CLAIMS

~~What is claimed is:~~

1. A scatterometry overlay (SCOL) measurement method comprising:

   generating a signal matrix by:

   illuminating a SCOL target at multiple values of at least one illumination parameter, and at multiple spot locations on the target, wherein the illumination is at a ~~NA (~~numerical aperture (NA) ~~>~~greater than 1/3 yielding a spot diameter ~~<~~less than 1µ,

   measuring interference signals of a zeroth diffraction order and a first diffraction order~~s~~, and

   constructing the signal matrix from the measured interference signals with respect to the illumination parameters and the spot locations on the target, and

   deriving a target overlay by analyzing the signal matrix.

2. The SCOL measurement method of claim 1, wherein the SCOL target comprises at least one periodic structure and the multiple spot locations are within a pitch of the at least one periodic structure.
3. The SCOL measurement method of claim 2, further comprising setting the multiple spot locations on the target within the target pitch along a measurement direction of the at least one periodic structure, and averaging the measured interference signal in a direction perpendicular to the measurement direction.
4. The SCOL measurement method of ~~any one of~~ claim~~s~~ 1~~-3~~, wherein the at least one illumination parameter comprises an illumination wavelength, and the multiple values thereof comprise at least three illumination wavelengths.
5. The SCOL measurement method of ~~any one of~~ claim~~s~~ 1~~-4~~, further comprising calibrating the signal matrix by performing or simulating measurements of SCOL targets with known overlay values.
6. The SCOL measurement method of claim 5, further comprising creating a model of the signal matrix with respect to the spot locations, illumination parameters, and target overlays.

7. A computer program product comprising a non-transitory computer readable storage medium having computer readable program for executing one or more instructions on a processor comprising ~~embodied therewith, the computer readable program configured to carry out~~ the SCOL measurement method of ~~any one of~~ claim~~s~~ 1~~-6~~.

8. A metrology module comprising the computer program product of claim 7.

~~9. Metrology measurements of the SCOL targets, carried out by the SCOL measurement method of any one of claims 1-6.~~

~~10. A SCOL target comprising a single cell having periodic structures at a plurality of layers and measuring 2µx2µ or smaller.~~

~~11. The SCOL target of claim 10, wherein the periodic structures are at most four pitch bars wide.~~

~~12. The SCOL target of claim 11, wherein the periodic structures are two pitch bars wide.~~

~~13. The SCOL target of any one of claims 10-12, placed in-die on a corresponding wafer.~~

~~14.~~9. A scatterometry overlay (SCOL) measurement system comprising:

an illumination unit configured to illuminate a SCOL target at multiple values of at least one illumination parameter, and at multiple spot locations on the target, wherein the illumination is at a ~~NA (~~numerical aperture (NA) ~~>~~greater than 1/3 yielding a spot diameter ~~<~~less than 1µ,

a measurement unit configured to measure interference signals of a zeroth diffraction order and a first diffraction order~~s~~, and

a processing unit configured to construct a signal matrix from the measured interference signals with respect to the illumination parameters and the spot locations on the target, and derive a target overlay by analyzing the signal matrix.

~~15.~~10. The SCOL measurement system of claim ~~14~~9, further configured to set the multiple spot locations on the target within a target pitch along a measurement direction of the at least one periodic structure, and averaging the measured interference signal in a direction perpendicular to the measurement direction by scanning the SCOL target along elements of the at least one periodic structure.

~~16.~~11. The SCOL measurement system of claim 9~~14 or 15~~, wherein the at least one illumination parameter comprises an illumination wavelength, and the multiple values thereof comprise at least three illumination wavelengths.

~~17.~~12. The SCOL measurement system of ~~any one of~~ claim~~s~~ ~~9~~14~~-16~~, further configured to calibrate the signal matrix by performing or simulating measurements of SCOL targets with known overlay values.

~~18.~~13. The SCOL measurement system of claim ~~17~~12, further configured to create a model of the signal matrix with respect to the spot locations, illumination parameters and target overlays.