

Claims

- 5 1. A flexible membrane (120) for a carrier head (100) of a chemical mechanical polisher, the flexible membrane comprising:
- a main portion (140) with a lower surface (510) to provide a substrate-mounting surface (142), the substrate mounting surface having a radius R; and
- an annular outer portion (150) extending upwardly from an outer edge of
- 10 the main portion (140), the annular outer portion (150) having a lower edge connected to the main portion (140) and an upper edge;
- characterized in that the flexible membrane comprises
- exactly three annular flaps to divide a volume above the main portion into a plurality of chambers when the flexible membrane (120) is secured to a carrier
- 15 head (100), the three annular flaps including
- a first annular flap (124a) joined to an inner surface of the main portion (140) at a radial position between 75% and 95% of R,
- a second annular flap (124b) joined to the annular outer portion at a position between the lower edge and the upper edge, the second annular flap
- 20 (124b) extending inwardly from the annular outer portion, and
- a third annular flap (124c) joined to the upper edge of the annular outer portion, the third annular flap (124c) extending inwardly from the annular outer portion.
2. The flexible membrane (120) of claim 1, wherein the substrate
- 25 mounting surface (142) has a diameter of about 150 mm.
3. The flexible membrane (120) of claim 2, wherein the first annular flap (124a) is joined to the main portion about 10 mm from the outer edge of the main portion.

4. The flexible membrane (120) of claim 2, wherein the first annular flap (124a) is joined to the main portion (140) at a radial position between 85% and 90% of R.

5. The flexible membrane (120) of claim 1, wherein the first annular flap (124a) includes a horizontally extending section and a vertically extending section connecting the horizontally extending section to the main portion (140).

6. The flexible membrane (120) of claim 5, comprising a notch (166) at a junction between the horizontally extending section and the vertically extending section.

10 7. The flexible membrane (120) of claim 5, wherein the horizontally extending section has a smaller thickness than the vertically extending section.

8. The flexible membrane (120) of claim 1, wherein each of the flaps has a thickness smaller than a thickness of the main portion.

15 9. The flexible membrane (120) of claim 8, wherein the annular outer portion comprises a body having a thickness greater than a thickness of the main portion.

10. The flexible membrane (120) of claim 1, comprising a notch (154) in an interior surface of the body of the annular outer portion at a junction of the body and the main portion.

20 11. The flexible membrane of claim 10, comprising an annular recess (156) in an outer surface of the body between a lower edge and an upper edge of the body.

25 12. The flexible membrane (120) of claim 11, wherein the outer surface of the body between the recess (156) and the lower edge is a single vertical surface.

13. The flexible membrane (120) of claim 12, wherein the outer surface of the body between the recess (156) and the upper edge is a single vertical surface.

14. The flexible membrane (120) of claim 13, wherein the outer surface of the body between the recess (156) and the lower edge is laterally aligned with the outer surface of the body between the recess (156) and the upper edge.

15. A chemical mechanical polishing head, comprising:

5 a base assembly (130);

a retaining ring secured to the base assembly (130); and

a flexible membrane (120) secured to the base assembly, the flexible membrane including

10 a main portion (140) with a lower surface to provide a substrate-mounting surface (142), the substrate mounting surface having a radius R, and

an annular outer portion (150) extending upwardly from an outer edge of the main portion, the annular outer portion (150) having a lower edge connected to the main portion (140) and an upper edge, characterized in that the flexible membrane comprises

15 exactly three annular flaps to divide a volume above the main portion (140) into a plurality of chambers when the flexible membrane (120) is secured to a carrier head (100), the three annular flaps including

a first annular flap (124a) joined to an inner surface of the main portion at a radial position between 75% and 95% of R,

20 a second annular flap (124b) joined to the annular outer portion at a position between the lower edge and the upper edge, the second annular flap (124b) extending inwardly from the annular outer portion, and

a third annular flap (124c) joined to the upper edge of the annular outer portion, the third annular flap (124c) extending inwardly from the
25 annular outer portion.