

CLAIMS

1. An apparatus for cleaning semiconductor wafer, comprising:
an inner tank;
at least one divider for dividing the inner tank into at least two cleaning tanks including a first cleaning tank and a second cleaning tank;
a first robot equipped with at least a pair of end effectors;
wherein the at least two cleaning tanks are filled with chemical solution having different liquid levels, and the liquid level of the first cleaning tank is lower than the liquid level of the second cleaning tank,
wherein each cleaning tank is provided with a cassette bracket in the bottom for holding wafers, and the at least one divider is provided with at least one slot; wherein the first robot grips and takes the wafer from the first cleaning tank to the second cleaning tank through the slot while keeping the wafer immersing in the chemical solution.
2. The apparatus as claimed in claim 1, wherein the chemical solution is SPM, and the temperature of SPM is in the range of 80°C-250°C.
3. The apparatus as claimed in claim 2, wherein SPM is the mixture of H₂SO₄ and H₂O₂, and the ratio of H₂O₂ to H₂SO₄ is 1:1to1:100.
4. The apparatus as claimed in claim 1, wherein the chemical solution in the first cleaning tank has a same temperature with the chemical solution in the second cleaning tank.
5. The apparatus as claimed in claim 1, wherein the chemical solution in the first cleaning tank has a different temperature with the chemical solution in the second cleaning tank.

6. The apparatus as claimed in claim 1, wherein the chemical solution in the first cleaning tank has a same concentration with the chemical solution in the second cleaning tank.

7. The apparatus as claimed in claim 1, wherein the chemical solution in the first cleaning tank has a different concentration with the chemical solution in the second cleaning tank.

8. The apparatus as claimed in claim 1, further comprising an outer tank, each cleaning tank is connected to the outer tank, and chemical solution is recycled back to the cleaning tank by a pumping system.

9. The apparatus as claimed in claim 8, wherein the pumping system comprises an inlet nozzle in the cleaning tank.

10. The apparatus as claimed in claim 9, wherein the inlet nozzle is at the bottom of the cleaning tank.

11. The apparatus as claimed in claim 9, wherein the inlet nozzle is at the side wall of the cleaning tank.

12. The apparatus as claimed in claim 9, wherein the inlet nozzle is directing at an angle to horizontal.

13. The apparatus as claimed in claim 1, wherein the second cleaning tank has an inlet for supplying the chemical solution.

14. The apparatus as claimed in claim 8, wherein the outer tank has a sensor for detecting liquid level in the outer tank and a drain under the sensor.

15. The apparatus as claimed in claim 1, wherein the height of the divider is higher than the height of the cleaning tank.

16. The apparatus as claimed in claim 1, wherein the chemical solution in the second cleaning tank is fresher than chemical solution in the first cleaning tank.

17. The apparatus as claimed in claim 1, wherein at least one side wall of the slot has an array of nozzles for spraying chemical solution to form a liquid curtain.

18. The apparatus as claimed in claim 17, wherein the chemical solution sprayed from the nozzles is supplied from the second cleaning tank.

19. The apparatus as claimed in claim 1, further comprising a slot door configured to seal or open the at least one slot.

20. The apparatus as claimed in claim 1, wherein the number of the pairs of end effectors is no more than the number of the slots.

21. The apparatus as claimed in claim 1, wherein the shape of the first robot equipped with more than one pair of end effectors is like a rake.

22. The apparatus as claimed in claim 1, wherein the number of the pairs of end effectors is 1 to 25.

23. The apparatus as claimed in claim 1, wherein the cassette bracket moves backwards and frontwards.

24. The apparatus as claimed in claim 1, wherein the at least one slot is vertical.

25. The apparatus as claimed in claim 1, wherein the at least one slot is

horizontal.

26. The apparatus as claimed in claim 1, wherein the at least one slot has an angle to the horizontal.

27. The apparatus as claimed in claim 1, further comprising a tank cover connected a wafer holder stick for holding down the wafers.

28. The apparatus as claimed in claim 27, further comprising two wafer holder sticks on the cassette bracket for holding up the wafer.

29. The apparatus as claimed in claim 28, wherein at least one of the wafer holder sticks rotated as driving roller by rotating mechanism, and the other wafer holder sticks are rotated as slaving rollers.

30. The apparatus as claimed in claim 1, further comprising a second robot for loading and unloading the wafers.

31. The apparatus as claimed in claim 1, further comprising an external cleaning tank for cleaning the first robot.

32. The apparatus as claimed in claim 1, wherein the slots cut through the upper divider.

33. A method for cleaning semiconductor wafer, comprising:
putting at least one wafer on the cassette bracket in a first cleaning tank filled with chemical solution;
after said wafers have been processed in the first cleaning tank, transferring the wafers from the first cleaning tank to a second cleaning tank with the wafers immersing in the chemical solution; and

after said wafers have been processed in the second cleaning tank, taking the wafers out of the tank;

wherein the liquid level of the first cleaning tank is lower than the liquid level of the second cleaning tank.

34. The method as claimed in claim 33, further comprising a step of transferring the wafers from the first cleaning tank to a third cleaning tank after the wafers have been processed in the first cleaning tank, then transfer the wafers from the third cleaning tank to the second cleaning tank after the wafers have been processed in the third cleaning tank.

35. The method as claimed in claim 33, further comprising a step of spraying chemical solution to form a liquid curtain between the first cleaning tank and the second cleaning tank.