

(19)



Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 0 960 693 A2

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
01.12.1999 Bulletin 1999/48

(51) Int. Cl.⁶: **B24B 37/04**, B24D 13/12,
B24D 13/14

(21) Application number: **99109243.8**

(22) Date of filing: **25.05.1999**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE**
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **28.05.1998 JP 14715998**

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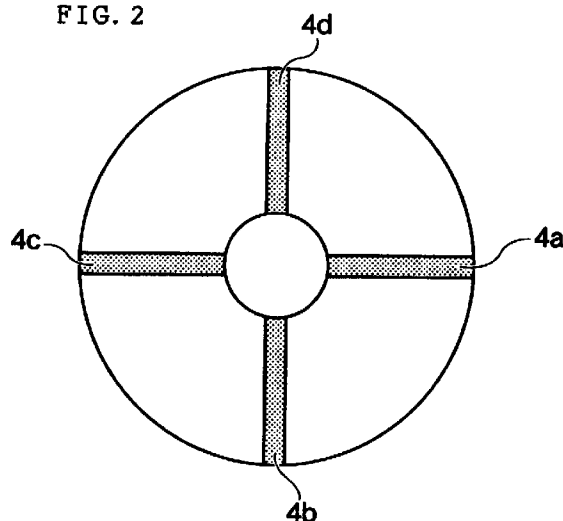
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(54) **A polishing machine**

(57) The present invention is a polishing machine, comprising a rotatable metallic platen whose surface is covered by the plural number of polishing pad, on the position of the surface of said metallic platen corresponding to the jointing lines of said polishing pads, the grooves are engraved, and the filling material which is different from the material composing the platen is inserted into said grooves. The desirable substance to be inserted into said grooves is stainless steel, synthetic resin or ceramics.

FIG. 2



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Description

BACK GROUND OF THE INVENTION

FIELD OF THE INVENTION

[0001] This invention relates to a structure and a material of platen belonging to a polishing machine which polishes the surface of a flat shape work-piece which is required to have a very precise flatness and parallelism, more in detail, relates to a structure and a material of a platen which effectively prevent the metallic contamination to the work-piece such as silicon wafer.

DESCRIPTION OF THE PRIOR ART

[0002] In general, the surface polishing of a plate shape work-piece made of glass, metal, semi-conductor, ceramics or carbon which is required to have precise flatness and parallelism is carried out by a polishing machine having a platen on which surface a polishing pad is stuck at both upper and lower position, or a platen at either of the positions. The work-piece is held and pressed between said upper and lower platens or pressed onto said one platen, the platens and the work-piece are rotated under the constant supply of aqueous slurry containing fine abrasive rains, and the work-piece is lapped as to have an even thickness, further to improve flatness and parallelism.

[0003] Recently, according to the necessity for the improvement of memory capacity and productivity of integrated circuit (IC) or large-scale integration (LSI), a silicon wafer or a compound semiconductor wafer (hereinafter shortened to wafer) which are the starting material of IC or LSI are becoming to be required to have a homogeneous thickness and to improve the machining accuracy and the dimensional stability, further the size of wafer is becoming bigger and bigger. Therefore, for the polishing of wafer, not only a main condition of machine but also the machine itself is becoming to be required to have excellent accuracy and stability, further, regarding other incidental conditions, more severe control is becoming necessary. Especially, in a case of silicon wafer, a production technique of silicon single crystal ingot is improved, and recently it becomes possible to produce a large size wafer for example 12 inch or 16 inch diameter. To carry out the effective on these large size wafer by higher productivity, recently, a large size polishing machine which possesses a platen bigger than 2000 mm, for instance 2200 mm diameter is becoming popular.

[0004] The polishing platen of this invention indicates a disk plate having considerable thickness made of metal such as cast iron, copper, tin or steel or nonmetallic materials such as ceramics or glass, on the surface of which, for example, uniform thin layer of sheet composed by non-woven cloth, texture, synthetic resin

foam, synthetic leather or a complex of them is stuck. And the polishing platen as mentioned above is arranged at the upper and lower position or at one position of the polishing machine. At the polishing process, in a case of double sided polishing machine, a work-piece is held and pressed between two platens, and in a case of single sided polishing machine, a work-piece is pressed to the platen by means of a holder. At least one of work-piece and platens is rotated, under the constant supply of polishing compound slurry containing abrasives. By the effect of the abrasive and by the effect of mechanical motion of polishing machine, the surface of work-piece is removed gradually and a flat and precise surface can be generated. And especially, in the case that the brittle material such as silicon wafer is a work-piece, a cast iron platen is ordinary used.

[0005] As the polishing pad used for pre-polishing, for example, a complex sheet composed by non-woven cloth and synthetic resin foam is used, and for final mirror finishing, for example, a sheet of suede type synthetic leather is ordinary used. A seamless sheet of these materials is stuck over the over-all surface of said cast iron platen, using e.g. a double sided adhesive tape. And as the polishing solution, the aqueous alkaline solution in which colloidal silicon oxide fine particles are dispersed, so called colloidal silica is ordinary used. The pre-polishing and polishing process are different from the previous process based on so-called mechanical processing which uses for instance a diamond grinding stone or hard abrasives of aluminum oxide. The feature of the pre-polishing and polishing process is to utilize the chemical effect of alkali to a silicon wafer, concretely utilize a corroding effect of alkali to a silicon wafer. That is, by the corroding effect of alkali, a thin soft corrosion layer is formed on the surface of a silicon wafer. The formed corrosion layer is removed by a mechanical action of fine particles of colloidal silica, thus the polishing process is progressed.

[0006] As mentioned above, since the polishing solution is strong alkaline solution, when it is contacted with cast iron composing the platen, it corrodes the platen and generates stain, which causes the problem of metal contamination of work-piece. However, as illustrated above, since over-all surface of said cast iron platen is covered by a seamless polishing pad, aqueous alkaline solution does not contact with the cast iron platen at the actual polishing surface, and the problem of metal contamination is not caused at the ordinary condition.

[0007] Especially in a case of silicon wafer, recently the diameter of wafer are becoming big, and a large diameter silicon wafer such as 12 inches size or 16 inches size are currently produced in the commercial scale. Therefore, to carry out the commercial production of these large scale silicon wafer effectively, a big size polishing machine which has a big size platen whose diameter is bigger than 2000 mm is becoming popular. To said big size polishing platen, a polishing pad of corresponding size should be stuck, however, under the

present conditions, an uniform and thin polishing pad which has such a wide width can not be obtained, further the sticking technique does not in the level to stick such a thin and wide polishing pad uniformly to the polishing platen. Therefore, currently, a standard size polishing pad is cut corresponding to a half size or a quarter size segment and these segments are combined to form a disk shape polishing pad which covers over-all surface of polishing platen.

[0008] At the sticking process of the polishing pad segments to the polishing platen, it is ordinary that the platen and the polishing pad is perfectly coincided, and the edge of polishing pad hung over from the outermost periphery of the platen is cut off along with the periphery of the platen. And the joint part of the segments of pad must be made not to remain the gap, however, it is very difficult not to remain the gap perfectly, and it is unavoidable to remain very narrow gap. At the practical process, polishing solution penetrates into the gap, corrodes metal of platen and generates stains. The generated stains diffuse over the polishing surface and cause the problem of a metal contamination problem on a work-piece. In the worst case, the particles of stain causes scratches of work-piece and deteriorate the yield of products. Further, the partial corrosion progresses along with the narrow gap, and the flatness and roughness of the platen becomes bad by repeating the change of polishing pad. Thus, the problem that the life time of the platen is shortened is pointed out in this case.

[0009] To avoid the problem mentioned above, the method to coat the surface of platen by resin can be mentioned, however, in this case, since the resin layer is removed with used polishing pad at the exchange procedure of used polishing pad to new one. Therefore, this method is not a fundamental countermeasure to solve the problem. Further, when the resin layer is partially removed, the surface flatness of platen becomes uneven and gives bad influences to the polishing. The method to seal the narrow gap between segments of polishing pad by glue of adhesive to prevent the penetration of polishing solution can be also mentioned. In this case, the sealed line with glue becomes slightly heaps up and makes the flatness of polishing surface slightly uneven, and consequently the surface roughness and total thickness variation of the polished surface of work-piece are deteriorated. Also in this case, there is a similar problem that the glue partial remains on the surface of platen and the surface flatness becomes bad, when an used polishing pad is removed from the platen.

BRIEF SUMMARY OF THE INVENTION

[0010] The inventors of this invention have carried out an intensive study to solve above mentioned problem which conventional polishing machine has, and have found that the corrosion of metal by polishing solution

and the metallic contamination of the work-piece can effectively be protected by improving the structure of the platen. That is, the object of this invention is to provide a structure of polishing platen which suits to a big size polishing machine, and reduce the metallic contamination of the work-piece.

[0011] The above mentioned object can be accomplished by a polishing machine, comprising a rotatable metallic platen whose surface is covered by the plural number of polishing pad, on the position of the surface of said metallic platen corresponding to the jointing lines of said polishing pads, the grooves are engraved, and the filling material which is different from the material composing the platen is inserted into said grooves. In the present invention, desirably the filling material to be inserted into said grooves is at least one selected from the group composed by stainless steel, synthetic resin and ceramics.

BRIEF DESCRIPTION OF THE DRAWING

[0012]

FIG.1 is a plan view of the metallic polishing platen of this invention on which the plural numbers of polishing pad are stuck.

FIG.2 is a plan view of the metallic platen of this invention.

FIG.3 is a longitudinal sectional view of the A-A' line of the polishing platen of this invention.

FIG.4 is a longitudinal sectional view of the another Example showing the structure of groove engraved on the surface of metallic platen of this invention.

[0013] In the drawings each numerical number represents;

- 1, 1a, 1b, 1c and 1d : polishing pad,
- 2, 2a, 2b, 2c and 2d : jointing line between polishing pads
- 3 : platen
- 4, 4a, 4b, 4c and 4c : groove
- 5 : filling material

DETAIL DESCRIPTION OF THE INVENTION

[0014] A polishing machine used in this invention possesses a rotatable platen on upper and lower position or on either position, and a work-piece is held between upper and lower platens or on the surface of the platen, and rotated under the constant supply of polishing compound and carry out the polishing of work-piece such as silicon wafer. And in a case of silicon wafer polishing, a cast iron platen having 50~70 mm thickness is ordinary used. The concrete Example of this invention can be illustrated by drawings.

[0015] FIG.1 is a plan view of the polishing surface of a polishing machine on which the polishing pad is stuck,

FIG.2 is the plan view of the polishing platen and FIG.3 is a longitudinal sectional view of the polishing platen of this invention. The Example of this invention indicates the surface of disk shape polishing platen covered by four similar polishing pads. In the drawing, polishing pads 1a, 1b, 1c and 1d have segmental similar shape and are stuck over the surface of platen 3, whose contacting lines 2a, 2b, 2c and 2d are on the assumed center lines on platen 3. Segments of polishing pads do not overlap on the lines but do not remain obvious gaps. Especially, it is necessary to avoid the overlapping of pads to prevent the piled up shape. Therefore, it is unavoidable to remain very narrow gaps between polishing pads.

[0016] On the surface of polishing platen 3, narrow grooves of 4a, 4b, 4c and 4d are engraved to the corresponding position of the contacting lines 2a, 2b, 2c and 2d, further filling material 5 is inserted into said grooves. The surface of filling material must be processed to have horizontal level with the platen, and also the surface roughness must be similar to the surface of the platen. That is, even if grooves are engraved and filling material is inserted into said grooves, the surface condition of the platen is desirable to be kept as if it is a monolith platen, not to give a bad effect to the polished surface of work-piece.

[0017] With respect to the property of filling material, it is necessary not to be corroded by alkaline solution penetrated from the narrow gap formed between polishing pads. Therefore, the chemical property of filling material is different from that of metallic material of the platen, and is not corroded by alkali. And consequently a hard type resin such as polyvinyl chloride or Delrin, stainless steel or ceramics which have strong resistance to alkali is preferably used. To maintain the physical property of platen homogeneously, the mechanical properties of the filling material, concretely hardness, Young's modulus and heat expanding coefficient is desirably similar to that of metallic platen. Therefore, the use of resin which is soft and has rubber elasticity is not desired.

[0018] The configuration of grooves are not desirable to be unnecessarily wide and deep, because it is necessary to reduce the difference of thermal change (expansion by heat) between platen and filling material, and to reduce the effects by water or by chemicals. Concretely, it is sufficient to be just cover the contacting line of polishing pads, and not intending to limit the scope of the invention but, for example, the groove of 10~20 mm width and smaller than 5 mm depth is desirable. If the width is narrower than 10 mm, the positioning of new polishing pads at the recovering procedure becomes very difficult. Further, the shape of groove is not limited, but the groove whose cross sectional view is rectangular, trapezoidal, triangular or semicircular is preferably used. As clearly shown in FIG.4, the trapezoidal shape groove whose inner side length is slightly longer than the another side length which faced to outer surface, to

which a rod shape filling material can be inserted is desirably used. In a case of groove of mentioned shape, the rod shape filling material can be fixed without using adhesive, and the removing or partial coming off of the filling material can be avoided.

[0019] As the procedure to fill the filling materials, the procedure to insert the rod shape filling material which is prepared as to fix the shape of groove to the groove is the most desirable, however, not intended to be limited. And as the fixing method, an ordinary method, for example, fixing by adhesive or fixing by screw bolts can be mentioned.

[0020] With respect to the polishing pad, the over-all reverse surface is stuck contact to the surface of platen strongly by means of double surface adhesive tape which is preliminary stuck to the polishing pads, thus the polishing solution does not contact with the metallic part of the platen. And, although the polishing pad is also stuck strongly to the surface of the filling materials, it does not remove partially when the used polishing pad is removed because the filling materials itself is strongly fixed to the platen.

Effect of the invention

[0021] By the platen having a structure mentioned above and locating the contacting line of polishing pads on the filling materials which is inserted into the groove engraved on the surface of metallic platen, the polishing solution does not contact with the metal which compose the platen, and the corrosion of metal does not occur, thus the metallic contamination of silicon wafer can be avoided. Namely, by this invention, it is possible to improve the defect of large size polishing machine, concretely a polishing machine having a platen bigger than 2200 mm diameter, which is difficult to prepare a seamless polishing pad which covers the over-all surface of the platen.

Claims

1. A polishing machine, comprising a rotatable metallic platen whose surface is covered by the plural number of polishing pad, on the position of the surface of said metallic platen corresponding to the jointing lines of said polishing pads, the grooves are engraved, and the filling material which is different from the material composing the platen is inserted into said grooves.
2. The polishing machine of claim 1, wherein the substance to be inserted into said grooves engraved on said metallic platen is at least one selected from the group composed by stainless steel, synthetic resin and ceramics.

FIG. 1

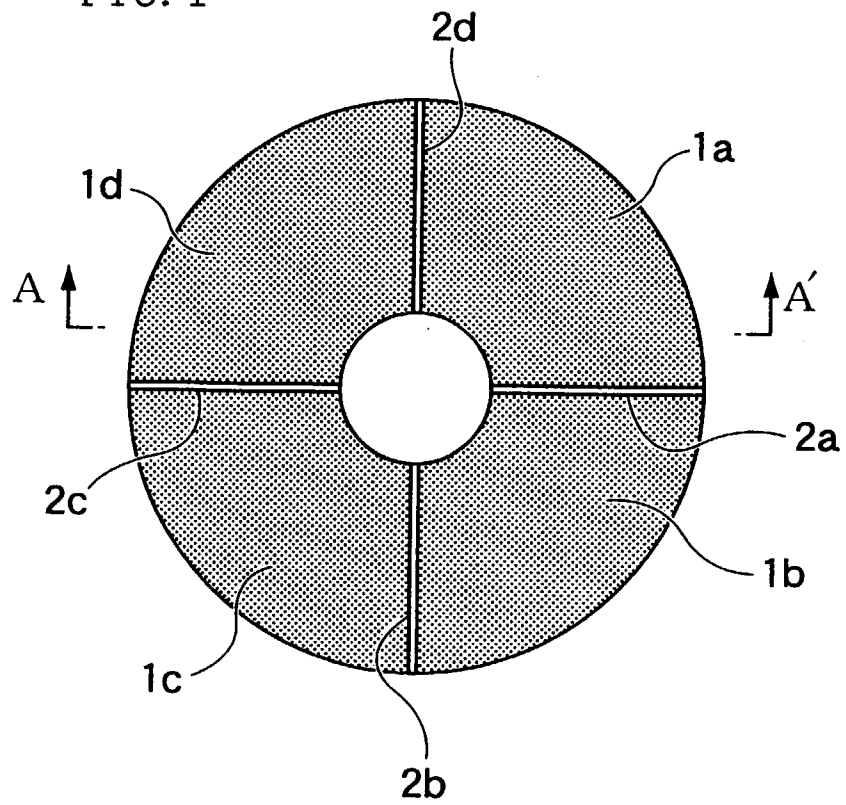


FIG. 2

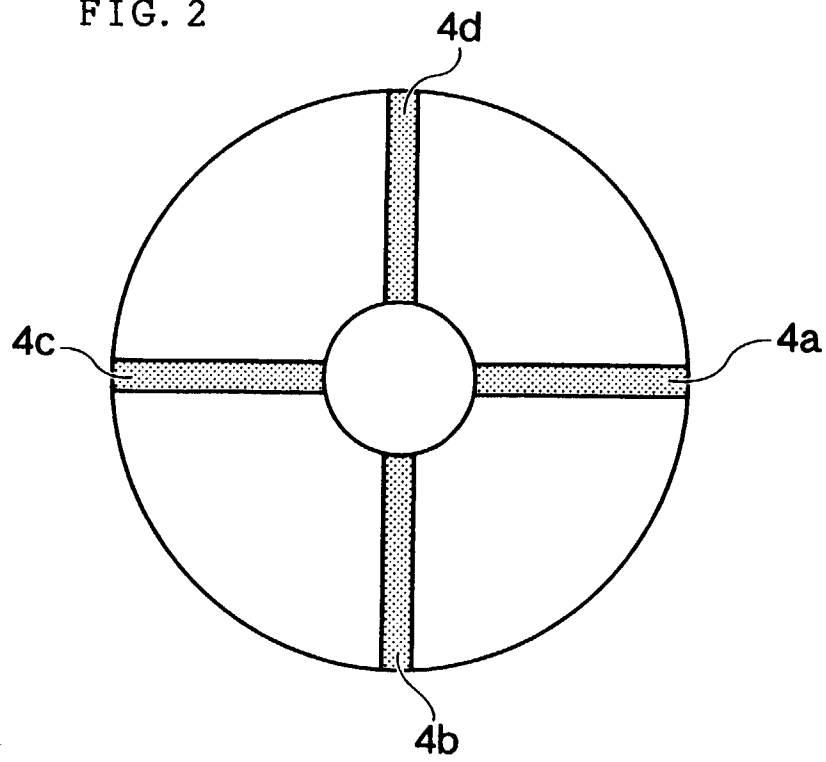


FIG. 3

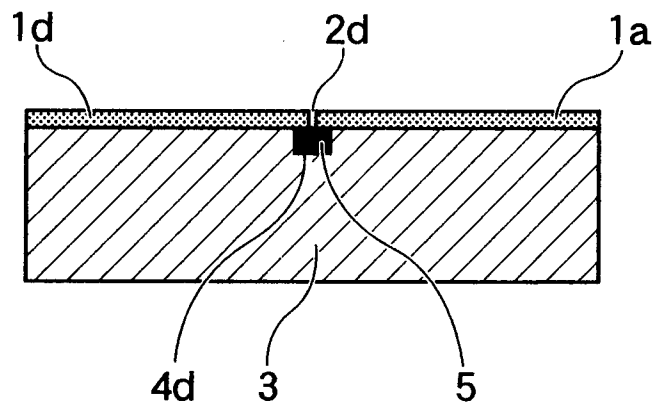


FIG. 4

