

Claims

1. An apparatus for inspecting at least side faces of a semiconductor device comprising:

a camera, defining an imaging beam path;

a mirror block, having a first mirror, a second mirror, a third mirror, and a fourth mirror, the mirrors being arranged such that they surround a free space in the form of a rectangle, and the opposing first mirror and third mirror are fixedly mounted and the opposing second mirror and fourth mirror are movably mounted; and

a tilted mirror, for directing an image of at least the side faces semiconductor device from the mirror block to the camera.

2. The apparatus as claimed in claim 1, wherein a first motor is attached to the camera for an adjustment of a focus position of the camera.

3. The apparatus as claimed in claim 2, wherein the first motor is part of the camera with a zoom-lens set-up with auto-focus.

4. The apparatus as claimed in claim 2, wherein for the adjustment of the focus position of the camera, the first motor is configured to carry out a linear movement of the camera along the imaging beam path.

5. The apparatus as claimed in claim 4, wherein a lead-screw is driven by the first motor and the driven leadscrew is coupled to a slide of the camera.

6. The apparatus as claimed in claim 1, wherein a second motor is assigned to the opposing second mirror and fourth mirror for positioning the second mirror and the fourth mirror so that a first distance between a side face of the semiconductor device and the respective first and third fixed mirrors equals a second distance between a side face of the semiconductor device and the respective second and fourth mirrors.

7. The apparatus as claimed in claim 6, wherein a lead-screw is driven by the second motor and via a cam mechanism, the second mirror and the fourth mirror are moved simultaneously.

8. The apparatus as claimed in claim 1, wherein the first mirror, the second mirror, the third mirror, and the fourth mirror of the mirror block define a mirror surface which is tilted by 40 to 48 degrees.

9. The apparatus as claimed in claim 1, wherein an illumination device is provided to illuminate the semiconductor device which is positioned for inspection in the free space defined by the first mirror, the second mirror, the third mirror, and the fourth mirror of the mirror block.

10. The apparatus as claimed in claim 1, further comprising a turret having a plurality of holding arms, each holding arm configured to hold a semiconductor device to be inspected, and each holding arm in the plurality of holding arms is further configured to place the semiconductor device in the free space of the mirror block of the apparatus.

11. The apparatus as claimed in claim 1, wherein the camera, the mirror block, the tilted mirror, and an illumination device are arranged in a single module.

12. A method for inspecting at least side faces of a semiconductor device, the method comprising:

placing the semiconductor device centrally into a free space defined by a mirror block, the mirror block having a fixed first mirror, a fixed third mirror, a movable second mirror, and a movable fourth mirror; providing information about a type of the semiconductor device to a control unit;

moving the second mirror and the fourth mirror such that a second distance between a respective side face of the semiconductor device and the second mirror and the fourth mirror is made equal to a first distance between a respective side face of the semiconductor device and the first mirror and the third mirror; and

adjusting a focus position of the camera along an imaging beam path to compensate for a change in a focal distance.

13. The method of claim 12, wherein a first motor adjusts the focus position of the camera by moving a zoom-lens set-up with auto-focus of the camera.

14. The method of claim 12, wherein a first motor adjusts the focus position of the camera by driving a leadscrew, and the leadscrew is coupled to a slide of the camera, for a linear movement of the camera.

15. The method of claim 12, wherein a second motor drives a leadscrew which acts on a cam mechanism for simultaneously moving the second mirror and the fourth mirror.

16. The method of claim 12, further comprising:

directing an image of the at least side faces of the semiconductor device via a tilted mirror into the imaging beam path of the camera; and

adjusting the focus of the camera.

17. The method of claim 16, wherein the tilted mirror directs in addition to the image of the at least side faces of the semiconductor device, an image of a bottom face of the semiconductor device into the imaging beam path of the camera, wherein the camera has a depth-of-focus so that the at least side faces and a bottom surface of the semiconductor device are kept in focus.

18. The method of claim 12, further comprising:
inserting the semiconductor device with a holding arm of a turret into the free space of the mirror block;
holding the semiconductor device during measurement in the free space of the mirror block; and
removing the semiconductor device with the holding arm of the turret from the free space of the mirror block.
19. A method for inspection of at least side faces of a semiconductor device, the method comprising:
rotating a turret with a plurality of holding arms, wherein each holding arm holds a single semiconductor device;
placing the respective semiconductor device with the respective holding arm centrally into a free space defined by a mirror block, having a fixed first mirror, a fixed third mirror, a movable second mirror, and a movable fourth mirror;
providing information about a type of the semiconductor device to a control unit;
moving the second mirror and the fourth mirror such that a second distance between a respective side face of the semiconductor device and the second mirror and the fourth mirror is equal to a first distance between a respective side face of the semiconductor device and the first mirror and the third mirror;
moving a camera along an imaging beam path to compensate for a change in a focal distance; and
removing the semiconductor device with the holding arm of the turret from the free space of the mirror block.
20. The method of claim 19, further comprising:
controlling a first motor and a second motor independently of each other, wherein the first motor moves the camera on a slide linearly in the direction of the imaging beam path, and wherein the second motor simultaneously moves the second mirror and the fourth mirror.
21. An apparatus for inspection of at least side faces of a semiconductor device comprising:
a housing, a camera, defining an imaging beam path and being linearly movable along the imaging beam path inside the housing;
a mirror block arranged at a first end of the housing, wherein the mirror block carries a first mirror, a second mirror, a third mirror, and a fourth mirror, the mirrors are arranged such that they surround a free space in the form of a rectangle and the free space is accessible from the outside of the housing, and wherein the opposing first mirror and third mirror are fixedly mounted and the opposing second mirror and fourth mirror are movably mounted; and

a tilted mirror arranged in the housing with respect to the camera and the mirror block, such that an image of at least the side faces of the semiconductor device in the mirror block is directed to the camera.

22. The apparatus as claimed in claim 21, wherein a first motor is arranged in the housing and assigned to the camera.

23. The apparatus as claimed in claim 21, wherein a second motor is arranged in the housing and assigned to the opposing second mirror and fourth mirror for positioning the second mirror and the fourth mirror so that a first distance between a side face of the semiconductor device and the respective first and third mirrors equals a second distance between a side face of the semiconductor device and the respective second and fourth mirrors.

24. A computer program product disposed on a non-transitory computer readable medium for inspection of at least side faces of a semiconductor device, the product comprising computer executable process steps operable to control a computer to:

- place the semiconductor device with a placing mechanism into a free space of a mirror block;

- determine a type to the semiconductor device;

- move, according to the type to the semiconductor device, a second mirror and a fourth mirror of the mirror block such that a second distance between a respective side face of the semiconductor device and the second mirror and the fourth mirror is made equal to a first distance between a respective side face of the semiconductor device and a first fixed mirror and a third fixed mirror of the mirror block; and

- adjusting a focus position of a camera along an imaging beam path in order to obtain a focused image of the at least side faces of the semiconductor device.