CLAIMS

1. A method of generating three-dimensional (3-D) information of a sample using an optical microscope, the method comprising:

varying the distance between the sample and an objective lens of the optical microscope at pre-determined steps;

capturing an image at each pre-determined step, wherein a first surface of the sample and a second surface of the sample are within a field of view of each of the captured images;

determining a characteristic value of each pixel in each captured image, wherein the characteristic value is intensity, contrast or fringe contrast; determining, for each captured image, the greatest characteristic value across all pixels in the captured image;

comparing the greatest characteristic value for each captured image to determine if a surface of the sample is present at each pre-determined step;

determining a first captured image that is focused on a first surface of the sample based on the characteristic value of each pixel in each captured image;

determining a second captured image that is focused on a second surface of the sample based on the characteristic value of each pixel in each captured image;

determining a first distance between the first surface and the second surface;

determining a thickness of a semi-transparent layer of the sample; and determining a thickness of a metal layer of the sample based at least in part on the thickness of the semi-transparent later wherein the optical microscope includes a stage, wherein the sample is supported by the stage, wherein the optical microscope is adapted to communicate with a computer system, wherein the computer system includes a memory device that is adapted to store each captured image, wherein the optical microscope one of: a confocal microscope, a structured illumination microscope, or an interferometer, and wherein the characteristic value of each pixel one of: intensity, contrast , or fringe contrast.

2. The method of Claim 1

, wherein the thickness of the metal layer is equal to the difference between the thickness of the semi-transparent layer and the first distance, wherein the first surface is a top surface of a photoresist layer, and wherein the second surface is a top surface of a metal layer.

3. The method of claim 1, wherein the thickness of the metal layer is equal to the sum of the thickness of the semitransparent layer and the first distance, wherein the first surface is a top surface of a passivation layer, and wherein the second surface is a top surface of a metal layer.

4. The method of Claim 2, wherein only a portion of each captured image is used to determine the thickness of the semi-transparent layer of the sample.

5. The method of Claim 4, wherein the portion of each captured image is selectable by an user input.

6. The method of Claim 1, wherein the determining the thickness of the semi-transparent layer comprises:

determining a third captured image that is focused on light reflected from the bottom surface of the semi-transparent layer of the sample based on the characteristic value of each pixel in each captured image; and

determining the location of the bottom surface of the semi-transparent layer based on the location where the third image was captured and the index of refraction of the semi-transparent layer.

7. A method of generating three-dimensional (3-D) information of a sample using an optical microscope, the method comprising:

varying the distance between the sample and an objective lens of the optical microscope at pre-determined steps;

capturing an image at each pre-determined step, wherein a first surface of the sample and a second surface of the sample are within a field of view of each of the captured images;

determining a characteristic value of each pixel in each captured image;

determining, for each captured image, a count of pixels that have a characteristic value within a first range, wherein all pixels that do not have a characteristic value within the first range are not included in the count of pixels;

determining if a surface of the sample is present at each pre-determined step based on the count of pixels for each captured image;

determining a first captured image that is focused on a first surface of the sample based on the characteristic value of each pixel in each captured image;

determining a second captured image that is focused on a second surface of the sample based on the characteristic value of each pixel in each captured image;

determining a first distance between the first surface and the second surface;

determining a thickness of a semi-transparent layer of the sample; and determining a thickness of a metal layer of the sample based at least in part on the thickness of the semi-transparent layer wherein the optical microscope includes a stage, wherein the sample is supported by the stage, wherein the optical microscope is adapted to communicate with a computer system, wherein the computer system includes a memory device that is adapted to store each captured image, wherein the optical microscope one of: a confocal microscope, a structured illumination microscope, or an interferometer, and wherein the characteristic value of each pixel one of: intensity, contrast, or fringe contrast.

8. The method of Claim 7, wherein the thickness of the metal layer is equal to the difference between the thickness of the semi-transparent layer and the first distance, wherein the first surface is a top surface of a photoresist layer, and wherein the second surface is a top surface of a metal layer.

9. The method of Claim 7, wherein the thickness of the metal layer is equal to the sum of the thickness of the semi-transparent layer and the first distance, wherein the first surface is a top surface of a passivation layer, and wherein the second surface is a top surface of a metal layer.

10. The method of Claim 9, wherein only a portion of each captured image is used to determine the thickness of the semi-transparent layer of the sample.

11. The method of Claim 10, wherein the portion of each captured image is selectable by an user input.

12. The method of Claim 7, wherein the determining the thickness of the semi-transparent layer comprises:

determining a third captured image that is focused on light reflected from the semi-transparent layer of the sample based on the characteristic value of each pixel in each captured image; and

determining the location of the bottom surface of the semi-transparent layer based on the location where the third image was captured and the index of refraction of the semi-transparent layer.

13. A three-dimensional (3-D) measurement system, comprising:

an optical microscope comprising an objective lens and a stage, wherein the optical microscope is adapted to vary the distance between a sample supported by the stage and the objective lens of the optical microscope at pre-determined steps; and a computer system comprising a processor and a storage device, wherein the computer system is adapted to:

store an image captured at each pre-determined step, wherein a first surface of the sample and a second surface of the sample is within a field of view of each image;

determine a characteristic value of each pixel in each captured image, wherein the characteristic value is selected from the group consisting of: intensity, contrast, and fringe contrast;

determine a first captured image that is focused on a first surface of the sample based on the characteristic value of each pixel in each captured image;

determine a second captured image that is focused on a second surface of the sample based on the characteristic value of each pixel in each captured image; and

determine a first distance between the first surface and the second surface, determine a thickness of a semi-transparent layer of the sample; and determine a thickness of a metal layer of the sample based at least in part on the thickness of the semi-transparent layer wherein the optical microscope includes a stage, wherein the sample is supported by the stage, wherein the optical microscope is adapted to communicate with a computer system, wherein the computer system includes a memory device that is adapted to store each captured image, wherein the optical microscope one of: a confocal microscope, a structured illumination microscope, or an interferometer, and wherein the characteristic value of each pixel one of: intensity, contrast, or fringe contrast.

14. The three-dimensional (3-D) measurement system of Claim 13, wherein the thickness of the metal layer is equal to the difference between the thickness of the semi-transparent layer and the first distance.

15. The three-dimension (3-D) measurement system of Claim 13, wherein the thickness of the metal layer is equal to the sum of the thickness of the semi-transparent layer and the first distance.

16. The three-dimensional (3-D) measurement system of Claim 13, wherein only a portion of each captured image is used to determine the thickness of the semi-transparent layer of the sample, and wherein the portion of each captured image is selectable by an user input.

17. The method of Claim 13, wherein the computer is further adapted to:

receive a user input that identifies a portion of each captured image is to be analyzed.

18. The method of Claim 14, wherein only a portion of each captured image is used to determine the thickness of the semi-transparent layer of the sample.