

CLAIMS

What is claimed:

1. A metrology target, comprising:

a first target structure set formed on one or more layers of a sample, wherein the first target structure set comprises at least one first target structure formed within at least one of a first working zone of the metrology target or a second working zone of the metrology target, wherein each first target structure comprises one or more first pattern elements formed along at least one of a first measurement direction or a second measurement direction; and

a second target structure set formed on one or more layers of the sample, wherein the second target structure set comprises at least one second target structure formed within at least one of the first working zone of the metrology target or the second working zone of the metrology target, wherein each second target structure comprises one or more second pattern elements formed along at least one of the first measurement direction or the second measurement direction, and wherein a center of symmetry of the first working zone of the metrology target and a center of symmetry of the second working zone of the metrology target overlap when an overlay error between one or more layers of the sample is not present, and wherein a difference with respect to the overlap of the center of symmetry of the first working zone and the center of symmetry of the second working zone is indicative of one or more overlay errors between layers of the metrology target along at least one of the first measurement direction or the second measurement direction.

2. The metrology target of Claim 1, wherein the first target structure set comprises at least one of one or more one-dimensional periodic target structures or one or more two-dimensional periodic target structures.

3. The metrology target of Claim 1, wherein the second target structure set comprises at least one of one or more one-dimensional periodic target structures or one or more two-dimensional periodic target structures.

4. The metrology target of Claim 1, further comprising:
a third target structure set formed on one or more layers of the sample, wherein the third target structure set comprises at least one third target structure formed within at least one of the first working zone of the metrology target or the second working zone of the metrology target, wherein the third target structure comprises one or more third pattern elements formed along at least one of the first measurement direction or the second measurement direction.
5. The metrology target of Claim 4, further comprising:
a fourth target structure set formed on one or more layers of the sample, wherein the fourth target structure set comprises at least one fourth target structure formed within at least one of the first working zone of the metrology target or the second working zone of the metrology target, wherein the fourth target structure comprises one or more fourth pattern elements formed along at least one of the first measurement direction or the second measurement direction.
6. The metrology target of Claim 5, further comprising:
a fifth target structure set formed on one or more layers of the sample, wherein the fifth target structure set comprises at least one fifth target structure formed within at least one of the first working zone of the metrology target or the second working zone of the metrology target, wherein the fifth target structure comprises one or more fourth pattern elements formed along at least one of the first measurement direction or the second measurement direction.
7. The metrology target of Claim 1, wherein at least a portion of the first working zone of the metrology target is adjacent to at least a portion of the second working zone of the metrology target along an x-direction.
8. The metrology target of Claim 1, wherein at least a portion of the first working zone of the metrology target is adjacent to at least a portion of the second working zone of the metrology target along a y-direction.

9. A system comprising:

a controller communicatively couplable to one or more metrology sub-systems, wherein the controller includes one or more processors, wherein the one or more processors are configured to execute a set of program instructions maintained in memory, wherein the set of program instructions is configured to cause the one or more processors to:

receive, from the one or more metrology sub-systems, one or more signals indicative of illumination emanating from a metrology target of a sample, wherein the metrology target of the sample comprises: a first target structure set formed on one or more layers of the sample, wherein the first target structure set comprises at least one first target structure formed within at least one of a first working zone of the metrology target or a second working zone of the metrology target, wherein each first target structure comprises one or more first pattern elements formed along at least one of a first measurement direction or a second measurement direction; and a second target structure set formed on one or more layers of the sample, wherein the second target structure set comprises at least one second target structure formed within at least one of the first working zone of the metrology target or the second working zone of the metrology target, wherein each second target structure comprises one or more second pattern elements formed along at least one of the first measurement direction or the second measurement direction, and wherein a center of symmetry of the first working zone of the metrology target and a center of symmetry of the second working zone of the metrology target overlap when an overlay error between one or more layers of the sample is not present, and wherein a difference with respect to the overlap of the center of symmetry of the first working zone and the center of symmetry of the second working zone is indicative of one or more overlay errors between layers of the metrology target along at least one of the first measurement direction or the second measurement direction;

generate at least a first overlay measurement based on one or more signals indicative of illumination emanating from one or more portions of the first target structure set;

generate at least a second overlay measurement based on one or more signals indicative of illumination emanating from one or more portions of the second target structure set; and

determine an overlay error of the sample based on the first overlay measurement and the second overlay measurement.

10. The system of Claim 9, wherein the first metrology measurement comprises an overlay metrology measurement along at least one of the first measurement direction or the second measurement direction.

11. The system of Claim 9, wherein the second metrology measurement comprises an overlay metrology measurement along at least one of the first measurement direction or the second measurement direction.

12. The system of Claim 9, wherein the first target structure set comprises at least one of one or more one-dimensional periodic target structures or one or more two-dimensional periodic target structures.

13. The system of Claim 9, wherein the second target structure set comprises at least one of one or more one-dimensional periodic target structures or one or more two-dimensional periodic target structures.

14. The system of Claim 9, wherein the metrology target of the sample further comprises:

a third target structure set formed on one or more layers of the sample, wherein the third target structure set comprises at least one third target structure formed within at least one of the first working zone of the metrology target or the second working zone of the metrology target, wherein the third target structure comprises one or more third pattern elements formed along at least one of the first measurement direction or the second measurement direction.

15. The system of Claim 14, wherein the metrology target of the sample further comprises:

a fourth target structure set formed on one or more layers of the sample, wherein the fourth target structure set comprises at least one fourth target structure formed within at least one of the first working zone of the metrology target or the second working zone of the metrology target, wherein the fourth target structure comprises one or more fourth pattern elements formed along at least one of the first measurement direction or the second measurement direction.

16. The system of Claim 15, wherein the metrology target of the sample further comprises:

a fifth target structure set formed on one or more layers of the sample, wherein the fifth target structure set comprises at least one fifth target structure formed within at least one of the first working zone of the metrology target or the second working zone of the metrology target, wherein the fifth target structure comprises one or more fourth pattern elements formed along at least one of the first measurement direction or the second measurement direction.

17. The system of Claim 9, wherein at least a portion of the first working zone of the metrology target is adjacent to at least a portion of the second working zone of the metrology target along an x-direction.

18. The system of Claim 9, wherein at least a portion of the first working zone of the metrology target is adjacent to at least a portion of the second working zone of the metrology target along a y-direction.

19. The system of Claim 9, wherein the sample comprises a semiconductor wafer.

20. A method of measuring overlay of a sample, comprising:

illuminating a sample having a metrology target, the metrology target comprising: a first target structure set formed on one or more layers of the sample, wherein the first

target structure set comprises at least one first target structure formed within at least one of a first working zone of the metrology target or a second working zone of the metrology target, wherein each first target structure comprises one or more first pattern elements formed along at least one of a first measurement direction or a second measurement direction, and a second target structure set formed on one or more layers of the sample, wherein the second target structure set comprises at least one second target structure formed within at least one of the first working zone of the metrology target or the second working zone of the metrology target, wherein each second target structure comprises one or more second pattern elements formed along at least one of the first measurement direction or the second measurement direction, and wherein a center of symmetry of the first working zone of the metrology target and a center of symmetry of the second working zone of the metrology target overlap when an overlay error between one or more layers of the sample is not present, and wherein a difference with respect to the overlap of the center of symmetry of the first working zone and the center of symmetry of the second working zone is indicative of one or more overlay errors between layers of the metrology target along at least one of the first measurement direction or the second measurement direction;

detecting illumination emanating from the metrology target of the sample;

generating at least a first overlay measurement based on one or more signals indicative of illumination emanating from one or more portions of the first target structure set;

generating at least a second overlay measurement based on one or more signals indicative of illumination emanating from one or more portions of the second target structure set; and

determining an overlay error of the sample based on the first overlay measurement and the second overlay measurement.

21. The method of Claim 20, wherein the first metrology measurement comprises an overlay metrology measurement along at least one of the first measurement direction or the second measurement direction.

22. The method of Claim 20, wherein the second metrology measurement comprises an overlay metrology measurement along at least one of the first measurement direction or the second measurement direction.

23. The method of Claim 20, wherein the first target structure set comprises at least one of one or more one-dimensional periodic target structures or one or more two-dimensional periodic target structures.

24. The method of Claim 20, wherein the second target structure set comprises at least one of one or more one-dimensional periodic target structures or one or more two-dimensional periodic target structures.

25. The method of Claim 20, wherein the metrology target further comprises:
a third target structure set formed on one or more layers of the sample, wherein the third target structure set comprises at least one third target structure formed within at least one of the first working zone of the metrology target or the second working zone of the metrology target, wherein the third target structure comprises one or more third pattern elements formed along at least one of the first measurement direction or the second measurement direction.

26. The method of Claim 25, further comprising:
generating at least a third overlay measurement based on one or more signals indicative of illumination emanating from one or more portions of the third target structure set; and
determining an overlay error of the sample based on at least two of the first overlay measurement, the second overlay measurement, or the third overlay measurement.

27. The method of Claim 25, wherein the metrology target further comprises:
a fourth target structure set formed on one or more layers of the sample, wherein the fourth target structure set comprises at least one fourth target structure formed within at least one of the first working zone of the metrology target or the second working zone

of the metrology target, wherein the fourth target structure comprises one or more fourth pattern elements formed along at least one of the first measurement direction or the second measurement direction.

28. The method of Claim 27, further comprising:

generating at least a fourth overlay measurement based on one or more signals indicative of illumination emanating from one or more portions of the fourth target structure set; and

determining an overlay error of the sample based on at least two of the first overlay measurement, the second overlay measurement, the third overlay measurement, or the fourth overlay measurement.

29. The method of Claim 27, wherein the metrology target further comprises:

a fifth target structure set formed on one or more layers of the sample, wherein the fifth target structure set comprises at least one fifth target structure formed within at least one of the first working zone of the metrology target or the second working zone of the metrology target, wherein the fifth target structure comprises one or more fifth pattern elements formed along at least one of the first measurement direction or the second measurement direction.

30. The method of Claim 29, further comprising:

generating at least a fifth overlay measurement based on one or more signals indicative of illumination emanating from one or more portions of the fifth target structure set; and

determining an overlay error of the sample based on at least two of the first overlay measurement, the second overlay measurement, the third overlay measurement, the fourth overlay measurement, or the fifth overlay measurement.

31. The method of Claim 20, wherein at least a portion of the first working zone of the metrology target is adjacent to at least a portion of the second working zone of the metrology target along an x-direction.

32. The method of Claim 20, wherein at least a portion of the first working zone of the metrology target is adjacent to at least a portion of the second working zone of the metrology target along a y-direction.

33. The method of Claim 20, wherein the sample comprises a semiconductor wafer.

34. A method of forming a metrology target comprising:

forming a first target structure set on one or more layers of the sample, wherein the first target structure set comprises at least one first target structure formed within at least one of a first working zone of the metrology target or a second working zone of the metrology target, wherein each first target structure comprises one or more first pattern elements formed along at least one of a first measurement direction or a second measurement direction; and

forming a second target structure set on one or more layers of the sample, wherein the second target structure set comprises at least one second target structure formed within at least one of the first working zone of the metrology target or the second working zone of the metrology target, wherein each second target structure comprises one or more second pattern elements formed along at least one of the first measurement direction or the second measurement direction, and wherein a center of symmetry of the first working zone of the metrology target and a center of symmetry of the second working zone of the metrology target overlap when an overlay error between one or more layers of the sample is not present, and wherein a difference with respect to the overlap of the center of symmetry of the first working zone and the center of symmetry of the second working zone is indicative of one or more overlay errors between layers of the metrology target along at least one of the first measurement direction or the second measurement direction.

35. The method of Claim 34, wherein the first target structure set comprises at least one of one or more one-dimensional periodic target structures or one or more two-dimensional periodic target structures.

36. The method of Claim 34, wherein the second target structure set comprises at least one of one or more one-dimensional periodic target structures or one or more two-dimensional periodic target structures.

37. The method of Claim 34, further comprising:

forming a third target structure set formed on one or more layers of the sample, wherein the third target structure set comprises at least one third target structure formed within at least one of the first working zone of the metrology target or the second working zone of the metrology target, wherein the third target structure comprises one or more third pattern elements formed along at least one of the first measurement direction or the second measurement direction.

38. The method of Claim 37, further comprising:

forming a fourth target structure set formed on one or more layers of the sample, wherein the fourth target structure set comprises at least one fourth target structure formed within at least one of the first working zone of the metrology target or the second working zone of the metrology target, wherein the fourth target structure comprises one or more fourth pattern elements formed along at least one of the first measurement direction or the second measurement direction.

39. The method of Claim 38, further comprising:

forming a fifth structure set formed on one or more layers of the sample, wherein the fifth target structure set comprises at least one fifth target structure formed within at least one of the first working zone of the metrology target or the second working zone of the metrology target, wherein the fifth target structure comprises one or more fifth pattern elements formed along at least one of the first measurement direction or the second measurement direction.

40. The method of Claim 34, wherein at least a portion of the first working zone of the metrology target is adjacent to at least a portion of the second working zone of the metrology target along an x-direction.

41. The method of Claim 34, wherein at least a portion of the first working zone of the metrology target is adjacent to at least a portion of the second working zone of the metrology target along a y-direction.