

CLAIMS

What is claimed is:

1. A method for setting up one or more ranges of one or more inspection parameters
5 in an optical inspection system, the method comprising:

(a) receiving a set of values of a inspection parameter, wherein the set of values corresponds to set-up areas of a set-up image obtained from a sample;

(b) constructing a test image comprising multiple test areas such that
10 locations of the test areas corresponds to locations of the set-up areas and colors of the test areas are determined by corresponding values in the set;

(c) displaying the test image and a range diagram on a user interface of the optical inspection system,

wherein the range diagram corresponds to the inspection parameter and comprises a nominal limit and a variation limit;

15 wherein the nominal limit and the variation limit define a range corresponding to a color that does not overlap with an outside range corresponding to an outside color, and

wherein the test areas have the color if the corresponding values in the set fall within the range or the outside color if the corresponding values fall within the
20 outside range;

(d) receiving an adjustment of the limit and/or the nominal limit based on the test image; and

(e) repeating (b)-(d) until the test image reaches predetermined criteria.

25 2. The method of claim 1, wherein the range diagram comprises a second limit defining an additional range between the limit and the second limit,

wherein the additional range does not overlap with the range or the outside range and corresponds to a additional color, and

30 wherein the test areas have the additional color of the corresponding values in the set fall within the additional range.

3. The method of claim 1, further comprising

receiving a second set of values of a second inspection parameter, wherein the second set of values corresponds to the set-up areas;

displaying a second range diagram on the user interface,

5 wherein the second range diagram corresponds to the second inspection parameter and comprises a second nominal limit and a second limit,

wherein the second nominal limit and the second limit define a second range corresponding to a second color that does not overlap with a second outside range corresponding to a second outside color; and

10 receiving an adjustment of the second limit and/or the second nominal limit.

4. The method of claim 3, further comprising constructing a second test image comprising multiple second test areas such locations of the second test areas corresponds to location of the set-up areas,

15 wherein the second test areas have the second color if the corresponding values in the second set fall within the second range or the second outside color if the corresponding values fall within the second outside range;

displaying the second test image, wherein the adjustment of the second limit and/or the second nominal limit are based on the second test image; and

20 repeating the displaying and receiving operation for the second test image until the second test image reaches second predetermined criteria.

5. The method of claim 3, wherein the colors of the test areas of the test image are further determined by corresponding values in the second set.

25

6. The method of claim 1, wherein the predetermined criteria is a balance between the color and the outside color relative to a level of defects present on a sample corresponding to the set-up image.

7. The method of claim 1, wherein the set-up image is obtained from a photovoltaic cell.

8. The method of claim 1, wherein the inspection parameter is a measure of
5 discoloration.

9. The method of claim 1, wherein the inspection parameter is selected from the group consisting of hue, saturation, and intensity.

10. The method of claim 1, further comprising calculating the set of values from
10 corresponding RGB values obtained from the set-up images.

11. The method of claim 1, further comprising obtaining the set-up image from a set-up sample.

12. The method of claim 1, further comprising receiving multiple sets of values of the
15 inspection parameter, wherein the multiple sets of values corresponding to multiple set-up images having varying defect levels.

13. The method of claim 1, wherein the set-up areas are individual pixels of the set-up
20 image.

14. The method of claim 1, wherein the range diagram comprises a diagram selected
25 from the group consisting of a hue circle, a saturation spectrum, and an intensity spectrum.

15. The method of claim 1, wherein the nominal limit is initially set to the most
common of all values in the set.

16. The method of claim 1, wherein a spread of the range remains the same when adjusting the nominal limit or the limit.

17. The method of claim 1, wherein receiving the adjustment comprises receiving a numerical input and/or performing a graphical adjustment of the limit and/or the nominal limit on the range diagram.

18. The method of claim 1, wherein the user interface is configured to allow a user to assign other colors to the range and the outside range.

10

19. A computer readable medium containing program instructions for setting up one or more ranges of one or more inspection parameters in an optical inspection system, the computer readable medium comprising:

(a) computer readable code for receiving a set of values of a inspection parameter, wherein the set of values corresponds to set-up areas of a set-up image obtained from a sample;

(b) computer readable code for constructing a test image comprising multiple test areas such that locations of the test areas corresponds to locations of the set-up areas and colors of the test areas are determined by corresponding values in the set;

(c) computer readable code for displaying the test image and a range diagram on a user interface of the optical inspection system,

wherein the range diagram corresponds to the inspection parameter and comprises a nominal limit and a variation limit,

wherein the nominal limit and the variation limit define a range corresponding to a color that does not overlap with an outside range corresponding to an outside color, and

wherein the test areas have the color if the corresponding values in the set fall within the range or the outside color if the corresponding values in the set fall within the outside range;

(d) computer readable code for receiving an adjustment of the limit and/or the nominal limit based on the test image; and

(e) computer readable code for repeating (b)-(d) until the test image reaches predetermined criteria.

5

20. An optical inspection system for setting up one or more ranges of one or more inspection parameters, comprising at least one memory and at least one processor that are configured to perform the following operations:

10 (a) receiving a set of values of a inspection parameter, wherein the set of values corresponds to set-up areas of a set-up image obtained from a sample;

(b) constructing a test image comprising multiple test areas such that locations of the test areas corresponds to locations of the set-up areas and colors of the test areas are determined by corresponding values in the set;

15 (c) displaying the test image and a range diagram on a user interface of the optical inspection system,

wherein the range diagram corresponds to the inspection parameter and comprises a nominal limit and a variation limit,

20 wherein the nominal limit and the variation limit define a range corresponding to a color that does not overlap with an outside range corresponding to an outside color, and

wherein the test areas have the color if the corresponding values in the set fall within the range or the outside color if the corresponding values fall within the outside range;

25 (d) receiving an adjustment of the limit and/or the nominal limit based on the test image; and

(e) repeating (b)-(d) until the test image reaches predetermined criteria.

CLAIMS

1. A method for setting up one or more ranges of one or more inspection parameters in an optical inspection system, the method comprising:

- (a) receiving a set of values of an inspection parameter, wherein the set of values corresponds to set-up areas of a set-up image obtained from a sample;
- (b) constructing a test image comprising multiple test areas such that locations of the test areas corresponds to locations of the set-up areas and such that colors of the test areas are determined by corresponding values in the set;
- (c) displaying the test image and a range diagram on a user interface of the optical inspection system, wherein the range diagram corresponds to the inspection parameter and comprises a nominal limit and a variation limit, wherein the nominal limit and the variation limit define a range corresponding to a color that does not overlap with an outside range corresponding to an outside color, and wherein the test areas have the color if the corresponding values in the set fall within the range or the outside color if the corresponding values fall within the outside range;
- (d) receiving an adjustment of the variation limit and/or the nominal limit based on the test image;
- (e) repeating (b)-(d) until the test image reaches predetermined criteria;

- (f) receiving a second set of values of a second inspection parameter,
 - wherein the inspection parameter and the second inspection parameter are different types of inspection parameters,
 - wherein the second set of values corresponds to the set-up areas of the set-up image or a second set-up image obtained from the sample;
- (g) constructing a second test image comprising multiple second test areas such that locations of the second test areas corresponds to location of the set-up areas and such that colors of the second test areas are determined by determined by corresponding values in the second set;
- (h) displaying the second test image and a second range diagram on the user interface of the optical inspection system,
 - wherein the second range diagram corresponds to the second inspection parameter and comprises a second nominal limit and a second variation limit,
 - wherein the second nominal limit and the second variation limit define a second range corresponding to a second color that does not overlap with a second outside range corresponding to a second outside color, and
 - wherein the second test areas have the second color if the corresponding values in the second set fall within the second range or the second outside color if the corresponding values fall within the second outside range;

- (i) receiving an adjustment of the second variation limit and/or the second nominal limit based on the second test image;
- (j) repeating (f)-(i) until the second test image reaches predetermined criteria; and
- (k) setting two or more ranges for the inspection parameter and the second inspection parameter in the optical inspection system based on the variation limit and the nominal limit corresponding the test image at the predetermined criteria and based on the second variation limit and the second nominal limit corresponding the second test image at the predetermined criteria.

2. The method of claim 1, wherein the predetermined criteria is a balance between the color and the outside color relative to a level of defects present on a sample corresponding to the set-up image.

3. The method of claim 1, wherein the set-up image is obtained from a photovoltaic cell.

4. The method of claim 1, wherein the inspection parameter is a measure of discoloration.

5. The method of claim 1, wherein the inspection parameter is selected from the group consisting of hue, saturation, and intensity.

6. The method of claim 1, further comprising calculating the set of values from corresponding RGB values obtained from the set-up images.

7. The method of claim 1, further comprising obtaining the set-up image from a set-up sample.

8. The method of claim 1, further comprising receiving multiple sets of values of the inspection parameter, wherein

the multiple sets of values corresponding to multiple set-up images having varying defect levels.

9. The method of claim 1, wherein the set-up areas are individual pixels of the set-up image.

10. The method of claim 1, wherein the range diagram comprises a diagram selected from the group consisting of a hue circle, a saturation spectrum, and an intensity spectrum.

11. The method of claim 1, wherein the nominal limit is initially set to the most common of all values in the set.

12. The method of claim 1, wherein a spread of the range remains the same when adjusting the nominal limit or the variation limit.

13. The method of claim 1, wherein receiving the adjustment comprises receiving a numerical input and/or performing a graphical adjustment of the variation limit and/or the nominal limit on the range diagram.

14. The method of claim 1, wherein the user interface is configured to allow a user to assign other colors to the range and the outside range.

15. The method of claim 1, further comprising inspecting one or more additional samples using the inspection parameter and the second inspection parameter in an automated mode using the two or more ranges for the inspection parameter and the second inspection parameter.

16. The method of claim 1, wherein the inspection parameter is hue, and wherein the second inspection parameter is saturation value.

17. The method of claim 1, wherein the second set of values corresponds to the set-up areas of the set-up image.

18. An optical inspection system for setting up one or more ranges of one or more inspection parameters, comprising at least one memory and at least one processor that are configured to perform the following operations:

- (a) receiving a set of values of an inspection parameter, wherein the set of values corresponds to set-up areas of a set-up image obtained from a sample;
- (b) constructing a test image comprising multiple test areas such that locations of the test areas corresponds to locations of the set-up areas and such that colors of the test areas are determined by corresponding values in the set;
- (c) displaying the test image and a range diagram on a user interface of the optical inspection system, wherein the range diagram corresponds to the inspection parameter and comprises a nominal limit and a variation limit, wherein the nominal limit and the variation limit define a range corresponding to a color that does not overlap with an outside range corresponding to an outside color, and wherein the test areas have the color if the corresponding values in the set fall within the range or the outside color if the corresponding values fall within the outside range;
- (d) receiving an adjustment of the variation limit and/or the nominal limit based on the test image; and
- (e) repeating (b)-(d) until the test image reaches predetermined criteria;
- (f) receiving a second set of values of a second inspection parameter, wherein the inspection parameter and the second inspection parameter are different types of inspection parameters, wherein the second set of values corresponds to the set-up areas of the set-up image or a second set-up image obtained from the sample;

- (g) constructing a second test image comprising multiple second test areas such that locations of the second test areas corresponds to location of the set-up areas and such that colors of the second test areas are determined by determined by corresponding values in the second set;
- (h) displaying the second test image and a second range diagram on the user interface of the optical inspection system,
 - wherein the second range diagram corresponds to the second inspection parameter and comprises a second nominal limit and a second variation limit,
 - wherein the second nominal limit and the second variation limit define a second range corresponding to a second color that does not overlap with a second outside range corresponding to a second outside color, and
 - wherein the second test areas have the second color if the corresponding values in the second set fall within the second range or the second outside color if the corresponding values fall within the second outside range;
- (i) receiving an adjustment of the second variation limit and/or the second nominal limit based on the second test image;
- (j) repeating (f)-(i) until the second test image reaches predetermined criteria; and
- (k) setting two or more ranges for the inspection parameter and the second inspection parameter in the optical inspection system based on the variation limit and the nominal limit corresponding the test image at the predetermined criteria and based on the second variation limit and the second nominal limit corresponding the second test image at the predetermined criteria.