CLAIMS

1. A wafer chuck assembly, comprising:

a wafer chuck comprising a surface having a substantially circular geometry, the surface having a center and a first area; and

a plurality of mesas distributed over the surface of the wafer chuck, wherein individual ones of the plurality of mesas extend a height above the surface of the wafer chuck, wherein the individual ones of the plurality of mesas comprise a contact surface, and wherein a second area substantially equals a sum of an area of the contact surface of the individual ones of the plurality of mesas is at least 3% of the first area.

2. The wafer chuck assembly of claim 1, wherein the individual ones of the plurality of mesas comprise at least one leading edge that is rounded or sloped.

3. The wafer chuck assembly of claim 1, wherein the second area is between 3% and 90% of the first area, and wherein the height is between 0.01 mm ad 0.25 mm.

4. The wafer chuck assembly of claim 1, wherein the individual ones of the plurality of mesas comprise a substantially circular or polygonal cross section.

5. The wafer chuck assembly of claim 4, wherein the individual ones of the plurality of mesas have a substantially equal diameter.

6. The wafer chuck assembly of claim 4, wherein a diameter of the individual ones of the plurality of mesas increases with an increase in radial distance along the surface.

7. The wafer chuck assembly of claim 6, wherein the individual ones of the plurality of mesas comprise a substantially polygonal plan view cross section, and wherein the individual ones of the plurality of mesas comprise substantially equal peripheral dimensions, and wherein the substantially polygonal plan view cross section is substantially hexagonal.

8. The wafer chuck assembly of claim 7, wherein the individual ones of the plurality of mesas are arranged in a close-packed distribution over the surface, and wherein adjacent individual ones of the plurality of mesas have a substantially equal pitch between the adjacent individual ones of the plurality of mesas.

9. The wafer chuck assembly of claim 8, wherein the adjacent individual ones of the plurality of mesas have a pitch that increases with the increase in the radial distance along the surface, wherein a radial distribution of a number of individual ones of the plurality of mesas per unit area decreases from the center to a periphery of the surface.

10. The wafer chuck assembly of claim 8, wherein the adjacent individual ones of the plurality of mesas have a pitch that decreases with the increase in the radial distance along the surface, and wherein a radial distribution of a number of individual ones per unit area of surface increases from the center to a periphery of the surface.

11. The wafer chuck assembly of claim 1, wherein the individual ones of the plurality of mesas comprise a wedge, wherein the wedge comprises a first sidewall that extends from a central region of the surface to a periphery of the surface and a second sidewall that extends from the central region to the periphery of the surface, and wherein the first sidewall of a first individual one of the plurality of mesas is adjacent to the second sidewall of a second individual one of the plurality of mesas.

12. The wafer chuck assembly of claim 1, wherein first individual ones of the plurality of mesas are first line mesas that are distributed in a first polar geometry on the surface, wherein individual ones of the first line mesas extend a first radial distance along first radial directions on the surface, and wherein the first radial distance extends from substantially a center of the surface to substantially a periphery of the surface.

13. The wafer chuck assembly of claim 12, wherein second individual ones of the plurality of mesas are second line mesas that are distributed in a second polar geometry on the surface, wherein individual ones of the second line mesas extend a second radial distance along second radial directions on the surface, and wherein the second radial distance extends

between substantially the first radial distance and substantially the periphery of the surface, and wherein the second radial distance is less than the first radial distance.

14. The wafer chuck assembly of claim 13, wherein third individual ones of the plurality of mesas are third line mesas that are distributed in a third polar geometry on the surface, wherein individual ones of the third line mesas extend a third radial distance along third radial directions on the surface, wherein the third radial distance extends between substantially the second radial distance and substantially the periphery of the surface, wherein the third radial distance is less than the first radial distance and the second radial distance, and wherein the third line mesas are between the first line mesas and the second line mesas.

15. The wafer chuck assembly of claim 14, wherein the individual ones of the first line mesas are separated from one another by a first angle, wherein the individual ones of the second line mesas are separated from one another by a second angle, and wherein the individual ones of the third line mesas are separated from one another by a third angle, wherein the first angle is substantially equal to the second angle, and wherein the second angle is substantially equal to the third angle.

16. The wafer chuck assembly of claim 1, wherein a first plurality of mesas comprises a first subset of the plurality of mesas, wherein individual ones of the first plurality of mesas comprise a first sidewall and a second sidewall, wherein the first sidewall extends along a first radial direction on the surface, wherein the second sidewall extends along a second radial direction on the surface, and wherein the first sidewall and the second sidewall extend between a center of the surface to a first radial distance.

17. The wafer chuck assembly of claim 16, wherein a second plurality of mesas comprises a second subset of the plurality of mesas, wherein individual ones of the second plurality of mesas comprise a third sidewall and a fourth sidewall, wherein the third sidewall extends along a third radial direction on the surface, wherein the fourth sidewall extends along a fourth radial direction on the surface, and wherein the third sidewall and the fourth sidewall extend between the first radial distance and a second radial distance.

18. The wafer chuck assembly of claim 17, wherein a third plurality of mesas comprises a third subset of the plurality of mesas, wherein individual ones of the third plurality of mesas comprise a fifth sidewall and a sixth sidewall, wherein the fifth sidewall extends along a fifth radial direction on the surface, wherein the sixth sidewall extends along a sixth radial direction on the surface, and wherein the fifth sidewall and the sixth sidewall extend between the second radial distance and a third radial distance.

19. The wafer chuck assembly of claim 18, wherein a fourth plurality of mesas comprises a fourth subset of the plurality of mesas, wherein:

a first individual ones of the fourth subset of the plurality of mesas comprising:

a seventh sidewall that extends along a seventh radial direction; and

an eighth sidewall that extends along a first non-diametric chord of the surface, wherein the first non-diametric chord extends at a first oblique angle relative to the seventh radial direction, and wherein the seventh sidewall and the eighth sidewall extend between the third radial distance and a fourth radial distance;

a second individual ones of the fourth subset of the plurality of mesas comprising:

a ninth sidewall that extends along an eighth radial direction; and

a tenth sidewall that extends along a second non-diametric chord of the surface, wherein the second non-diametric chord extends at a second oblique angle relative to the eighth radial direction, and wherein the ninth sidewall and the tenth sidewall extend between the third radial distance and the fourth radial distance; and

a third individual ones of the fourth subset of the plurality of mesas between the first individual ones and the second individual ones of mesas, wherein the third individual ones of the fourth subset of the plurality of mesas comprise:

an eleventh sidewall, wherein the eleventh sidewall is adjacent and parallel to the eighth sidewall; and

a twelfth sidewall, wherein the twelfth sidewall is adjacent and parallel to the tenth sidewall, wherein the eleventh sidewall and the twelfth sidewall intersect at the third radial distance and extend to the fourth radial distance.

20. A wafer processing apparatus, comprising:

a wafer processing chamber comprising a wafer chuck assembly, the wafer chuck assembly being a wafer chuck assembly according to any one of claims 1-19.

21. A method for using a wafer processing apparatus, the method comprising:

mounting a wafer substrate on a wafer chuck comprising a wafer chuck surface comprising a substantially circular geometry, wherein the wafer chuck surface has a first area and a plurality of mesas distributed over the wafer chuck surface, wherein the plurality of mesas has a second area that is at least about a threshold percentage of the first area; and

clamping the wafer substrate to the wafer chuck surface, wherein individual ones of the plurality of mesas contact at least the threshold percentage of a surface of the wafer substrate such that pressure over the individual ones of the plurality of mesas from the wafer substrate, that is clamped, is below a threshold pressure.

22. The method of claim 21, wherein the threshold percentage of the first area of the wafer chuck surface is between 3% and 90%.

23. The method of claim 21, wherein clamping the wafer substrate to the wafer chuck surface comprises electrostatically clamping the wafer substrate to the wafer chuck surface or wherein clamping the wafer substrate to the wafer chuck surface comprises vacuum clamping the wafer substrate to the wafer chuck surface.