POLISHING PAD AND THE METHOD OF FORMING MICRO-STRUCTURE THEREOF

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ABSTRACT

This invention is related to a polishing pad, and more particularly a polishing pad with flexible micro-structure. The polishing pad comprises a connecting surface and a polishing surface. The connecting surface is used to secure on a polishing device. The polishing surface with flexible micro-structure is used to grind and adequately press close to the surface of semiconductor piece. The present invention not only increases the area of polishing surface that contact with the semiconductor piece but also get over the difficulty in pressing close to different piece. It will save grinding time and have a better effect.
POLISHING PAD AND THE METHOD OF FORMING MICRO-STRUCTURE THEREOF

BACKGROUND OF THE INVENTION

[0001] 1. Technical Field

[0002] The present invention relates to a polishing pad, more particularly to a polishing pad with a flexible micro-structure.

[0003] 2. Description of Related Art

[0004] Most of electrical chips are formed with various laminates, for example, a silicon semiconductor wafer may be as the material of laminates. A polishing or scrapping step may be necessary for removal of excessive laminate when a new laminate is added on a concerned structure, so as to achieve polarization or other objectives. Such a step is generally called chemical mechanical polishing (CMP). The excessive materials can be removed from the surface of a wafer by many CMP steps when various materials are laminated for the formation of a chip.

[0005] For a traditional CMP step, a wafer is reversely fixed on a carrier which may drive the wafer to rotate. The other carrier loads and drives a polishing pad to circle. Chemical slurry is led between the wafer and the polishing pad to react physically and chemically with the portion of the wafer to remove partial layers. However, on the condition of a concerned work piece with a rough surface for polarization, the attached area between the polishing pad and the work piece increases by degrees, which not only spend much time but also reduce the life of the polishing pad because the utilized degree and region are not uniform for the polishing pad. Furthermore, the work piece with a rough surface cannot be fully attached to the polishing pad in a general and uniform polishing step. Thus, such special polishing requirement is not achieved by the general polishing step.

[0006] Accordingly, the present invention is directed to a polishing pad with the flexible micro-structure. The micro-structure may be fully attached to the surface of a concerned work piece to increase the attached surface during polishing. The feature of the micro-structure not only saves polishing time but also meets the requirement of various work pieces. Moreover, the micro-structure is of good absorption to absorb much slurry during polishing for the achievement of good polishing effect.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0014] The invention as well as a preferred mode of use, further objectives and advantages thereof will best be understood by reference to the following detailed description of illustrative embodiments when read in conjunction with the accompanying drawings, wherein:

[0015] FIG. 1A is a cross-sectional schematic diagram illustrating polishing device in accordance with a preferred embodiment of the present invention.

[0016] FIG. 1B is a cross-sectional schematic diagram illustrating polishing pad in accordance with a preferred embodiment of the present invention.

[0017] FIG. 2A and FIG. 2B are schematically top-view and cross-sectional diagrams respectively illustrating the micro-structure of the polishing pad in accordance with the present invention.

[0018] FIG. 3A and FIG. 3B are schematically top-view and cross-sectional diagrams respectively illustrating the micro-structure of the polishing pad in accordance with the present invention.

[0019] FIG. 4A and FIG. 4B are schematically top-view and cross-sectional diagrams respectively illustrating the micro-structure of the polishing pad in accordance with the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0020] The present invention provides a polishing pad with a micro-structure. Some detail process or manufacture of the polishing pad used are implemented by the current technology. Thus, some known description is not mentioned in following illustration. The sizes of components are not practical rather than for illustration.

[0021] FIG. 1A is a cross-sectional schematic diagram illustrating a polishing device in accordance with a preferred embodiment of the present invention. An exemplary polishing pad 10 comprises a connecting surface 11 and a polishing surface 12. The connecting surface 11 is configured for securing a polishing device 14 with adhesive glue 13 (pressure-sensitive glue). The polishing surface 12 is configured for polishing a semiconductor piece or other work piece 30.
Wherein there is a flexible micro-structure 15 on the polishing surface 12 to enable the polishing surface 12 to be attached totally to the surface of the semiconductor piece or other work piece 30. Shown in FIG. 1B, the micro-structure 15 of the polishing surface 12 may increase the area attached to a plurality of protrudes over the work piece 30 and provide press force in the more densities. On the other hand, when the micro-structure 15 of the polishing surface 12 are attached to the caves on the work piece 30, the press force may be smaller because of the little attached surface between the polishing surface 12 and the work piece 30. Thus, such a polishing surface 12 with the feature of the micro-structure 15 may spend less time for polishing and satisfy various polishing requirement to achieve polishing performance.

[0022] FIG. 2A and FIG. 2B are schematically top-view and cross-sectional diagrams respectively illustrating the micro-structure of the polishing pad in accordance with the present invention. In the example, the micro-structure is a micro cave 21 with a width from 1 nanometer to 100 microns.

[0023] FIG. 3A and FIG. 3B are schematically top-view and cross-sectional diagrams respectively illustrating the micro-structure of the polishing pad in accordance with the present invention. In the example, the micro-structure includes a plurality of foams formed by a micro foaming technology, for example but not limited to, physical or chemical foaming technology.

[0024] FIG. 4A and FIG. 4B are schematically top-view and cross-sectional diagrams respectively illustrating the micro-structure of the polishing pad in accordance with the present invention. In the example, the micro-structure is a hair feather micro-structure 23 of the dimension from 1 nm to 100 microns. The better performance of polishing may be achieved to utilize the hair feather micro-structure to absorb much slurry because of the good absorption capability for the hair feather micro-structure.

[0025] The present invention is directed to the manufacture of polishing pad by micro foaming technology. The manufacture includes: providing a resin and a plurality of nano dots; stirring the nano dots and the resin for homogeneously distributing the nano dots in the resin; curing the resin for forming a sheet; and removing the nano dots for enabling the surface of the sheet with a plurality of cave holes to form the micro-structure.

[0026] The present invention is directed to the manufacture of polishing pad by micro foaming technology. The manufacture includes: providing a resin and a plurality of salt dots in the resin; stirring the salt dots and the resin for homogeneously distributing the salt dots in the resin; curing the resin for forming a sheet; and removing the salt dots for enabling the surface of the sheet with a plurality of cave holes to form the micro-structure. In the example, the resin may be cured by heating, and the salt dots may be removed with aqueous solution.

[0027] The present invention is directed to the manufacture of polishing pad by micro foaming technology. The manufacture includes: providing a resin and solvent, for example but not limited to, dimethyl formamide (DMF) or other hydrophilic agent which is insoluble with the resin; stirring the mixture of the resin and the solvent for homogeneously distributing the solvent in the resin; curing the resin to form a sheet; removing the solvent to form a plurality of cave holes on the surface of the sheet for the formation of the micro-structure. In the example, the resin may be cured by heating, and the solvent may be removed by aqueous solution.

[0028] The present invention is directed to the manufacture of polishing pad. The manufacture includes: providing a substrate with thin fibers; coating the substrate in a resin; curing the coated substrate to form a sheet; and polishing the surface of the sheet for forming a surface with the micro-structure. In the example, the micro-structure is a hair feather micro-structure, and the resin may be cured by heating.

[0029] The present invention is directed to the manufacture of polishing pad by micro foaming technology. The manufacture includes: providing a resin; providing a foaming agent in the resin; stirring the resin and the foaming agent for homogeneously distributing the foaming agent in the resin; curing the resin for forming a sheet; and heating the resin to vaporize the foaming agent to enable the surface of the sheet with a plurality of cave holes to form the micro-structure. In the example, the curing and the heating steps may be implemented at same time.

[0030] The present invention provides a polishing pad with the flexible micro-structure. The micro-structure may be fully attached to the surface of a concerned work piece to increase the attached surface during polishing. The feature of the micro-structure not only saves polishing time but also meets the requirement of various work pieces. Besides, the micro-structure may sweep the particles on the surface of a concerned work piece to prevent the particles from scraping the surface of the concerned work piece. Moreover, the micro-structure is of good absorption to absorb much slurry during polishing for the achievement of good polishing effect.

[0031] Although the present invention has been explained in relation to its preferred embodiment, it is to be understood that other modifications and variation can be made without departing the spirit and scope of the invention as hereafter claimed.

What is claimed is:
1. A polishing pad, comprising:
   a connecting surface, configured for securing on a polishing device; and
   a polishing surface, configured for polishing a semiconductor piece or a work piece;
   wherein said polishing surface is with a flexible micro-structure to attach to surface of the semiconductor piece or the work piece and increase area of said polishing surface contact with said semiconductor piece or work piece.

2. The polishing pad according to claim 1, wherein said micro-structure is a micro cave.

3. The polishing pad according to claim 2, wherein a width of said micro cave is from 1 nanometer to 100 microns.

4. The polishing pad according to claim 1, wherein said micro-structure is formed by a micro foaming technology.

5. The polishing pad according to claim 4, wherein said micro foaming technology comprises a physical micro foaming technology.

6. The polishing pad according to claim 4, wherein said micro foaming technology comprises a chemical micro foaming technology.

7. The polishing pad according to claim 4, wherein said micro foaming technology comprises the steps:
   providing a resin;
   providing a plurality of nano dots in said resin;
   stirring said nano dots and said resin for distributing said nano dots in said resin;
   curing said resin for forming a sheet; and
removing said nano dots for enabling a surface of said sheet with a plurality of cave holes to form said micro-structure.

8. The polishing pad according to claim 4, wherein said micro foaming technology comprises the steps:
   providing a resin;
   providing a plurality of salt dots in said resin;
   stirring said salt dots and said resin for distributing said salt dots in said resin;
   curing said resin for forming a sheet; and
   removing said salt dots for enabling a surface of said sheet with a plurality of cave holes to form said micro-structure.

9. The polishing pad according to claim 8, wherein said removing step comprises removing said salt dots with water.

10. The polishing pad according to claim 4, wherein said micro foaming technology comprises the steps:
    providing a resin;
    providing a solvent in said resin, wherein said resin is insolvable with said solvent;
    stirring said solvent and said resin for distributing said solvent in said resin;
    curing said resin for forming a sheet; and
    removing said solvent for enabling a surface of said sheet with a plurality of cave holes to form said micro-structure.

11. The polishing pad according to claim 10, wherein said solvent comprises a hydrophilic solvent.

12. The polishing pad according to claim 10, wherein said solvent comprises dimethyl formamide (DMF).

13. The polishing pad according to claim 10, wherein said removing step comprises removing said solvent with water.

14. The polishing pad according to claim 1, wherein said polishing pad is attached to said polishing device with an adhesive glue.

15. The polishing pad according to claim 14, wherein said adhesive glue comprises a press-sensitive glue.

16. A method of forming a micro-structure on a polishing pad, comprising the steps:
    providing a substrate with thin fibers;
    coating said substrate in a resin;
    curing said coated substrate to form a sheet; and
    polishing a surface of said sheet for forming a surface with said micro-structure.

17. The method of forming a micro-structure on a polishing pad according to claim 16, wherein said micro-structure comprises a hair feather micro-structure.

18. The method of forming a micro-structure on a polishing pad according to claim 17, wherein a dimension of said is from 1 nano meter to 100 microns.

19. A method of forming a micro-structure on a polishing pad, comprising the steps:
    providing a resin;
    providing a foaming agent in said resin;
    stirring said resin and said foaming agent for distributing said foaming agent into said resin;
    curing said resin for forming a sheet; and
    heating said resin to vaporize said foaming agent to enable a surface of said sheet with a plurality of cave holes to form said micro-structure.

20. The method of forming a micro-structure on a polishing pad according to claim 19, wherein said curing and said heating steps are implemented at same time.

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