Claims

1. An optical apparatus for locating a plurality of placement positions on a carrier object, the optical apparatus comprising:

an imaging device having a plurality of imaging sensors, each imaging sensor being operative to capture an image of a part of a selected row of placement positions on the carrier object and the plurality of imaging sensors defining a combined field of view that includes all of the selected row of placement positions;

a positioning device coupled to the imaging device, the positioning device being operative to position the imaging device relative to successive rows of placement positions on the carrier object; and

a processor connected to the imaging device and which is configured to receive the images captured by the plurality of imaging sensors for image processing in order to identify exact locations of the placement positions comprised in the selected row of placement positions.

2. The optical apparatus of claim 1, wherein the plurality of imaging sensors are arranged in a row or in an array arrangement on the imaging device.

3. The optical apparatus of claim 1, wherein each of the plurality of imaging sensors has a resolution of at least 1.9 megapixels.

4. The optical apparatus of claim 1, wherein the imaging device comprises between 1 and 25 imaging sensors.

5. The optical apparatus of claim 1, wherein the processor is configured to receive the images from the imaging device in data packets having a fixed size.

6. The optical apparatus of claim 5, wherein the processor is operative to identify and select at least one image portion from a respective image that has been captured by one of the plurality of imaging sensors, and a size of the image portion is inversely related to a resolution of the image that is received by the processor so as to maintain a consistent rate of data transfer from the imaging device to the processor.

7. The optical apparatus of claim 6, wherein the processor is configured to sample a plurality of image portions at a pixel sampling rate that decreases with an increase in the size of the image portions.

8. The optical apparatus of claim 1, wherein the processor is further operative to stitch together separate images that have been captured by some or all of the plurality of imaging sensors to form a single image.

9. The optical apparatus of claim 8, wherein the processor is operative to identify and select regions of interest from some or all of the images, and to stitch together the regions of interest to form a single image.

10. The optical apparatus of claim 1, further comprising a lighting device attached to the imaging device, the lighting device being operative to direct light towards the combined field of view of the plurality of imaging sensors to increase a brightness level of the selected row of placement positions.

11. The optical apparatus of claim 1, wherein the carrier object is a semiconductor die carrier configured to receive semiconductor dies during die bonding.

12. The optical apparatus of claim 1, wherein the carrier object is a printed circuit board configured to receive semiconductor packages during package placement.

13. A die bonder for bonding semiconductor dies to a semiconductor die carrier, the die bonder comprising the optical apparatus of claim 1.

14. A method of locating a plurality of placement positions on a carrier object, the method comprising the steps of:

positioning an imaging device with respect to a selected row of placement positions on the carrier object using a positioning device to which the imaging device is coupled, wherein the imaging device comprises a plurality of imaging sensors;

capturing an image of a part of the selected row of placement positions using each imaging sensor, the plurality of imaging sensors defining a combined field of view that includes all the selected row of placement positions;

receiving the images captured by the plurality of imaging sensors by a processor;

processing the captured images using the processor in order to identify exact locations of the placement positions of the selected row of placement positions; and

repositioning the imaging device with respect to a next selected row of placement positions on the carrier object using the positioning device.

15. The method of claim 14, wherein the step of receiving the images captured by the plurality of imaging sensors by the processor comprises the step of receiving the images in data packets having a fixed size from the imaging device by the processor.

16. The method of claim 15, wherein the step of receiving the images in data packets having a fixed size by the processor comprises the steps of identifying and selecting at least one image portion from a respective image that has been captured by one of the plurality of imaging sensors using the processor, wherein a size of the image portion is inversely related to a resolution of the image that is received by the processor so as to maintain a consistent rate of data transfer from the imaging device to the processor.

17. The method of claim 16, wherein the steps of identifying and selecting the plurality of image portions comprise the step of sampling a plurality of image portions by the processor at a pixel sampling rate that decreases with an increase in the size of the image portions.

18. The method of claim 14, further comprising the step of stitching together the images that have been captured by some or all of the plurality of imaging sensors using the processor to form a single image.

19. The method of claim 18, wherein the step of stitching together the images further comprises the steps of identifying and selecting regions of interest from some or all of the captured images, and stitching together the regions of interest to form a single image.

Claims

1. An optical apparatus for locating a plurality of placement positions on a carrier object, the optical apparatus comprising:

an imaging device comprising a plurality of imaging sensors, each imaging sensor being operative to capture an image of a part of a selected row of placement positions on the carrier object, and the plurality of imaging sensors defining a combined field of view that includes an entirety of the selected row of placement positions;

a positioning device coupled to the imaging device, the positioning device being configured and operative to position the imaging device in a direction perpendicular to the selected row of placement positions relative to successive rows of placement positions on the carrier object; and

a processor connected to the imaging device and which is configured to receive the images captured by the plurality of imaging sensors for image processing in order to identify exact locations of the placement positions comprised in the selected row of placement positions.

2. The optical apparatus of claim 1, wherein the plurality of imaging sensors are arranged in a row or in an array arrangement on the imaging device.

3. The optical apparatus of claim 1 or claim 2, wherein each of the plurality of imaging sensors has a resolution of at least 1.9 megapixels.

4. The optical apparatus of any one of the preceding claims, wherein the imaging device comprises between 1 and 25 imaging sensors.

5. The optical apparatus of any one of the preceding claims, wherein the processor is configured to receive the images from the imaging device in data packets having a fixed size.

6. The optical apparatus of claim 5, wherein the processor is operative to identify and select at least one image portion from a respective image that has been captured by one of the plurality of imaging sensors, and a size of the image portion is inversely related to a resolution of the image that is received by the processor so as to maintain a consistent rate of data transfer from the imaging device to the processor.

7. The optical apparatus of claim 6, wherein the processor is configured to sample a plurality of image portions at a pixel sampling rate that decreases with an increase in the size of the image portions.

8. The optical apparatus of any one of the preceding claims, wherein the processor is further operative to stitch together separate images that have been captured by some or all of the plurality of imaging sensors to form a single image having an image area larger than that of each of the separate images that has been captured.

9. The optical apparatus of claim 8, wherein the processor is operative to identify and select regions of interest from some or all of the images, and to stitch together the regions of interest to form a single combined image having a combined image area larger than that of each of the selected regions of interest.

10. The optical apparatus of any one of the preceding claims, further comprising a lighting device attached to the imaging device, the lighting device being operative to direct light towards the combined field of view of the plurality of imaging sensors to increase a brightness level of the selected row of placement positions.

11. The optical apparatus of any one of the preceding claims, wherein the carrier object is a semiconductor die carrier configured to receive semiconductor dies during die bonding.

12. The optical apparatus of any one of the preceding claims, wherein the carrier object is a printed circuit board configured to receive semiconductor packages during package placement.

13. A die bonder for bonding semiconductor dies to a semiconductor die carrier, the die bonder comprising the optical apparatus of any one of the preceding claims.

14. A method of locating a plurality of placement positions on a carrier object, the method comprising the steps of:

positioning an imaging device with respect to a selected row of placement positions on the carrier object using a positioning device to which the imaging device is coupled, wherein the imaging device comprises a plurality of imaging sensors;

capturing an image of a part of the selected row of placement positions using each imaging sensor, the plurality of imaging sensors defining a combined field of view that includes an entirety of the selected row of placement positions;

receiving the images captured by the plurality of imaging sensors by a processor;

processing the captured images using the processor in order to identify exact locations of the placement positions of the selected row of placement positions; and

repositioning the imaging device in a direction perpendicular to the selected row of placement positions with respect to a next selected row of placement positions on the carrier object using the positioning device.

15. The method of claim 14, wherein the step of receiving the images captured by the plurality of imaging sensors by the processor comprises the step of receiving the images in data packets having a fixed size from the imaging device by the processor.

16. The method of claim 15, wherein the step of receiving the images in data packets having a fixed size by the processor comprises the steps of identifying and selecting at least one image portion from a respective image that has been captured by one of the plurality of imaging sensors using the processor, wherein a size of the image portion is inversely related to a resolution of the image that is received by the processor so as to maintain a consistent rate of data transfer from the imaging device to the processor.

17. The method of claim 16, wherein the steps of identifying and selecting the plurality of image portions comprise the step of sampling a plurality of image portions by the processor at a pixel sampling rate that decreases with an increase in the size of the image portions.

18. The method of any one of claims 14 to 17, further comprising the step of stitching together the images that have been captured by some or all of the plurality of imaging sensors using the processor to form a single image having an image area larger than that of each of the images that has been captured.

19. The method of claim 18, wherein the step of stitching together the images further comprises the steps of identifying and selecting regions of interest from some or all of the captured images, and stitching together the regions of interest to form a single combined image having a combined image area larger than that of each of the selected regions of interest.