

WAFER POLISH RING

BACKGROUND OF THE INVENTION

1. Field of Invention

The invention relates to wafer polishing devices and more particularly to a wafer
5 polish ring with improved characteristics.

2. Description of Related Art

Typically, semiconductor devices are manufactured by forming a plurality of
layers of material on a semiconductor substrate (called a wafer), and patterning these
layers to form the desired electrical devices (e.g., transistors, capacitors, etc).
10 However, there are many irregularities and defects that exist at the edge region of the
wafer. For example, the various process layers formed at the edge region of the wafer
may not adhere very well and may be too thick or too thin. Further, in the edge regions
of the wafer, process layers may be stacked on previous layers with which they are
incompatible, process layers may be only partially formed, and removal of process
15 layers may be incomplete. These problems may result in holes being formed in the
layers, thereby increasing the amount of contaminants that may interfere with the
manufacture of semiconductor devices. Such irregularities and defects may also
cause cracks that may propagate from the edge region of the wafer into the main body
of the wafer during subsequent processing of the wafer. The irregularities and defects
20 that may occur at the edge region of a wafer may occur for the following reasons:

In high-temperature processes normally encountered in semiconductor
manufacturing, there is always some temperature variation across the wafer. These
variations may be greater at the wafer's outer edges where cooling and heating may
occur more rapidly. Additionally, repeated touching and handling of the wafer during
25 manufacturing operations is another reason that irregularities and defects may occur
at the wafer's edge. The edge of the wafer may also contain a variety of defects due to

various process steps. For example, the edge of the wafers may sometimes be subjected to clamping during various process steps. This clamping may leave marks, indentions, cracks or scratches on the layers at the edge of the wafer. Problems and defects discussed above are even more troublesome as features sizes on
5 semiconductor devices become smaller. Typically, smaller feature sizes require cleaner manufacturing environments, i.e., the number of contaminants in the manufacturing environment must be reduced. This in turn requires that all potential sources of contaminants, including those originating at the wafer's edge, must be reduced or eliminated. Thus, the need for providing an improved wafer polish ring
10 exists.

SUMMARY OF THE INVENTION

It is therefore one object of the invention to provide a ring for polishing wafers comprising an annular main unit comprising a coupling surface; and an annular polishing unit comprising a corresponding coupling surface complementarily secured
15 to the coupling surface.

The above and other objects, features and advantages of the invention will become apparent from the following detailed description taken with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

20 FIG. 1 is a perspective view of a wafer polish ring according to a first preferred embodiment of the invention;

FIG. 2A is an exploded view of the wafer polish ring shown in FIG. 1 viewing from an angle above;

FIG. 2B is another exploded view of the wafer polish ring shown in FIG. 1 but
25 viewing from an angle below;

FIG. 3A is a cross-sectional view showing the main unit and the polishing unit

according to a second preferred embodiment of the invention;

FIG. 3B is a view similar to FIG. 3A showing the assembled main unit and polishing unit of FIG. 3A;

FIG. 4A is an exploded view showing the main unit and the polishing unit
5 according to a third preferred embodiment of the invention;

FIG. 4B is an exploded perspective view of the engaged main unit and polishing unit of FIG. 4A to be fastened by one of a plurality of shaped blocks;

FIG. 5 is a perspective view of a wafer polish ring according to a fourth preferred embodiment of the invention; and

10 FIG. 6 is a perspective view of a wafer polish ring according to a fifth preferred embodiment of the invention showing a replacement of the damaged polish pad.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIGS. 1, 2A and 2B, a wafer polish ring 1 in accordance with a first preferred embodiment of the invention comprises the following components as
15 discussed in detail below.

A main unit 11 is of polymer formed by injection molding or metal formed by molding. The main unit 11 comprises an annular top surface 11A including a plurality of equally spaced holes 111 to be operatively secured to a polishing head of a chemical mechanical polishing (CMP) device so that they can be actuated as a whole.
20 The main unit 11 further comprises an annular bottom surface 11B including an annular flat 112 along an inner edge, an annular flange 113 along an outer edge of the flat 112, a plurality of equally spaced threaded holes 114 on the joining edge of the flat 112 and the flange 113, and a plurality of fasteners 115.

A polishing unit 12 is of polymer of wear resistant (e.g., PPS (polyphenylene sulfide) or PEEK (polyetheretherketone)) formed by injection molding. The polishing
25 unit 12 comprises an annular top surface 12A which includes an annular riser 122 an

inner edge, the riser 122 being shaped complementarily to the flat 112, a plurality of equally spaced guide holes 124 each having a slot 1241 extending tangentially a short distance, and an annular flat 123 along an outer edge of the riser 122. The slot 1241 has an enlarged lower portion. The polishing unit 12 further comprises a polish
5 surface 12B for wafer polishing purposes opposite the top surface 12A.

In assembly, the fasteners 115 are partially driven into the threaded holes 114 to secure thereto with a gap formed between the head of each fastener 115 and the mouth of the corresponding threaded hole 114. The head of the fastener 115 is slightly smaller than the guide hole 124 so as to dispose therein. Further, the fastener 115 can
10 be pushed to fasten its shank in the upper narrow portion of the slot 1241 and its head in the lower enlarged portion of the slot 1241. As a result, the main unit 11 and the polishing unit 12 are secured together.

Referring to FIGS. 3A and 3B, a wafer polish ring 1 in accordance with a second preferred embodiment of the invention is shown. The characteristics of the second
15 preferred embodiment are detailed below. The fasteners 115, the threaded holes 114, the holes 124, and the slots 1241 are eliminated. Instead, the bottom surface 11B including the flange 113 and the flat 112 is secured to the complementarily shaped top surface 12A including the riser 122 and the flat 123 by means of adhesive (e.g., epoxy resin) 2.

20 Referring to FIGS. 4A and 4B, a wafer polish ring 1 in accordance with a third preferred embodiment of the invention is shown. The characteristics of the third preferred embodiment are detailed below. The fasteners 115, the threaded holes 114, the holes 124, and the slots 1241 are eliminated. Instead, the top surface of the polishing unit 12 is provided with a plurality of equally spaced dovetails 121 and the
25 bottom surface of the main unit 11 is provided with a plurality of equally spaced corresponding cut-out spaces 116. The dovetails 121 and the cut-out spaces 116 are

aligned and engaged with each other so as to form shaped spaces with can be filled with a plurality of shaped blocks 117 by insertion. As a result, the main unit 11 and the polishing unit 12 are secured together.

Referring to FIG. 5, a wafer polish ring 1 in accordance with a fourth preferred
5 embodiment of the invention is shown. The characteristics of the fourth preferred embodiment are detailed below. The polish surface 12B is divided into a plurality of equally spaced polish sections with a gap 125 formed between any two adjacent polish sections.

Referring to FIG. 6, a wafer polish ring 1 in accordance with a fifth preferred
10 embodiment of the invention is shown. The characteristics of the fifth preferred embodiment are detailed below. The polish surface 12B is provided with a plurality of equally spaced polish pads 126 secured thereto by means of adhesive or any other fastening means known in the art. Hence, any worn polish pad 126 can be replaced with a new one.

15 While the invention has been described in terms of preferred embodiments, those skilled in the art will recognize that the invention can be practiced with modifications within the spirit and scope of the appended claims.

WHAT IS CLAIMED IS:

1. A ring for polishing wafers comprising:
 - an annular main unit (11) comprising a coupling surface (11B); and
 - an annular polishing unit (12) comprising a corresponding coupling surface (12A)
- 5 complimentarily secured to the coupling surface (11B).
2. The ring of claim 1, wherein the coupling surface (11B) comprises an annular flat (112) along an inner edge, an annular flange (113) along an outer edge of the flat (112), a plurality of equally spaced threaded holes (114) on the joining edge of the flat (112) and the flange (113), and a plurality of fasteners (115); wherein the
- 10 corresponding coupling surface (12A) comprises an annular riser (122) an inner edge, the riser (122) being shaped complimentarily to the flat (112), a plurality of equally spaced guide holes (124) each having a slot (1241) extending tangentially, and an annular flat (123) along an outer edge of the riser (122), the slot (1241) having an enlarged portion toward the bottom; and wherein the fasteners (115) are partially
- 15 driven into the threaded holes (114) to secure thereto with a gap formed between the head of each fastener (115) and the corresponding threaded hole (114), the head of the fastener (115) is smaller than the guide hole (124) so as to dispose therein, and the fastener (115) is adapted to fasten its head in the enlarged portion of the slot (1241).
- 20 3. The ring of claim 1, wherein the coupling surface (11B) is secured to the corresponding coupling surface (12A) by means of adhesive (2).
4. The ring of claim 1, wherein the top surface of the polishing unit (12) is provided with a plurality of equally spaced dovetails (121), wherein the bottom surface of the main unit (11) is provided with a plurality of equally spaced corresponding cut-out
- 25 spaces (116) aligned and engaged with, and further comprising a plurality of shaped blocks (117) each adapted to securely insert into a space formed by the dovetail (121)

and the corresponding cut-out space (116).

5. The ring of claim 1, wherein the polishing unit (12) further comprises a polish surface (12B) opposite the corresponding coupling surface (12A).

6. The ring of claim 5, wherein the polish surface (12B) is provided with a plurality of
5 equally spaced gaps (125).

7. The ring of claim 5, further comprising a plurality of equally spaced polish pads (126) formed on the polish surface (12B).