CLAIMS

1. An apparatus comprising:

a lift pin to raise and lower a semiconductor substrate relative to a substrate support assembly in a processing chamber, wherein the lift pin comprises:

a top end having a conical shape tapering downwardly; and

a bottom end having a cylindrical shape; and

a lift pin holder to hold the bottom end of the lift pin; and

a top plate of the substrate support assembly comprising a bore wherein the top end of the lift pin engages with the bore and suspends from the bore when the lift pin is in a down position.

2. The apparatus of claim 1 further comprising:

a support structure arranged at a base of the substrate support assembly to support the lift pin holder and to raise and lower the semiconductor substrate relative to the top plate,

wherein the lift pin holder suspends above the support structure when the lift pin is in the down position.

3. The apparatus of claim 2 further comprising:

a shim arranged in a slot in the support structure wherein the lift pin holder rests on the shim when the support structure raises the lift pin to raise the semiconductor substrate from the top plate; and

a retainer arranged on the shim that surrounds the lift pin holder when the lift pin holder rests on the shim.

4. The apparatus of claim 1 wherein the bore in the top plate is a conical and tapers downwardly and wherein the lift pin suspends from the conical bore with the conical bore supporting the top end of the lift pin when the lift pin is in the down position.

5. The apparatus of claim 4 wherein in the down position, the top end of the lift pin suspends from the conical bore at a predetermined distance from a top surface of the top plate of the substrate support assembly.

6. The apparatus of claim 1 further comprising a ring shaped structure arranged at a base of the substrate support assembly to support the lift pin holder and to raise and lower the semiconductor substrate relative to the substrate support assembly.

7. The apparatus of claim 6 wherein bore in the top plate is conical and tapers downwardly and wherein in the down position:

the lift pin holder holding the bottom end of the lift pin suspends above the ring shaped structure.

8. The apparatus of claim 7 further comprising a shim arranged in a slot in the ring shaped structure wherein the lift pin holder rests on the shim when the ring shaped structure raises the lift pin to raise the semiconductor substrate from the top plate.

9. The apparatus of claim 8 further comprising an annular retainer arranged on the shim.

10. The apparatus of claim 9 wherein the annular retainer surrounds a base portion of the lift pin holder when the lift pin holder rests on the shim.

11. The apparatus of claim 1 wherein the lift pin further comprises a groove proximate to the bottom end and wherein the lift pin holder comprises a ball lock to lock into the groove.

12. The apparatus of claim 3 wherein the lift pin, the lift pin holder, the shim, and the retainer are made of a ceramic material.

13. A system comprising:

a plurality of lift pins to raise and lower a semiconductor substrate relative to a substrate support assembly in a processing chamber, wherein each of the lift pins comprises:

a top end having a conical shape tapering downwardly; and

a bottom end having a cylindrical shape; and

a plurality of lift pin holders, each of the lift pin holders to hold the bottom end of a respective one of the lift pins;

a top plate of the substrate support assembly comprising a plurality of conical bores tapering downwardly, wherein the top ends of the lift pins suspend from the conical bores when the lift pins are in a down position; and

a ring shaped structure arranged at a base of the substrate support assembly to support the lift pin holders and to raise and lower the semiconductor substrate relative to the top plate, wherein the lift pin holders suspend above the ring shaped structure when the lift pins are in the down position.

14. The system of claim 13 further comprising:

a plurality of shims respectively arranged in a plurality of slots in the ring shaped structure,

wherein the lift pin holders rest on respective of the shims when the ring shaped structure raises the lift pins to raise the semiconductor substrate from the top plate, and

wherein the raised semiconductor substrate is parallel to the top plate.

15. The system of claim 14 further comprising:

a plurality of retainers arranged on respective ones of the shims,

wherein the retainers surround respective ones of the lift pin holders when the lift pin holders rest on the shims.

16. A lift pin comprising:

a first conical portion;

a second portion extending from the first conical portion; and

a third cylindrical portion comprising a groove, the third cylindrical portion extending from the second portion and inserted into a holder comprising a ball lock that locks into the groove.

17. A lift pin assembly comprising:

a lift pin to raise and lower a semiconductor substrate relative to a substrate support assembly in a processing chamber, wherein the lift pin comprises:

a top end having a conical shape tapering downwardly;

a bottom end having a cylindrical shape; and

a groove proximate to the bottom end; and

a lift pin holder to hold the bottom end of the lift pin, wherein the lift pin holder comprises a ball lock to lock into the groove.

18. A system comprising the lift pin assembly of claim 17 and the substrate support assembly wherein the substrate support assembly comprises a top plate having a conical bore tapering downwardly and wherein the lift pin suspends from the conical bore at a predetermined distance from a top surface of the top plate with the conical bore supporting the top end of the lift pin when the lift pin is in a down position.

19. A system comprising the lift pin assembly of claim 17, the system further comprising:

a top plate of the substrate support assembly comprising a conical bore tapering downwardly wherein the top end of the lift pin suspends from the conical bore when the lift pin is in a down position; and

a ring shaped structure arranged at a base of the substrate support assembly to support the lift pin holder and to raise and lower the semiconductor substrate relative to the top plate, wherein the lift pin holder suspends above the ring shaped structure when the lift pin is in the down position.

20. The system of claim 19 further comprising:

a shim arranged in a slot in the ring shaped structure wherein the lift pin holder rests on the shim when the ring shaped structure raises the lift pin to raise the semiconductor substrate from the top plate; and

a retainer arranged on the shim that surrounds the lift pin holder when the lift pin holder rests on the shim.