

CLAIMS

What is claimed:

1. A metrology system comprising:
 - a stage configured to secure a sample, wherein one or more diffraction-based overlay metrology targets are disposed on the sample;
 - a light source;
 - one or more sensors; and
 - a set of optics configured to direct illumination light from the light source to the one or more diffraction-based overlay metrology targets of the sample,
 - wherein the set of optics includes an insertable, rotatable half-wave plate, wherein the insertable, rotatable half-wave plate is selectively insertable into an optical path such that the insertable, rotatable half-wave plate selectively passes both illumination light from an illumination channel of the set of optics and collection light from a collection channel of the set of optics,
 - wherein the insertable, rotatable half-wave plate is configured to selectively align an orientation of linearly polarized illumination light from the light source to an orientation of a grating of the one or more diffraction-based overlay metrology targets.
2. The metrology system of claim 1, wherein the one or more diffraction-based overlay metrology targets include one or more diagonal diffraction-based overlay metrology targets.
3. The metrology system of claim 2, wherein the insertable, rotatable half-wave plate is configured to align the orientation of the incident linearly polarized illumination from the light source to the orientation of the grating of the one or more diagonal diffraction-based overlay metrology targets to enhance a sensitivity of the one or more sensors to overlay.
4. The metrology system of claim 1, further comprising:

an actuation stage, wherein the actuation stage secures the insertable, rotatable half-wave plate and is configured to selectively insert the insertable, rotatable half-wave plate into the optical path and rotate the insertable, rotatable half-wave plate.

5. The metrology system of claim 4, wherein the actuation stage secures the insertable, rotatable half-wave plate is configured to selectively insert the insertable, rotatable half-wave plate into the optical path in response to one or more control signals from a controller.

6. The metrology system of claim 1, wherein a collection polarizer is maintained at a fixed orientation.

7. The metrology system of claim 6, wherein the sample is maintained at a fixed orientation.

8. The metrology system of claim 2, further comprising:

a controller communicatively coupled to the one or more sensors, wherein the controller includes one or more processors configured to:

receive one or more signals from the one or more sensors indicative of illumination collected from the one or more diagonal diffraction-based overlay metrology targets; and

determine overlay misregistration between a first layer and a second layer of the one or more diagonal diffraction-based overlay metrology targets based on the one or more signals received from the one or more sensors.

9. The metrology system of claim 8, wherein the controller is further configured to:

receive one or more signals from the one or more sensors indicative of illumination collected from one or more parallel target elements corresponding with

one or more process layers and one or more diagonal elements corresponding with one or more resist layers; and

determine overlay misregistration between a first resist layer and a second resist layer based on the one or more signals from the one or more diagonal elements; and

determine overlay misregistration between a first process layer and a second process layer based on the one or more signals from the one or more parallel elements.

10. The metrology system of claim 8, wherein the controller is further configured to:

receive calibration data from one or more additional characterization tools, wherein the controller corrects the determined overlay misregistration between a resist layer and a process layer of the one or more diagonal diffraction-based overlay metrology targets based on the calibration data from the one or more additional characterization tools.

11. The metrology system of claim 10, wherein the one or more additional characterization tools comprise at least one of an e-beam metrology tool or an imaging-based metrology tool.

12. The metrology system of claim 1, wherein the light source comprises a supercontinuum laser source.

13. The metrology system of claim 1, wherein the illumination from the light source is delivered via a polarized single-mode optical fiber.

14. The metrology system of claim 1, wherein the set of optics includes an apodized illumination pupil, wherein an obliquity of the illumination pupil is adjustable.

15. The metrology system of claim 1, wherein the set of optics includes a spot scanner for providing decoherence to the illumination from the light source.

16. The metrology system of claim 1, wherein the set of optics includes at least one of one or more illumination field stops or one or more collection field stops.

17. The metrology system of claim 1, wherein the one or more sensors comprise: an array sensor positioned at a pupil plane.

18. A method comprising:
generating light with a light source;
directing the light along an optical path to one or more diffraction-based overlay metrology targets disposed on a sample via a set of optics;
selectively inserting a half-wave plate into the optical path such that the half-wave plate selectively passes illumination light from an illumination channel of the set of optics and collection light from a collection channel of the set of optics;
aligning an orientation of linearly polarized illumination light from the light source to an orientation of a grating of the one or more diffraction-based overlay metrology targets;
transmitting collected light through the half-wave plate and a collection polarizer;
collecting light from the collection polarizer with one or more sensors; and
determining overlay misregistration between a first layer and a second layer of the one or more diffraction-based overlay metrology targets based on the collected light.

19. The method of claim 18, wherein the one or more diffraction-based overlay metrology targets include one or more diagonal diffraction-based overlay metrology targets.

20. The method of claim 19, further comprising:

receiving one or more signals from the one or more sensors indicative of illumination collected from one or more parallel target elements corresponding with one or more process layers and one or more diagonal elements corresponding with one or more resist layers; and

determining overlay misregistration between a first resist layer and a second resist layer based on the one or more signals from the one or more diagonal elements; and

determining overlay misregistration between a first process layer and a second process layer based on the one or more signals from the one or more parallel elements.

21. The method of claim 19, further comprising:

receiving calibration data from one or more additional characterization tools; and

correcting the determined overlay misregistration between the first layer and the second layer of the one or more diagonal diffraction-based overlay metrology targets based on the calibration data from the one or more additional characterization tools.

22. A method comprising:

generating light with a light source;

directing the light along an optical path to one or more diffraction-based overlay metrology targets disposed on a sample via a set of optics;

selectively inserting a half-wave plate into the optical path such that the half-wave plate selectively passes illumination light from an illumination channel of the set of optics and collection light from a collection channel of the set of optics;

aligning an orientation of linearly polarized illumination light from the light source to an orientation of a grating of the one or more diffraction-based overlay metrology targets;

transmitting collected light through the half-wave plate and a collection polarizer;

collecting light from the collection polarizer with one or more sensors;
determining overlay misregistration between a first layer and a second layer of the one or more diffraction-based overlay metrology targets based on the collected light;
receiving calibration data from one or more additional characterization tools;
and
correcting the determined overlay misregistration between the first layer and the second layer of the one or more diffraction-based overlay metrology targets based on the calibration data from the one or more additional characterization tools.

23. The method of claim 22, wherein the one or more diffraction-based overlay metrology targets include one or more diagonal diffraction-based overlay metrology targets.