

What is claimed is:

1. An overlay target comprising:
 - a grating-over-grating structure including:
 - a bottom grating structure disposed on a specimen; and
 - 5 a top grating structure disposed on the bottom grating structure;
 - a calibration scan location including the bottom grating structure but not the top grating structure; and
 - an overlay scan location including the top grating structure and the bottom grating structure.
2. The overlay target of claim 1, wherein the grating-over-grating structure further includes an
10 open area including neither the bottom grating structure nor the top grating structure.
3. A method, comprising:
 - acquiring an overlay target with an electron beam-based output acquisition subsystem
 - thereby forming an acquisition image, wherein the overlay target comprises:
 - a grating-over-grating structure including:
 - 15 a bottom grating structure; and
 - a top grating structure disposed on the bottom grating structure;
 - a calibration scan location including the bottom grating structure but not the top grating structure; and
 - an overlay scan location including the top grating structure and the bottom grating
20 structure; and
 - measuring an overlay of the grating-over-grating structure using the acquisition image.
4. The method of claim 3, wherein measuring the overlay of the grating-over-grating structure comprises solving and extracting the overlay from the acquisition image.
5. The method of claim 4, wherein the solving and extracting comprises extracting an extracted
25 signal from a single layer.
6. The method of claim 5, further comprising improving a signal-to-noise ratio of the extracted signal.

7. The method of claim 6, wherein the improving comprises applying a design-based filter to the extracted signal.
8. The method of claim 5, wherein the solving and extracting further comprises solving a scattering of the extracted signal.
- 5 9. The method of claim 8, wherein solving the scattering comprises:
applying a backscattered electron profile to the extracted signal;
determining a transfer function for the extracted signal; and
generating a model for the scattering comprising the transfer function.
- 10 10. The method of claim 9, wherein a parameter of the model is optimized using a center of symmetry of the secondary electron signal or a local asymmetry, or by matching the calibration scan location with a second calibration scan location for which an interaction between backscattered electrons and secondary electrons of a specific layer is found.
11. A non-transitory computer-readable storage medium, comprising one or more programs for executing the method of claim 3 on one or more computing devices.
- 15 12. A non-transitory computer-readable storage medium, comprising one or more programs for executing the method of claim 4 on one or more computing devices.
13. A system, comprising:
a stage configured to hold a specimen having an overlay target, wherein the overlay target comprises a grating-over-grating structure including:
20 a bottom grating structure disposed on the specimen; and
a top grating structure disposed on the bottom grating structure;
a calibration scan location including the bottom grating structure but not the top grating structure; and
an overlay scan location including the top grating structure and the bottom grating
25 structure; and
an electron beam-based output acquisition subsystem configured to measure the overlay target on the stage; and

a processor in electronic communication with the electron beam-based output acquisition subsystem configured to measure an overlay of the grating-over-grating structure using the acquisition image.

14. The system of claim 13, wherein the processor is configured to measure the overlay of the grating-over-grating structure using the acquisition image by solving and extracting the overlay from the acquisition image.

15. The system of claim 14, wherein the solving and extracting comprises extracting an extracted signal from a single layer.

16. The system of claim 15, further comprising improving a signal-to-noise ratio of the extracted signal using the processor.

17. The system of claim 16, wherein the improving comprises applying a design-based filter to the extracted signal.

18. The system of claim 15, wherein the solving and extracting further comprises solving a scattering of the extracted signal.

19. The system of claim 18, wherein solving the scattering comprises:
applying a backscattered electron profile to the extracted signal;
determining a transfer function for the extracted signal; and
generating a model for the scattering comprising the transfer function.

20. The system of claim 19, wherein a parameter of the model is optimized using a center of symmetry of the secondary electron signal or a local asymmetry or by matching the calibration scan location with a second calibration scan location for which an interaction between backscattered electrons and secondary electrons of a specific layer is found.