

CLAIMS

What is claimed:

1. An overlay metrology target comprising:

a set of device features on a first layer of a sample, wherein at least a portion of the set of device features is periodic with a device period;

a first set of target features on a second layer of the sample and overlapping the set of device features, wherein the first set of target features is periodic with a first measurement period, wherein the first measurement period is selected to provide a first set of Moiré fringes visible by a detector when the target is imaged by the detector; and

a second set of target features on the second layer of the sample and overlapping the set of device features, wherein the second set of target features is periodic with a second measurement period, wherein the second measurement period is selected to provide a second set of Moiré fringes visible by the detector when the target is imaged by the detector,

wherein relative positions of the first set of Moiré fringes and the second set of Moiré fringes are indicative of overlay error between the first layer of the sample and the second layer of the sample.

2. The overlay metrology target of claim 1, wherein the overlay error is determinable by dividing the relative positions of the first set of Moiré fringes and the second set of Moiré fringes by Moiré gain factors associated the device period, the first measurement period, and the second measurement period.

3. The overlay metrology target of claim 1, wherein the set of device features comprise:

a replicated portion of a portion of a full set of device features on the first layer of the sample.

4. The overlay metrology target of claim 1, wherein the set of device features comprise:

a portion of a full set of device features on the first layer of the sample.

5. The overlay metrology target of claim 1, wherein the second measurement period is different than the first measurement period.
6. The overlay metrology target of claim 1, wherein the device period is lower than a resolution of the detector.
7. The overlay metrology target of claim 1, wherein the set of device features correspond to random access memory features.
8. The overlay metrology target of claim 7, wherein the random access memory (RAM) features comprise:
 - at least one of dynamic random access memory (DRAM) features or static random access memory (SRAM) features.
9. An overlay metrology system comprising:
 - an illumination source to illuminate a sample, wherein the sample includes an overlay target comprising:
 - a set of device features on a first layer of the sample, wherein at least a portion of the set of device features is periodic with a device period;
 - a first set of target features on a second layer of the sample and overlapping the set of device features, wherein the first set of target features is periodic with a first measurement period; and
 - a second set of target features on the second layer of the sample and overlapping the set of device features, wherein the second set of target features is periodic with a second measurement period;
 - a detector configured to image the overlay target when illuminated by the illumination source, wherein the first measurement period is selected to provide a first set of Moiré fringes visible by the detector when the target is imaged by the detector, and the second measurement period is selected to provide a second set of Moiré fringes visible by the detector when the target is imaged by the detector; and

a controller communicatively coupled with the detector, the controller including one or more processors configured to execute program instructions causing the one or more processors to:

- receive an image of the overlay target;
- measure relative positions of the first Moire fringe and the second Moire fringe in the image as an apparent overlay error; and
- determine an overlay error between the first layer of the sample and the second layer of the sample by adjusting the apparent overlay error by Moire gain factors associated with the device period, the first measurement period, and the second measurement period.

10. The overlay metrology system of claim 9, wherein the set of device features comprise:
a replicated portion of a portion of a full set of device features on the first layer of the sample.

11. The overlay metrology system of claim 9, wherein the set of device features comprise:
a portion of a full set of device features on the first layer of the sample.

12. The overlay metrology system of claim 9, wherein the second measurement period is different than the first measurement period.

13. The overlay metrology system of claim 9, wherein the device period is lower than a resolution of the detector.

14. The overlay metrology system of claim 9, wherein the set of device features correspond to random access memory features.

15. The overlay metrology system of claim 14, wherein the random access memory (RAM) features comprise:

- at least one of dynamic random access memory (DRAM) features or static random access memory (SRAM) features.

16. An overlay metrology method comprising:

fabricating a set of device features on a first layer of a sample, wherein at least a portion of the set of device features is periodic with a device period;

fabricating a first set of target features on a second layer of the sample and overlapping the set of device features, wherein the first set of target features is periodic with a first measurement period, wherein the first measurement period is selected to provide a first set of Moiré fringes visible by a detector when the target is imaged by the detector; and

fabricating a second set of target features on the second layer of the sample and overlapping the set of device features, wherein the second set of target features is periodic with a second measurement period, wherein the second measurement period is selected to provide a second set of Moiré fringes visible by the detector when the target is imaged by the detector.

17. The overlay metrology method of claim 16, further comprising:

fabricating a second set of device features on a third layer of the sample, wherein at least a portion of the second set of device features is periodic with the device period;

fabricating a third set of target features on a fourth layer of the sample and overlapping the second set of device features, wherein the third set of target features is periodic with a third measurement period, wherein the third measurement period is selected to provide a third set of Moiré fringes visible by the detector when the target is imaged by the detector; and

fabricating a fourth set of target features on the fourth layer of the sample and overlapping the second set of device features, wherein the fourth set of target features is periodic with a fourth measurement period, wherein the fourth measurement period is selected to provide a fourth set of Moiré fringes visible by the detector when the target is imaged by the detector.

18. The overlay metrology method of claim 17, wherein the third measurement period is equal to the first measurement period.

19. The overlay metrology method of claim 18, wherein the fourth measurement period is equal to the second measurement period.

20. The overlay metrology method of claim 17, wherein the third measurement period is different than the first measurement period.

21. The overlay metrology method of claim 20, wherein the fourth measurement period is different than the second measurement period.

22. An overlay metrology method, comprising:

illuminating a sample using an illumination source, wherein the sample includes an overlay target comprising:

a set of device features on a first layer of the sample, wherein at least a portion of the set of device features is periodic with a device period;

a first set of target features on a second layer of the sample and overlapping the set of device features, wherein the first set of target features is periodic with a first measurement period; and

a second set of target features on the second layer of the sample and overlapping the set of device features, wherein the second set of target features is periodic with a second measurement period;

imaging the overlay target using a detector, wherein the first measurement period is selected to provide a first set of Moiré fringes visible by the detector when the target is imaged by the detector, and the second measurement period is selected to provide a second set of Moiré fringes visible by the detector when the target is imaged by the detector; and

using a controller communicatively coupled with the detector:

receiving an image of the overlay target;

measuring relative positions of the first Moire fringe and the second Moire fringe in the image as an apparent overlay error; and

determining an overlay error between the first layer of the sample and the second layer of the sample by adjusting the apparent overlay error by Moire gain

factors associated with the device period, the first measurement period, and the second measurement period.