retainer ring under pressure before the central membrane, the wafer is prevented from slipping out of the wafer holder.

[**0025**] In step **115**, the polishing device determines whether the polishing pad requires conditioning. As with step **103**, the polishing pad may determine whether the predetermined time interval for conditioning a polishing pad has passed. If the predetermined time interval for conditioning the polishing pad has passed in step **115**, the inventive conditioning method **100a** returns to step **105** to condition the polishing pad; otherwise, if the predetermined time interval has not passed, the inventive conditioning method **100a** proceeds with step **117**.

[**0026**] Assuming the predetermined time interval has not passed in step **115**, the polishing pad determines whether the wafer is completely polished in step **117**. If the wafer is completely polished, the inventive conditioning method **100a** proceeds with step **119**; otherwise, if the wafer is not completely polished, the inventive conditioning method **100a** goes to step **113** to continue polishing the wafer.

[**0027**] Assuming the wafer is completely polished in step **117**, the rinsing fluid is optionally supplied to the polishing

pad so as to rinse the polishing pad and the polished wafer in step 119. The polished wafer is removed from the polishing pad in step 120. In step 121, the controller optionally may determine whether each wafer in a wafer carrier has been polished. If each wafer in a wafer carrier has not been polished, the inventive conditioning method 100a returns to step 102 placing another wafer against the polishing pad; otherwise, the inventive conditioning method 100a ends in step 123.

[0028] It will be understood that throughout each of the above steps, a conditioning arm may scan back and forth across the polishing pad so as to aid in the distribution of the various fluids. Further, the conditioning arm may comprise a pad conditioner (e.g., a diamond embedded disk) that roughens or conditions the polishing pad by pressing thereagainst.

[0029] It will also be understood that throughout each of the above steps, the polishing device may generate relative movement between the wafer and the polishing pad. In one aspect, the polishing pad may rotate or translate, while in another aspect, a wafer support may rotate or translate. Yet, in a further aspect, both the polishing pad and the wafer support may rotate and/or translate. The initial rotational rate of the polishing pad or the wafer support may vary as described below. The polishing pad or the wafer support may initially not rotate or may rotate at a rate between 10-200 rpm. For aspects that initially do not rotate the polishing pad or the wafer support, the polishing device may increase the rotational rate to 10-200 rpm when a wafer is loaded into the polishing device. In one aspect, the polishing pad or the wafer support may rotate at 93 rpm. In another aspect, the polishing pad and the wafer support may accelerate to their desired velocities when the polishing solution is supplied.

[0030] It will be understood that although a wafer is present on the polishing pad while the conditioning fluid is supplied to the polishing pad, the polishing pad is not polishing the wafer because a force of 0 psi is applied to the wafer. Thus, the polishing pad is ex-situ conditioned.

[0031] FIG. 2 is a second aspect of an inventive conditioning method 100b, which is similar to the inventive conditioning method 100a of FIG. 1, but which eliminates the rinse step (step 109) of the inventive conditioning method 100a. Thus, the conditioning fluid mixes with the polishing solution in the inventive conditioning method 100b, unlike the inventive conditioning method 100a wherein the rinse step (step 109) is employed to remove the conditioning fluid from the polishing pad so as to prevent mixing between the conditioning fluid and the polishing solution.

[0032] Studies have shown that initiation of polishing and polishing rates are lower with Cabot EP-C5003 (a polishing solution as described above) relative to Cabot EP-C5001 under the same polishing conditions. To obtain similar polishing rates with Cabot EP-C5003 and Cabot EP-C5001, greater pressure is required when Cabot EP-C5003 is employed. Cabot EP-C5003 exhibits a slower initiation of polishing because EP-C5003 has an increased concentration of corrosion inhibitors (e.g., benzotriazol, BTA), which compete for the copper surface of the wafer against oxidizing components (e.g., hydrogen peroxide) of the polishing solution. By allowing the conditioning fluid to mix with the

polishing solution, the problem of slower polishing initiation rate may be eliminated. For example, ElectraClean™ may initiate polishing by removing layers of copper oxide on the wafer surface, which may otherwise act to passivate the copper oxides attack by the polishing solution's hydrogen peroxide and may thereby deter the initiation of polishing.

[0033] FIG. 3 is a schematic top plan view of an inventive polishing apparatus 11 that may perform the inventive conditioning method 100a. The inventive polishing apparatus 11 may comprise a platen 15 on which a polishing pad 17 configured to polish semiconductor wafers is mounted. In one aspect, the platen 15 is rotatable and the polishing pad 17 has at least one groove 19 and typically has a plurality of concentric circumferential grooves 19 as shown in FIG. 3. In another aspect, non-grooved pads may be employed. A wafer mounting head 21 is configured to press a wafer W against the polishing pad 17.

[0034] The inventive polishing apparatus 11 further comprises a conditioning arm 23 and a holder or conditioning head 25 mounted to one end of the conditioning arm 23. A pad conditioner 27, such as a disk embedded with diamond crystals, may be mounted to the underside of the conditioning head 25. The conditioning arm 23 is configured to scan back and forth across the polishing pad 17.

[0035] One or more liquid supply lines 29 are configured to direct fluid from a liquid source 31 to the polishing pad 17. In one aspect, the liquid supply lines 29 are coupled to an arm 33 that extends above the surface of the polishing pad 17, as is conventionally known in the art. In one aspect, the inventive polishing apparatus 11 may comprise three supply lines: a conditioning solution supply line 29a, a deionized water supply line 29b, and a polishing solution supply line 29c. A first liquid source 31a may contain a conditioning solution (e.g., Applied Materials' ElectraClean) and is coupled to the conditioning solution supply line 29a. A second liquid source 31b may contain deionized water and is coupled to the deionized water supply line 29b. The deionized water may be pressurized. A third source 31c may contain a polishing solution (e.g., an abrasive slurry) and is coupled to the polishing solution supply line 29c. A controller C is configured to couple to the platen 15, the polishing pad 17, the mounting head 21, the conditioning arm 23, and the supply lines 29, and controls the operation thereof. The controller C may comprise a program stored therein and configured to perform the inventive conditioning methods 100a-b described above.

[0036] FIG. 4 is a top plan view of a system 39 configured to polish wafers. The system 39 comprises a plurality of polishing apparatuses 11₁-11₃ each of which is configured to perform standard polishing operations, and in one aspect, two of which are programmed to perform the inventive conditioning method described above. Among the polishing apparatuses 11₁-11₃ like reference numerals are used to identify corresponding components.

[0037] The system 39 also includes a load cup 41, and a rotatable cross bar 43 to which a plurality of wafer mounting heads 21a-d are coupled. Thus, a wafer W may be loaded onto the load cup 41 and loaded or mounted therefrom to the first wafer mounting head 21a while wafer mounting heads 21b-d press wafers against the polishing pads 17 of the various polishing apparatuses 11₁-11₃.

[0038] In operation, a first wafer W₁ is loaded (e.g., via a wafer handler that is not shown) onto the load cup 41 and

mounted therefrom to the first wafer mounting head **21a**. The rotatable cross bar **43** is indexed carrying the first wafer W_1 to the first polishing apparatus **111** where the first wafer W_1 is polished as previously described, while a second wafer W_2 is loaded onto the load cup **41** and mounted therefrom to the second wafer mounting head **21b**. The rotatable cross bar **43** is indexed again; the wafer W_1 is polished by the second polishing apparatus **112** (e.g., via a different polishing fluid than that used by the first polishing apparatus **111**); the second wafer W_2 is polished by the first polishing apparatus **111** and a third wafer W_3 is loaded to the load cup **41** and mounted to the third wafer mounting head **21c**.

[0039] Thereafter, the rotatable cross bar **43** indexes and the first wafer W_1 is carried to the polishing apparatus **113**. Meanwhile the second wafer W_2 is polished by the second polishing apparatus **112**; the third wafer W_3 is polished by the first polishing apparatus **111**, and a fourth wafer W_4 is loaded onto the load cup **41** and mounted to a fourth wafer mounting head **21d**.

[0040] The rotatable cross bar **43** then indexes carrying the first wafer W_1 to the load cup **41** (as shown in **FIG. 4**) where the first wafer mounting head **21a** places the first wafer W_1 on the load cup **41** and a wafer handler (not shown) extracts the first wafer W_1 from the system **39**. The inventive conditioning method **100** may be performed by any number of the polishing apparatuses **111-113** and in one aspect, is performed by each of the polishing apparatuses **111-113** in order to benefit from any throughput increases the inventive conditioning method **100** may provide.

[0041] As is evident from the description above, the inventive conditioning method and the inventive polishing apparatus may prevent materials from building up on a polishing pad or may remove built up materials from a polishing pad without the reduction in throughput associated with conventional ex-situ conditioning because the wafer may be present on the polishing pad during ex-situ conditioning. Recall that during ex-situ conditioning, a wafer is conventionally moved away from the polishing pad. In one aspect of the invention, however, rather than holding a wafer against a polishing pad with 0 Psi, the wafer is held aloft, above the polishing pad (e.g., via the wafer holder).

[0042] The foregoing description discloses only the preferred embodiments of the invention, modifications of the above-disclosed apparatus and method which fall within the scope of the invention will be readily apparent to those of ordinary skill in the art. For instance, although the invention is described with reference to a horizontally oriented rotational polishing device, the invention advantageously may be employed with any polishing device including vertically oriented polishers and/or polishers which employ translating polishing pads or conveyor-type polishing bands such as that described in U.S. Pat. No. 5,692,947. The composition of a suitable cleaning solution is disclosed in U.S. patent application Ser. No. 09/359,141 (filed Jul. 21, 1999) and Ser. No. 09/163,582 (filed Sep. 30, 1998). The entire disclosures of both applications are incorporated herein by this reference.

[0043] The invention may be employed with any type of polishing pad, hard polishing pads (e.g., cast polyurethane) soft, porous polishing pads (e.g., PVA or soft polyurethane) either of which may or may not have grooves formed or scribed therein. The grooves may form any pattern including an x-y grid, such as the grooves found in the fixed abrasive

pads manufactured by the Minnesota Mining and Manufacturing Company and described for example in U.S. Pat. No. 5,378,251.

[0044] Accordingly, while the present invention has been disclosed in connection with the preferred embodiments thereof, it should be understood that other embodiments may fall within the spirit and scope of the invention, as defined by the following claims.

The invention claimed is:

1. A method configured to condition a polishing pad, the method comprising:

holding a wafer against a polishing pad with a 0 psi force;
applying a conditioning fluid to the polishing pad while holding the wafer against the polishing pad with a 0 psi force;

applying a rinsing fluid to the polishing pad;

increasing the force between the wafer and the polishing pad; and

applying a polishing solution to the polishing pad so as to polish the wafer.

2. The method of claim 1 wherein applying a conditioning fluid to the polishing pad comprises removing built up materials from the polishing pad.

3. The method of claim 1 wherein applying the conditioning solution to the polishing pad occurs after polishing the wafer.

4. The method of claim 3 wherein the wafer comprises copper layers.

5. The method of claim 3 wherein the conditioning fluid comprises citric acid and ammonium hydroxide.

6. The method of claim 1 further comprising conditioning the polishing pad with an abrasive element while

holding a wafer against a polishing pad with a 0 psi force;

applying a conditioning fluid to the polishing pad while holding the wafer against the polishing pad with a 0 psi force;

applying a rinsing fluid to the polishing pad; and

applying a polishing solution to the polishing pad so as to polish the wafer.

7. The method of claim 1 wherein the wafer comprises copper layers.

8. The method of claim 1 wherein the conditioning fluid comprises citric acid and ammonium hydroxide.

9. A method configured to condition a polishing pad, the method comprising:

holding a wafer against a polishing pad with a 0 psi force;

applying a conditioning fluid to the polishing pad so as to remove built up materials from the polishing pad while holding the wafer against the polishing pad with a 0 psi force;

increasing the force between the wafer and the polishing pad; and

applying a polishing solution to the polishing pad.

10. The method of claim 9 wherein applying the conditioning solution to the polishing pad occurs after polishing the wafer.

11. The method of claim 9 wherein the wafer comprises copper layers.

12. The method of claim 9 wherein the conditioning fluid comprises citric acid and ammonium hydroxide.

13. The method of claim 9 further comprising conditioning the polishing pad with an abrasive element while:

holding a wafer against a polishing pad with a 0 psi force;

applying a conditioning fluid to the polishing pad while holding the wafer against the polishing pad with a 0 psi force;

increasing the force between the wafer and the polishing pad; and

applying a polishing solution to the polishing pad.

14. An apparatus configured to condition a polishing pad, the apparatus comprising:

a polishing pad;

a wafer holder coupled to the polishing pad and configured to hold a wafer in contact with the polishing pad;

a conditioning arm configured to move across the polishing pad;

at least one supply line configured to supply a fluid to the polishing; and

a controller coupled to the at least one supply line and the wafer holder, the controller having a program configured to direct the wafer holder to hold the wafer against the polishing pad with a 0 psi force and further configured to direct the at least one supply line to supply a fluid to the polishing pad while the wafer holder holds the wafer against the polishing pad with a 0 psi force.

15. The apparatus of claim 14 further comprising a source of conditioning solution coupled to the first supply line, and wherein the program is adapted to supply conditioning solution to the polishing pad while the wafer holder holds the wafer against the polishing pad with 0 psi force.

16. The apparatus of claim 15 wherein the at least one supply line comprises three supply lines.

17. The apparatus of claim 16 further comprising:

a source of deionized water coupled to the second supply line; and

a source of polishing solution coupled to the third supply line.

18. The method of claim 9 further comprising:

ceasing application of the conditioning fluid so that the polishing solution dilutes the conditioning fluid.

19. A method configured to condition a polishing pad, the method comprising:

determining whether a predetermined time interval has passed, and if so:

holding a wafer against a polishing pad with a 0 psi force;

applying a conditioning fluid to the polishing pad while holding the wafer against the polishing pad with a 0 psi force;

applying a rinsing fluid to the polishing pad;

increasing the force between the wafer and the polishing pad; and

applying a polishing solution to the polishing pad so as to polish the wafer.

20. A method configured to condition a polishing pad, the method comprising:

determining whether a predetermined time interval has passed, and if so:

holding a wafer against a polishing pad with a 0 psi force;

applying a conditioning fluid to the polishing pad while holding the wafer against the polishing pad with a 0 psi force;

increasing the force between the wafer and the polishing pad; and

applying a polishing solution to the polishing pad so as to polish the wafer.

21. The method of claim 1 further comprising:

ceasing application of the conditioning fluid so that the rinsing fluid dilutes the conditioning fluid; and

ceasing application of the rinsing fluid so that the polishing solution dilutes the rinsing fluid.

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