high disk consistency. But the sweep distance on pad surface of the new type of pad conditioner is less than the diamond disk pad conditioner. In other words, sweep distance of the new type of pad conditioner is restricted to the abrasive element numbers and positions.

[0005] Embodiments of the current invention seek to provide a spacer for the CVD pad conditioner applied in chemical mechanical planarization process. With the pad conditioner of the current invention, the pad edge damage (such as roll up) when the pad conditioner spins over the edge of the pad can be avoided. Also, the creation of greater depth of penetration and friction near the pad edge caused by the increase of downforce for the elements remaining on the pad due to portions of the pad conditioner sweeping beyond the pad diameter can be mitigated.

[0006] In one aspect, the present invention provides a pad conditioner including a carrier, at least one abrasive element, and a spacer. The carrier includes a surface with an exposed region and a plurality of mounting regions. The abrasive element is disposed on the mounting region of the surface of the carrier, and at least one abrasive element having a working surface includes a plurality of features each having a distal end. The spacer is disposed on the surface of the carrier and covering at least a portion of the exposed region, wherein the spacer has a first surface and a second surface opposed to the first surface, and the second surface is adjacent to the surface of the carrier. The spacer further includes an inclined edge, and the angle (A) between the inclined edge and the surface of the carrier is from 10 degrees to 80 degrees. The distance (D1) between the distal end of the highest feature of the at least one abrasive element and the surface of the carrier is greater than the distance (D2) between the first surface of the spacer and the surface of the carrier.

[0007] In another aspect, the present invention provides a spacer for a pad conditioner which includes a carrier and at least an abrasive element. The carrier of the pad conditioner comprises a surface with plural mounting regions and an exposed region. The abrasive element is disposed on the mounting region

and comprises a plurality of features each having a distal end. The spacer includes a first surface and a second surface opposed to each other, wherein the second surface is adjacent to the carrier. The distance (Dl) between the distal end of the highest feature of the abrasive element and the surface of the carrier is greater than the distance (D2) between the first surface of the spacer and the surface of the carrier. The spacer further comprises an inclined edge, and the angle (A) between the inclined edge and the surface of the carrier is from 10 degrees to 80 degrees.

[0008] In yet another aspect, the present invention provides a wafer chemical mechanical planarization system that includes a platen, a pad disposed on the platen and having an abrasive face, and a pad conditioner. The pad conditioner includes a carrier, at least one abrasive element, and a spacer. The carrier includes a surface with an exposed region and plurality of mounting regions, and the abrasive element is disposed on the mounting region of the surface of the carrier. At least one abrasive element includes a working surface facing the pad and including a plurality of features each having a distal end. The spacer is disposed on the surface of the carrier and covering at least a portion of the exposed region, wherein the spacer has a first surface and a second surface opposed to each other, and the second surface is adjacent to the carrier surface. The distal end of the highest feature of the abrasive element is in contact with the abrasive face of the pad, and the first surface of the spacer and the abrasive face of the pad have a gap (G) therebetween. The spacer of the pad conditioner further comprises an inclined edge, and the angle (A) between the inclined edge and the surface of the carrier is from 10 degrees to 80 degrees.

BRIEF DESCRIPTION OF THE DRAWING

[0009] Figure 1 is a schematic diagram of the pad conditioner according to one embodiment of the present invention.

[0010] Figure 2 is the a-a' cross-sectional view of Fig. 1.

[0011] Figure 3 is the enlarged view for zone b in Fig. 2.

[0012] Figure 4 is a schematic diagram of the wafer chemical mechanical planarization

What is claimed is:

1. A pad conditioner, comprising:

a carrier comprising a surface with an exposed region and a plurality of mounting regions;

at least one abrasive element disposed on the mounting region of the surface of the carrier, the at least one abrasive element having a working surface which includes a plurality of features each having a distal end; and

a spacer disposed on the surface of the carrier and covering at least a portion of the exposed region, wherein the spacer has a first surface and a second surface opposed to the first surface, the second surface adjacent to the surface of the carrier, and the spacer further comprising an inclined edge, and the angle (A) between the inclined edge and the surface of the carrier is from 10 degrees to 80 degrees;

wherein the distance (D1) between the distal end of the highest feature of the at least one abrasive element and the surface of the carrier is greater than the distance (D2) between the first surface of the spacer and the surface of the carrier.

2. The pad conditioner according to claim 1, wherein the at least one abrasive element comprises one or more of: superabrasive grit in a metal matrix, ceramic bodies comprising ceramic material in an amount of at least 85% by weight, and ceramic bodies comprising a diamond coating.

3. The pad conditioner according to claim 1, wherein the plurality of features of the abrasive element is precisely shaped features.

4. The pad conditioner according to claim 1, wherein the abrasive elements are spaced apart in an equal interval around the circumference of the carrier.

5. The pad conditioner according to claim 1, wherein the spacer is disposed concentrically within the circumference of the carrier.

6. The pad conditioner according to claim 1, wherein the spacer further comprises a plurality of ribs, and each of the rib is spaced in an equal interval around the circumference of the carrier.

7. The pad conditioner according to claim 1, wherein the differences between D1 and D2 is no less than 0.2mm.

8. A spacer for a pad conditioner, the pad conditioner comprising a carrier having a surface with a plurality of mounting regions and an exposed region, and at least an abrasive element disposed on the mounting region and having a plurality of features each having a distal end, the spacer comprising a first surface and a second surface opposed to the first surface and adjacent to the carrier, wherein the distance (D1) between the distal end of the highest feature of the abrasive element and the surface of the carrier is greater than the distance (D2) between the first surface of the spacer and the surface of the carrier, and the spacer further comprising an inclined edge, and the angle (A) between the inclined edge and the surface of the carrier is from 10 degrees to 80 degrees.

9. The spacer according to claim 8, wherein the differences between D1 and D2 is no less than 0.2mm.

10. A wafer chemical mechanical planarization system, comprising:

a platen;

a pad disposed on the platen and having an abrasive face; and

a pad conditioner comprising:

a carrier comprising a surface with an exposed region and a plurality of mounting regions;

at least one abrasive element disposed on the mounting region of the surface of the carrier, the at least one abrasive element having a working surface facing the pad and including a plurality of features each having a distal end; and

a spacer disposed on the surface of the carrier and covering at least a portion of the exposed region, wherein the spacer has a first surface and a second surface opposed to

the first surface, the second surface adjacent to the surface of the carrier;

wherein the distal end of the highest feature of the abrasive element is in contact with the abrasive face of the pad, and the first surface of the spacer and the abrasive face of the pad have a gap (G) therebetween, and the spacer of the pad conditioner further comprising an inclined edge, and the angle (A) between the inclined edge and the surface of the carrier is from 10 degrees to 80 degrees.

11. The wafer chemical mechanical planarization system according to claim 10, wherein the plurality of features of the abrasive element is precisely shaped features.

12. The wafer chemical mechanical planarization system according to claim 10, wherein the abrasive elements of the pad conditioner are spaced apart in an equal interval around the circumference of the carrier.

13. The wafer chemical mechanical planarization system according to claim 12, wherein the spacer of the pad conditioner is disposed concentrically within the circumference of the carrier.

14. The wafer chemical mechanical planarization system according to claim 12, wherein the spacer of the pad conditioner further comprises a plurality of ribs, and each of the rib is spaced in an equal interval around the circumference of the carrier.

15. The wafer chemical mechanical planarization system according to claim 10, wherein the gap (G) is no less than 0.2mm**.**