Claims

1. An apparatus for defect detection in a work piece comprising:

at least one light source for providing illumination of a wavelength range transparent to the work piece, wherein the light source is configured to direct illumination onto the work piece at a surface of a first face of the work piece and transmit the illumination through the work piece, wherein at least a portion of the illumination transmitted through the work piece is internally reflected by at least one of a top surface or a bottom surface of the work piece before exiting the work piece at a surface of a second face of the work piece opposite the first face, wherein one or more defects block illumination from exiting the second face of the work piece;

a camera including a lens and a detector for collecting the illumination transmitted through the work piece and exiting from the surface of the second face of the work piece, wherein the camera is configured to image one or more defects within the work piece based on the collected illumination exited through the surface of the second face of work piece and the illumination blocked by the one or more defects; and

a stage for moving the work piece, wherein the stage and the camera are configured to impart a relative motion between the work piece and the camera to form one or more images from the illumination transmitted through the work piece and exiting from the surface of the second face of the work piece.

2. The apparatus as claimed in claim 1, wherein the second face of the work piece is oriented to the first face of the work piece such that a dark-field image is obtainable.

3. The apparatus as claimed in claim 1, wherein the at least one light source is arranged such that the illumination is directed to a top face of the work piece and the camera receives the illumination from the top face of the work piece.

4. The apparatus as claimed in claim 1, wherein the detector of the camera is a line sensor and the camera is configured as a line scan camera.

5. The apparatus as claimed in claim 4, wherein a lens of the camera is configured to image a line of illumination exiting from a side face of the work piece onto the line sensor, wherein the illumination exiting from the side face originates from at least one illumination source arranged such that back-light illumination is obtained.

6. The apparatus as claimed in claim 5, wherein a stage, that holds the work piece, is configured to move along a scan direction that is perpendicular to the line to be imaged, such that a complete image of one or more side faces of the work piece is generated.

7. The apparatus as claimed in claim 4, wherein a lens of the camera is configured to image a line of illumination from at least a portion of a top face of the work piece onto the line sensor, wherein the line of illumination is positioned adjacent to a side face of the work piece and the at least one light source is arranged such that the illumination from the top face is coaxial to the illumination directed onto the top face of the work piece.

8. The apparatus as claimed in claim 7, wherein a stage, that holds the work piece, is configured to move along a scan direction, that is perpendicular to the line, such that a complete image of a portion of the top face, adjacent to at least one side face of the work piece, is generated.

9. The apparatus as claimed in claim 4, wherein an optical setup is provided to generate simultaneously an image of a line of illumination exiting from a side face of the work piece and an image of a line of illumination from a top face of the work piece, wherein the line of illumination from the top face is positioned adjacent to the line of illumination of the respective side face of the work piece.

10. The apparatus as claimed in claim 9, wherein a front end of the optical setup carries a top mirror and a first bottom mirror and a second bottom mirror, the top mirror captures an image of the line of illumination from a portion of the top face of the work piece and the first bottom mirror and the second bottom mirror capture an image of a

line of illumination exiting from a side face of the work piece.

11. The apparatus as claimed in claim 9, wherein the optical setup is designed such that the image of a line of illumination exiting from a side face of the work piece and the image of a line of illumination from a top face of the work piece are simultaneously in focus.

12. The apparatus as claimed in claim 9, wherein illumination from the at least one light source is coupled separately to a side face of the work piece and the top face of the work piece.

13. The apparatus as claimed in claim 1, wherein a light guide is positioned between the at least one light source and at least one of a top face or a side face of the work piece.

14. The apparatus as claimed in claim 1, wherein the work piece is a singulated semiconductor device.

15. The apparatus as claimed in claim 14, wherein the wavelength range of the illumination comprises infrared light.

16. An apparatus for defect detection in a work piece comprising:

at least one light source for providing illumination of a wavelength range transparent to the work piece, wherein the at least one light source is configured to direct illumination onto the work piece at a surface of a first face of the workpiece and transmit the illumination through the work piece, wherein at least a portion of the illumination transmitted through the work piece is internally reflected by at least one of a top surface or a bottom surface of the work piece before exiting the work piece at a surface of a second face of the workpiece opposite the first face, wherein the one or more defects block illumination from exiting the second face of the workpiece;

a camera, including a lens and a line sensor, for collecting the illumination transmitted through the work piece and exiting from the surface of the second face of

the work piece, wherein the camera is configured to image one or more defects within the workpiece based on the collected illumination exited through the surface of the second face of work piece and the illumination blocked by the one or more defects;

a chuck for holding the work piece;

a stage for carrying the chuck; and

a control connected to a computer for providing a relative movement between the stage with the work piece and the camera, wherein the stage and the camera are configured to impart a relative motion between the work piece and the camera to form one or more images from the illumination transmitted through the work piece and exiting from the surface of the second face of the work piece.

17. The apparatus as claimed in claim 16, wherein the stage is configured to move such that a focus of the camera is on a respective side face during the entire movement of the stage.

18. The apparatus as claimed in claim 16, wherein the second face of the work piece is oriented to the first face of the work piece such that a dark field image of the second face is obtainable.

19. The apparatus as claimed in claim 16, wherein a light guide is used to guide the illumination from the at least one light source to a respective side face of the work piece.

20. The apparatus as claimed in claim 16, wherein the work piece comprises a singulated semiconductor device.

21. The apparatus as claimed in claim 20, wherein the wavelength range of the illumination comprises infrared light.

22. An apparatus for defect detection in a work piece comprising:

at least one light source for providing illumination of a wavelength range transparent to the work piece, wherein the light source is configured to direct illumination onto the work piece at a surface of a first edge of the workpiece and transmit the

illumination through the work piece, wherein at least a portion of the illumination transmitted through the work piece is internally reflected by at least one of a top surface or a bottom surface of the work piece before exiting the work piece at a surface of a second edge of the workpiece opposite the first edge, wherein one or more defects block illumination from exiting the second edge of the workpiece; and

a camera including a lens and a detector for collecting the illumination transmitted through the work piece and exiting from the surface of the second edge of the work piece, wherein the camera is further configured to image one or more defects within the workpiece based on the collected illumination exited through the surface of the second edge of work piece and the illumination blocked by the one or more defects.