~~CLAIMS~~

~~What is claimed:~~

Claims

1. A system for analyzing a sample, comprising:

~~one or more support members configured to support~~ a ~~sample;~~

metrology tool comprising: an illumination source;

a first switch optically coupled to the illumination source~~;~~

, the first switch including a plurality of first sub-switches; a plurality of transmitting optical fibers coupled to the first switch, wherein the first switch is configured to optically couple the illumination source to at least one transmitting optical fiber of the plurality of transmitting optical fibers;

a detector;

a second switch optically coupled to the detector~~;~~

, the second switch including a plurality of second sub-switches; a plurality of receiving optical fibers coupled to the second switch, wherein the second switch is configured to optically couple the detector to at least one receiving optical fiber of the plurality of receiving optical fibers; ~~and~~
a plurality of probes coupled to respective ones of the plurality of transmitting optical fibers and respective ones of the plurality of receiving optical fibers; a plurality of multi-terminal connectors, wherein each multi-terminal connector includes at least three terminals, wherein a first terminal is connected to a respective transmitting optical fiber, a second terminal is connected to a respective receiving optical fiber, and a third terminal is connected to a respective probe, the plurality of probes configured to illuminate respective portions of a surface of the sample and configured to receive illumination ~~reflected, refracted, or radiated from the respective portions of the surface of the sample~~from the respective portions of the surface of the sample; and one or more optical elements in series with at least one of the at least one transmitting optical fiber or the at least one receiving optical fiber, the one or more optical elements configured to provide active tilt compensation and thereby reduce an effect of sample warpage on coupling efficiency into at least one of the at least one transmitting optical fiber or the at least one receiving optical fiber.

2. The system of claim 1~~-~~, wherein the at least one transmitting optical fiber and the at least one receiving optical fiber are coupled to at least one probe of the plurality of probes by at least one of a bifurcated fiber bundle, a fan-out cable, or a Y-cable.

3. The system of claim 1~~-~~, wherein at least one probe of the plurality of probes includes a portion of the at least one transmitting optical fiber and a portion of the at least one receiving optical fiber.

4. The system of claim 3, wherein the at least one probe further includes a housing that at least partially surrounds the portion of the at least one transmitting optical fiber and the portion of the at least one receiving optical fiber.

5. The system of claim 1~~, further comprising:~~, wherein the one or more optical elements include at least one focusing lens.

~~one or more optical elements in series with at least one of the at least one transmitting optical fiber or the at least one receiving optical fiber.~~

6. The system of claim ~~5, wherein the one or more optical elements include at least one focusing lens.~~ ~~7. The system of claim 5~~1, wherein the one or more optical elements include at least one collimating lens.

~~8~~7. The system of claim ~~5~~1, wherein the one or more optical elements are in series with the at least one probe that is coupled to the at least one transmitting optical fiber and the at least one receiving optical fiber.

~~9~~8. The system of claim ~~8~~7, wherein the at least one probe includes or is coupled to the one or more optical elements.

~~10~~9. The system of claim 1~~, further comprising:~~

~~an optics plate configured to support the plurality of probes~~, wherein ~~the plurality of probes are at least partially disposed within a plurality of openings defined by the optics plate.~~

~~1 1 . The system of claim 1 , further comprising:~~

at least one controller is communicatively coupled to the first switch and the second switch, the at least one controller configured to analyze at least one portion of the sample by:

causing the first switch to optically couple the illumination source to at least one transmitting optical fiber of the plurality of transmitting optical fibers; and
causing the second switch to optically couple the detector to at least one receiving optical fiber of the plurality of receiving optical fibers.

~~12~~10. The system of claim ~~1 1 9~~, wherein the at least one controller is configured to analyze at least one other portion of the sample by:
causing the first switch to optically couple the illumination source to at least one other transmitting optical fiber of the plurality of transmitting optical fibers; and causing the second switch to optically couple the detector to at least one other receiving optical fiber of the plurality of receiving optical fibers, wherein the at least one other transmitting optical fiber and the at least one other receiving optical fiber are coupled to another probe of the plurality of probes.

~~13~~11. The system of claim ~~1 1 9~~, wherein the at least one controller is configured to simultaneously analyze two or more portions of the sample by:
causing the first switch to optically couple the illumination source to two or more transmitting optical fibers of the plurality of transmitting optical fibers; and causing the second switch to optically couple the detector to two or more receiving optical fibers of the plurality of receiving optical fibers, wherein the two or more transmitting optical fibers and the two or more receiving optical fibers are coupled to two or more respective probes of the plurality of probes.

~~14~~12. The system of claim 1~~-~~, further comprising one or more support members, wherein the one or more support members are configured to actuate the sample in one or more directions.

~~15~~13. The system of claim ~~1~~ 12, wherein the one or more support members are configured to rotate the sample clockwise or counterclockwise.

~~16~~14. The system of claim 1~~-~~, wherein the illumination source comprises at least one broadband illumination source.

~~17~~15. The system of claim ~~16~~14, wherein the at least one broadband illumination source comprises at least one of a discharge plasma light source, a laser driven plasma light source, or a supercontinuum light source.

16. ~~18.~~ The system of claim 1~~-~~, wherein the detector comprises a spectrometer.

~~19~~17. The system of claim 1~~-~~, wherein the sample comprises at least one of a wafer, a reticle, or a panel.

~~20.~~ 18. The system of claim 1~~-~~, further comprising:

a second illumination source;

a third switch optically coupled to the second illumination source;

a second plurality of transmitting optical fibers coupled to the third switch, wherein the third switch is configured to optically couple the second illumination source to a transmitting optical fiber of the second plurality of transmitting optical fibers;

a second detector;

a fourth switch optically coupled to the second detector;

a second plurality of receiving optical fibers coupled to the fourth switch, wherein the fourth switch is configured to optically couple the second detector to a receiving optical fiber of the second plurality of receiving optical fibers; and
a second plurality of probes coupled to respective ones of the second plurality of transmitting optical fibers and respective ones of the second plurality of receiving optical fibers, the second plurality of probes configured to illuminate respective portions of a backside surface of the sample and configured to receive illumination reflected, refracted, or radiated from the respective portions of the backside surface of the sample.

~~21~~ 19. The system of claim ~~20~~18, further comprising one or more support members, wherein the one or more support members are configured to support the sample by contacting two or more edges of the sample, wherein at least a portion of the backside surface of the sample is left exposed.

~~22~~20. The system of claim ~~20~~18, further comprising one or more support members, wherein the one or more support members are configured to support the sample by contacting a first portion of the backside surface of the sample, wherein a second portion of the backside surface of the sample is left exposed.

~~23. The system of claim 1 , wherein the one or more support members comprise a substrate with a plurality of suction ports for holding the sample against the substrate with a suction force, wherein is substrate is configured to support the plurality of probes, wherein the plurality of probes are at least partially disposed within a plurality of openings defined by the substrate.~~
~~24. The system of claim 1~~ 21. The system of claim 1, wherein the system is configured to be integrated within a wafer handler for at least one of a process tool or multi-function analysis tool.

~~25~~22. A system for analyzing a sample, comprising:

a metrology tool comprising: one or more support members configured to support ~~a~~the sample;

an illumination source;

a plurality of transmitting optical fibers optically coupled to the illumination source; a detector;
a plurality of receiving optical fibers optically coupled to the detector; and a plurality of probes coupled to respective ones of the plurality of transmitting optical fibers and respective ones of the plurality of receiving optical fibers; a plurality of multi-terminal connectors, wherein each multi-terminal connector includes at least three terminals, wherein a first terminal is connected to a respective transmitting optical fiber, a second terminal is connected to a respective receiving optical fiber, and a third terminal is connected to a respective probe, the plurality of probes configured to illuminate respective portions of a surface of the sample and configured to receive illumination ~~reflected, refracted, or radiated from the respective portions of the surface of the sample~~from the respective portions of the surface of the sample, wherein the one or more support members comprise a substrate with a plurality of suction ports for holding the sample against the substrate with a suction force, wherein the substrate is configured to support the plurality of probes, and wherein the plurality of suction ports are distributed across the substrate; and one or more optical elements in series with at least one of one or more of the plurality of transmitting optical fibers or one or more of the receiving optical fibers, the one or more optical elements configured to provide active tilt compensation and

thereby reduce an effect of sample warpage on coupling efficiency into at least one of one or more of the plurality of transmitting optical fibers or one or more of the receiving optical fibers.

2623. The system of claim 2522, further comprising:

a first splitter configured to optically couple the illumination source to the plurality of transmitting optical fibers; and
a second splitter configured to optically couple the detector to the plurality of receiving optical fibers.

2724. The system of claim 2522, wherein a transmitting optical fiber and a receiving optical fibersfiber are coupled to a respective probe of the plurality of probes by at least one of a bifurcated fiber bundle, a fan-out cable, or a Y-cable.

2825. The system of claim 2522, wherein at least one probe includes a portion of a transmitting optical fiber and a portion of a receiving optical fiber.

2926. The system of claim 2825, wherein the at least one probe further includes a housing that at least partially surrounds the portion of the transmitting optical fiber and the portion of the receiving optical fiber.

27. 30.The system of claim 25, further comprising:

one or more optical elements in series with at least one of a transmitting optical fiber or a receiving optical fiber.
31. The system of claim 3022, wherein the one or more optical elements include at least one focusing lens.

3228. The system of claim 3022, wherein the one or more optical elements include at least one collimating lens.

3329. The system of claim 3022, wherein at least one probe includes or is coupled to the one or more optical elements.

30. 34. The system of claim 25, further comprising:

an optics plate configured to support the plurality of probes, wherein the plurality of probes are at least partially disposed within a plurality of openings defined by the optics plate.
35. The system of claim 2522, wherein the one or more support members are configured to actuate the sample in one or more directions.

3631. The system of claim 2522, wherein the one or more support members are configured to rotate the sample clockwise or counterclockwise.

3732. The system of claim 2522, wherein the illumination source comprises at least one broadband illumination source.

3833. The system of claim 3732, wherein the at least one broadband illumination source comprises at least one of a discharge plasma light source, a laser driven plasma light source, or a supercontinuum light source.

3934. The system of claim 2522, wherein the detector comprises a spectrometer.

4035. The system of claim 3934, wherein the spectrometer comprises an imaging spectrometer.

41 36. The system of claim 2522, wherein the sample comprises at least one of a wafer, a reticle, or a panel.

4237. The system of claim 2522, further comprising:

a second illumination source;

a second plurality of transmitting optical fibers optically coupled to the second illumination source;

a second detector;

a second plurality of receiving optical fibers optically coupled to the second detector; and
a second plurality of probes coupled to respective ones of the second plurality of transmitting optical fibers and respective ones of the second plurality of receiving optical fibers, the second plurality of probes configured to illuminate respective portions of a backside surface of the sample and configured to receive illumination reflected, refracted, or radiated from the respective portions of the backside surface of the sample.

4338. The system of claim 4237, wherein the one or more support members are configured to support the sample by contacting two or more edges of the sample, wherein at least a portion of the backside surface of the sample is left exposed.

4439. The system of claim 4237, wherein the one or more support members are configured to support the sample by contacting a first portion of the backside surface of the sample, wherein a second portion of the backside surface of the sample is left exposed.

~~45. The system of claim 25, wherein the one or more support members comprise a substrate with a plurality of suction ports for holding the sample against the substrate with a suction force, wherein is substrate is configured to support the plurality of probes, wherein the plurality of probes are at least partially disposed within a plurality of openings defined by the substrate.~~
~~46. The system of claim 25~~40. The system of claim 22, wherein the system is configured to be integrated within a wafer handler for at least one of a process tool or multi-function analysis tool.

4741. A method of analyzing a sample, comprising:

providing a metrology tool integrated with a wafer handler of an inspection tool; supporting, with the metrology tool, a sample with one or more support members proximate to a plurality of probes, the plurality of probes coupled to respective ones of a plurality of transmitting optical fibers and respective ones of a plurality of receiving optical fibers;

optically coupling an illumination source to at least one transmitting optical fiber of the plurality of transmitting optical fibers with a first switch to illuminate at least one portion of a surface of the sample with at least one probe that is coupled to the at least one transmitting optical fiber, the at least one probe being further coupled to at least one receiving optical fiber of the plurality of receiving optical fibers~~; and~~
, the first switch including a plurality of first sub-switches linked together in a hierarchical configuration; and optically coupling a detector to the at least one receiving optical fiber with a second switch to receive illumination ~~reflected, refracted, or radiated from the at least one portion of the surface of the sample via the at least one probe~~from the at least one portion of the surface of the sample via the at least one probe, the second switch including a plurality of second sub-switches linked together in a hierarchical configuration; providing active tilt compensation, with one or more optical elements in series with at least one of the one or more of the plurality of transmitting optical fibers or one or more of the receiving optical fibers, to reduce an effect of sample warpage on coupling efficiency into at least one of the one or more of the plurality of transmitting optical fibers or one or more of the receiving optical fibers; acquiring, with the detector, optical measurement data from at least some of the plurality of the receiving optical fibers; and determining a variation in thickness of a film across the sample, wherein the film is deposited on at least one of a front surface or a bottom surface of the sample.

4842. The method of claim 4741, further comprising:

optically coupling the illumination source to at least one other transmitting optical fiber of the plurality of transmitting optical fibers with the first switch to illuminate at least one other portion of the surface of the sample with at least one other probe that is coupled to the at least one other transmitting optical fiber, the at least one other probe being further coupled to at least one other receiving optical fiber of the plurality of receiving optical fibers; and

optically coupling the detector to the at least one other receiving optical fiber with the second switch to receive illumination reflected, refracted, or radiated from the at least one other portion of the surface of the sample via the at least one other probe.

~~49~~43. The method of claim ~~47~~41, further comprising:

actuating the sample in one or more directions.

~~50~~44. The method of claim ~~47~~41, further comprising:

rotating the sample clockwise or counterclockwise.

~~51~~ 45. The method of claim ~~47~~41, further comprising:

supporting the sample with the one or more support members proximate to a second plurality of probes, the second plurality of probes coupled to respective ones of a second plurality of transmitting optical fibers and respective ones of a second plurality of receiving optical fibers;

optically coupling a second illumination source to at least one transmitting optical fiber of the second plurality of transmitting optical fibers with a third switch to illuminate at least one portion of a backside surface of the sample with at least one probe of the second plurality of probes that is coupled to the at least one transmitting optical fiber of the second plurality of transmitting optical fibers, the at least one probe being further coupled to at least one receiving optical fiber of the second plurality of receiving optical fibers; and optically coupling a second detector to the at least one receiving optical fiber of the second plurality of receiving optical fibers with a fourth switch to receive illumination reflected, refracted, or radiated from the at least one portion of the backside surface of the sample via the at least one probe of the second plurality of probes.

~~52~~46. The method of claim ~~51~~ 45, wherein the one or more support members contact two or more edges of the sample, and at least a portion of the backside surface of the sample is left exposed.

~~53~~47. The method of claim ~~51~~ 45, wherein the one or more support members contact a first portion of the backside surface of the sample, and a second portion of the backside surface of the sample is left exposed.