CLAIMS

What is claimed is:

1. A method of measuring a relative critical dimension during electron beam inspection of a target substrate, the method comprising:

obtaining a reference image;

defining a region of interest in the reference image;

obtaining a target image using an electron beam imaging apparatus;

aligning the target and reference images;

locating the region of interest in the target image; and

measuring a relative critical dimension within the region of interest in the target image.

2. The method of claim 1, wherein measuring the relative critical dimension (RCD) comprises:

scanning along a scan length that is perpendicular to the RCD;

measuring point RCDs along the scan length; and

averaging the point RCDs.

3. The method of claim 2 further comprising:

applying a filter to the point RCDs.

4. The method of claim 3, wherein the filter comprises a nearest-neighbor type filter that averages a point RCD with neighboring point RCDs.

5. The method of claim 4, wherein the nearest-neighbor type filter averages a point RCD with a preceding point RCD and a subsequent point RCD along the scan length.

6. The method of claim 4, wherein the nearest-neighbor type filter averages a point RCD with two preceding point RCDs and two subsequent point RCDs along the scan length.

7. The method of claim 4, wherein the nearest-neighbor type filter averages a point RCD with three preceding point RCDs and three subsequent point RCDs along the scan length.

8. The method of claim 4, wherein the nearest-neighbor type filter weights the point RCD.

9. The method of claim 2 further comprising:

determining if the point RCDs include a zero value to detect a short/open characteristic.

10. The method of claim 9 further comprising:

computing a run length of the short/open characteristic.

11. The method of claim 2 further comprising:

computing a minimum RCD, a maximum RCD and a standard deviation for the RCD.

12. An apparatus comprising:

a source for generating an incident electron beam;

a scanning system for controllably deflecting the incident electron beam to scan the incident electron beam over a surface such that secondary electrons are emitted therefrom;

a detection system for detecting the secondary electrons so as to generate an image data; and

a control and processing system programmed to

obtain a reference image,

define a region of interest in the reference image,

obtain a target image,

align the target and reference images,

locate the region of interest in the target image, and

measure a relative critical dimension within the region of interest in the target image.

13. The apparatus of claim 12, wherein the control and processing system is further programmed to measure the relative critical dimension (RCD) by

scanning along a scan length that is perpendicular to the RCD,

determining point RCDs along the scan length, and

averaging the point RCDs.

14. The apparatus of claim 13, wherein the control and processing system is further programmed to apply a filter to the point RCDs.

15. The apparatus of claim 14, wherein the filter comprises a nearest-neighbor type filter that averages a point RCD with neighboring point RCDs.

16. The apparatus of claim 15, wherein the nearest-neighbor type filter weights the point RCD.

17. The apparatus of claim 13, wherein the control and processing system is further programmed to determine if the point RCDs include a zero value to detect a short/open characteristic.

18. The apparatus of claim 17, wherein the control and processing system is further programmed to compute a run length of the short/open characteristic.

19. The apparatus of claim 13, wherein the control and processing system is further programmed to compute a minimum RCD, a maximum RCD and a standard deviation for the RCD.

20. A method of measuring a relative critical dimension (RCD), the method comprising:

scanning along a scan length that is perpendicular to the RCD;

measuring point RCDs along the scan length;

applying a filter to the point RCDs; and

averaging the point RCDs.

21. The method of claim 20, wherein the filter comprises a nearest-neighbor type filter that averages a point RCD with neighboring point RCDs.

CLAIMS

1. A method of measuring a relative critical dimension during electron beam inspection of a target substrate, the method comprising:

obtaining a reference image;

defining a region of interest in the reference image;

obtaining a target image using an electron beam imaging apparatus;

aligning the target and reference images;

locating the region of interest in the target image; and

measuring a relative critical dimension (RCD) within the region of interest in the target image, wherein measuring the RCD comprises

scanning along a scan length that is perpendicular to the RCD, and

measuring point RCDs along the scan length, wherein measuring a point RCD comprises

performing a derivative on pixel intensities in a vertical column of pixels at a horizontal scan point to determine a function indicative of a change in pixel intensity along the vertical column of pixels, and

applying positive and negative thresholds to the change in the pixel intensity.

2. The method of claim 1, wherein measuring the RCD further comprises:

averaging the point RCDs.

3. The method of claim 2 further comprising:

applying a filter to the point RCDs.

4. The method of claim 3, wherein the filter comprises a nearest-neighbor type filter that averages the point RCD with neighboring point RCDs.

5. The method of claim **4**, wherein the nearest-neighbor type filter averages the point RCD with a preceding point RCD and a subsequent point RCD along the scan length.

6. The method of claim **4**, wherein the nearest-neighbor type filter averages the point RCD with two preceding point RCDs and two subsequent point RCDs along the scan length.

7. The method of claim **4**, wherein the nearest-neighbor type filter averages the point RCD with three preceding point RCDs and three subsequent point RCDs along the scan length.

8. The method of claim **4**, wherein the nearest-neighbor type filter weights the point RCD.

9. The method of claim **2** further comprising:

determining if the point RCDs include a zero value to detect a short/open characteristic.

10. The method of claim **9** further comprising:

computing a run length of the short/open characteristic.

11. The method of claim **2** further comprising:

computing a minimum RCD, a maximum RCD and a standard deviation for the RCD.

12. An apparatus comprising:

a source for generating an incident electron beam;

a scanning system for controllably deflecting the incident electron beam to scan the incident electron beam over a surface such that secondary electrons are emitted therefrom;

a detection system for detecting the secondary electrons so as to generate an image data; and

a control and processing system programmed to

obtain a reference image,

define a region of interest in the reference image,

obtain a target image,

align the target and reference images,

locate the region of interest in the target image, and

measure a relative critical dimension (RCD) within the region of interest in the target image, wherein the RCD is measured by

scanning along a scan length that is perpendicular to the RCD, and

measuring point RCDs along the scan length, wherein a point RCD is measured by

performing a derivative on pixel intensities in a vertical column of pixels at a horizontal scan point to determine a function indicative of a change in pixel intensity along the vertical column of pixels, and

applying positive and negative thresholds to the change in the pixel intensity.

13. The apparatus of claim **12**, wherein the control and processing system is further programmed to measure the RCD by averaging the point RCDs along the scan length.

14. The apparatus of claim **13**, wherein the control and processing system is further programmed to apply a filter to the point RCDs.

15. The apparatus of claim **14**, wherein the filter comprises a nearest-neighbor type filter that averages the point RCD with neighboring point RCDs.

16. The apparatus of claim **15**, wherein the nearest-neighbor type filter weights the point RCD.

17. The apparatus of claim **13**, wherein the control and processing system is further programmed to determine if the point RCDs include a zero value to detect a short/open characteristic.

18. The apparatus of claim **17**, wherein the control and processing system is further programmed to compute a run length of the short/open characteristic.

19. The apparatus of claim **13**, wherein the control and processing system is further programmed to compute a minimum RCD, a maximum RCD and a standard deviation for the RCD.

20. A method of measuring a relative critical dimension (RCD), the method comprising:

scanning along a scan length that is perpendicular to the RCD;

measuring point RCDs along the scan length, wherein measuring a point RCD comprises

performing a derivative on pixel intensities in a vertical column of pixels at a horizontal scan point to determine a function indicative of a change in pixel intensity along the vertical column of pixels, and

applying thresholds to the change in the pixel intensity;

applying a filter to the point RCDs; and

averaging the point RCDs.

21. The method of claim **20**, wherein the filter comprises a nearest-neighbor type filter that averages the point RCD with neighboring point RCDs.