

WHAT IS CLAIMED IS:

1. A cleave system for cleaving a semiconductor structure having a top surface and a bottom surface generally parallel to the top surface, the cleave system comprising:

a cleave arm that is moveable from a starting position to a raised position in which a cleave stress is applied to the semiconductor structure;

a suction member for grasping the semiconductor structure on the top surface of the semiconductor structure;

a suction rod that extends through the cleave arm, the suction rod being connected to the suction member toward a first end of the suction rod; and

a spring member that applies a cleave force to the semiconductor structure when the cleave arm is in the raised position.

2. The cleave system as set forth in claim 1 wherein the suction rod extends through the spring member.

3. The cleave system as set forth in claim 2 comprising a collar that extends radially outward from the suction rod, the spring member being disposed between the collar and the cleave arm, the spring member being compressed when the cleave arm is in the raised position.

4. The cleave system as set forth in claim 3 wherein the collar is part of a collar clamp that is adjustable along a longitudinal axis of the suction rod to change the compression of the spring member.

5. The cleave system as set forth in any one of claims 1 to 4 wherein the spring member is a compression spring.

6. The cleave system as set forth in any one of claims 1 to 4 wherein the spring member is a belleville spring.

7. The cleave system as set forth in any one of claims 1 to 4 wherein the spring member is an extension spring, the spring member being disposed below the cleave arm.

8. The cleave system as set forth in any one of claims 1 to 7 wherein the suction member is a suction cup, the suction rod including a channel defined therein that is fluidly connected to the suction cup to apply a vacuum to the suction cup.

9. The cleave system as set forth in any one of claims 1 to 8 wherein the suction member is a first suction member, the suction rod is a first suction rod, and the spring member is a first spring member, the cleave system comprising

a second suction member for grasping the semiconductor structure;

a second suction rod that extends through the cleave arm, the second suction rod being connected to the second suction member toward a first end of the second suction rod; and

a second spring member that applies a cleave force to the semiconductor structure when the cleave arm is in the raised position.

10. The cleave system as set forth in claim 9 further comprising:

a third suction member for grasping the semiconductor structure;

a third suction rod that extends through the cleave arm, the third suction rod being connected to the third suction member toward a first end of the third suction rod; and

a third spring member that applies a cleave force to the semiconductor structure when the cleave arm is in the raised position.

11. The cleave system as set forth in any one of claims 1 to 10 wherein the cleave arm pivots about a pivot axis to move the cleave arm between the starting position to the raised position, the cleave system comprising a motor that causes the cleave arm to pivot upon activation of the motor.

12. The cleave system as set forth in claim 11 further comprising a bellows suction cup connected to the cleave arm, the bellows suction cup being disposed radially inward to the suction member.

13. The cleave system as set forth in any one of claims 1 to 12 wherein the cleave arm defines a recess, the spring member being at least partially received in the recess, the recess having a floor which abuts the spring member.

14. The cleave system as set forth in any one of claims 1 to 13 wherein the suction rod is not connected to the cleave arm.

15. The cleave system as set forth in any one of claims 1 to 14 comprising a bearing disposed within the cleave arm, the suction rod moving within the bearing as the cleave arm moves from the starting position to the raised position.

16. The cleave system as set forth in any one of claims 1 to 15 comprising one or more suction members for grasping the semiconductor structure on the bottom surface of the semiconductor structure.

17. A cleave system for cleaving a semiconductor structure having a top surface and a bottom surface generally parallel to the top surface, the cleave system comprising:

one or more suction cups for grasping the semiconductor structure on the top surface of the semiconductor structure;

a suction rod connected to the one or more suction cups toward a first end of the suction rod; and

a spring member that applies a cleave force to the semiconductor structure during cleaving, the suction rod extending through the spring member.

18. The cleave system as set forth in claim 17 further comprising a bellows suction cup configured to contact the top surface of the semiconductor structure, the bellows suction cup being disposed radially inward to the one or more suction cups.

19. A method for cleaving a semiconductor structure having a top surface and a bottom surface

generally parallel to the top surface, the method comprising:

contacting the top surface of the semiconductor structure with a suction cup;

applying a vacuum in the suction cup to grasp the top surface of the semiconductor structure;

moving a cleave arm from a starting position to a raised position to cause a spring member to exert a cleave force on the semiconductor structure, the spring member storing spring energy when the cleave arm is raised;

contacting the semiconductor structure with a blade to initiate cleaving the semiconductor structure when the cleave arm is in the raised position; and

releasing the stored spring energy after contacting the semiconductor structure with the blade to separate the semiconductor structure along a cleave plane into two pieces.

20. The method as set forth in claim 19 wherein the suction cup is connected to a suction rod that extends through the cleave arm, the suction rod extending through the spring member.

21. The method as set forth in claim 19 or claim 20 wherein:

the cleave arm moves axially upward the suction rod when the cleave arm is moved to the raised position; and

the suction rod moves axially downward relative to the cleave arm when the semiconductor structure is separated into two pieces.

22. The method as set forth in any one of claims 19 to 21 wherein the cleave force applied by the spring member is transmitted through the suction rod, the cleave force applied by the spring member being the only cleave force applied to the semiconductor structure.

23. The method as set forth in any one of claims 19 to 22 wherein the cleave arm does not move during propagation of the cleave.