CLAIMS

[Claim 1]

A semiconductor device inspection system comprising:

a light generating unit for generating light to be irradiated a semiconductor device serving as a device under test;

a test signal application unit for applying a test signal that operates the semiconductor device to the semiconductor device;

a light detection unit for detecting the light reflected by the semiconductor device and outputting a detection signal when the light is irradiated to the semiconductor device;

a first spectrum analyzer, to which the detection signal is input, for measuring first phase information serving as phase information of the detection signal;

a reference signal generating unit for generating a reference signal of a predetermined frequency;

a second spectrum analyzer, to which the reference signal is input, for measuring second phase information serving as phase information of the reference signal; and

an analysis unit for deriving phase information of the detection signal at the predetermined frequency based on the first phase information and the second phase information,

wherein the first spectrum analyzer measures the first phase information with respect to a frequency of a base signal that operates the first spectrum analyzer,

the second spectrum analyzer measures the second phase information with respect to a frequency of a base signal that operates the

second spectrum analyzer, and

the frequency and the phase of the base signal of the first spectrum analyzer are synchronized with the frequency and the phase of the base signal of the second spectrum analyzer.

[Claim 2]

The semiconductor device inspection system according to claim 1, wherein both of the frequency of the base signal of the first spectrum analyzer and the frequency of the base signal of the second spectrum analyzer are the predetermined frequency.

[Claim 3]

The semiconductor device inspection system according to claim 1 or 2, further comprising a synchronization unit electrically coupled to the first spectrum analyzer and the second spectrum analyzer and for synchronizing the frequency and the phase of the base signal of the first spectrum analyzer with the frequency and the phase of the base signal of the second spectrum analyzer.

[Claim 4]

The semiconductor device inspection system according to any one of claims 1 to 3, wherein the predetermined frequency is a frequency n times the frequency of the test signal, and

n is a positive integer.

[Claim 5]

The semiconductor device inspection system according to any one of claims 1 to 4, further comprising:

a light scanning unit for receiving the light generated by the light generating unit and scanning the light to a predetermined radiation

position of the semiconductor device; and

an image generating unit for generating a phase image at the predetermined frequency based on the radiation position to which the light is scanned by the light scanning unit and the phase information of the detection signal at the predetermined frequency derived from the analysis unit.

[Claim 6]

The semiconductor device inspection system according to any one of claims 1 to 5, wherein the first spectrum analyzer measures amplitude information of the detection signal at the predetermined frequency.

[Claim 7]

The semiconductor device inspection system according to claim 6, further comprising:

a light scanning unit for receiving the light generated by the light generating unit and scanning the light to a predetermined radiation position of the semiconductor device; and

an image generating unit for generating an amplitude image at the predetermined frequency based on the radiation position to which the light is scanned by the light scanning unit and the amplitude information of the detection signal at the predetermined frequency measured by the first spectrum analyzer.

[Claim 8]

The semiconductor device inspection system according to claim 6 or 7, further comprising:

a light scanning unit for receiving the light generated by the

light generating unit and scanning the light to a predetermined radiation position of the semiconductor device; and

an image generating unit for generating an image related to an in-phase component and a quadrature component at the predetermined frequency based on the radiation position to which the light is scanned by the light scanning unit, the phase information of the detection signal at the predetermined frequency derived by the analysis unit, and the amplitude information of the detection signal at the predetermined frequency measured by the first spectrum analyzer.

[Claim 9]

A semiconductor device inspection method comprising:

a step of irradiating light to a semiconductor device serving as a device under test;

a step of applying a test signal to the semiconductor device;

a step of detecting the light reflected by the semiconductor device and outputting the detection signal when the light is irradiated to the semiconductor device;

a step of measuring first phase information serving as phase information of the detection signal with respect to a frequency of a base signal that operates a first spectrum analyzer;

a step of generating a reference signal of a predetermined frequency;

a step of measuring second phase information serving as phase information of the reference signal with respect to a frequency of a base signal that operates a second spectrum analyzer; and

a step of deriving phase information of the detection signal at

the predetermined frequency based on the first phase information and the second phase information,

wherein a frequency and a phase of the base signal of the first spectrum analyzer are synchronized with a frequency and a phase of the base signal of the second spectrum analyzer.

[Claim 10]

The semiconductor device inspection method according to claim 9, wherein both of the frequency of the base signal of the first spectrum analyzer and the frequency of the base signal of the second spectrum analyzer are the predetermined frequency.

[Claim 11]

The semiconductor device inspection method according to claim 9 or 10, wherein the predetermined frequency is a frequency n times the frequency of the test signal, and

n is a positive integer.

[Claim 12]

The semiconductor device inspection method according to any one of claims 9 to 11, further comprising:

a step of scanning the light to a predetermined radiation position of the semiconductor device; and

a step of generating a phase image at the predetermined frequency based on the radiation position to which the light is scanned in the scanning of the light, and the phase information of the detection signal at the predetermined frequency derived in the deriving of the phase information of the detection signal.

[Claim 13]

The semiconductor device inspection method according to any one of claims 9 to 12, further comprising a step of measuring amplitude information of the detection signal at the predetermined frequency by the first spectrum analyzer.

[Claim 14]

The semiconductor device inspection method according to claim 13, further comprising:

a step of scanning the light to the predetermined radiation position of the semiconductor device; and

a step of generating an amplitude image at the predetermined frequency based on the radiation position to which the light is scanned in the scanning of the light, and the amplitude information of the detection signal at the predetermined frequency measured in the measuring of the amplitude information of the detection signal.

[Claim 15]

The semiconductor device inspection method according to claim 13 or 14, further comprising:

a step of scanning the light to the predetermined radiation position of the semiconductor device; and

a step of generating an image related to an in-phase component and a quadrature component at the predetermined frequency based on the radiation position to which the light is scanned in the scanning of the light, the phase information of the detection signal at the predetermined frequency derived in the deriving of the phase information of the detection signal, and the amplitude information of the detection signal at the predetermined frequency measured in the measuring of the

amplitude information of the detection signal.

CLAIMS

[Claim 1]

A semiconductor device inspection system comprising:

a light generating unit for generating light to be irradiated a semiconductor device serving as a device under test;

a test signal application unit for applying a test signal that operates the semiconductor device to the semiconductor device;

a light detection unit for detecting the light reflected by the semiconductor device and outputting a detection signal when the light is irradiated to the semiconductor device;

a first spectrum analyzer, to which the detection signal is input, for measuring first phase information serving as phase information of the detection signal;

a reference signal generating unit for generating a reference signal of a predetermined frequency;

a second spectrum analyzer, to which the reference signal is input, for measuring second phase information serving as phase information of the reference signal; and

an analysis unit for deriving phase information of the detection signal at the predetermined frequency based on the first phase information and the second phase information,

wherein the first spectrum analyzer measures the first phase information with respect to a frequency of a base signal that operates the first spectrum analyzer,

the second spectrum analyzer measures the second phase information with respect to a frequency of a base signal that operates the second spectrum analyzer, and

the frequency and the phase of the base signal of the first spectrum analyzer are synchronized with the frequency and the phase of the base signal of the second spectrum analyzer.

[Claim 2]

The semiconductor device inspection system according to claim 1, wherein both of the frequency of the base signal of the first spectrum analyzer and the frequency of the base signal of the second spectrum analyzer are the predetermined frequency.

[Claim 3]

The semiconductor device inspection system according to claim 1 or 2, further comprising a synchronization unit electrically coupled to the first spectrum analyzer and the second spectrum analyzer and for synchronizing the frequency and the phase of the base signal of the first spectrum analyzer with the frequency and the phase of the base signal of the second spectrum analyzer.

[Claim 4]

The semiconductor device inspection system according to any one of claims 1 to 3, wherein the predetermined frequency is a frequency n times the frequency of the test signal, and

n is a positive integer.

[Claim 5]

The semiconductor device inspection system according to any one of claims 1 to 4, further comprising:

a light scanning unit for receiving the light generated by the light generating unit and scanning the light to a predetermined radiation position of the semiconductor device; and

an image generating unit for generating a phase image at the predetermined frequency based on the radiation position to which the light is scanned by the light scanning unit and the phase information of the detection signal at the predetermined frequency derived from the analysis unit.

[Claim 6]

The semiconductor device inspection system according to any one of claims 1 to 5, wherein the first spectrum analyzer measures amplitude information of the detection signal at the predetermined frequency.

[Claim 7]

The semiconductor device inspection system according to claim 6, further comprising:

a light scanning unit for receiving the light generated by the light generating unit and scanning the light to a predetermined radiation position of the semiconductor device; and

an image generating unit for generating an amplitude image at the predetermined frequency based on the radiation position to which the light is scanned by the light scanning unit and the amplitude information of the

detection signal at the predetermined frequency measured by the first spectrum analyzer.

[Claim 8]

The semiconductor device inspection system according to claim 6 or 7, further comprising:

a light scanning unit for receiving the light generated by the light generating unit and scanning the light to a predetermined radiation position of the semiconductor device; and

an image generating unit for generating an image related to an in-phase component and a quadrature component at the predetermined frequency based on the radiation position to which the light is scanned by the light scanning unit, the phase information of the detection signal at the predetermined frequency derived by the analysis unit, and the amplitude information of the detection signal at the predetermined frequency measured by the first spectrum analyzer.

[Claim 9]

A semiconductor device inspection method comprising:

a step of irradiating light to a semiconductor device serving as a device under test;

a step of applying a test signal to the semiconductor device;

a step of detecting the light reflected by the semiconductor device and outputting the detection signal when the light is irradiated to the semiconductor device;

a step of measuring first phase information serving as phase information of the detection signal with respect to a frequency of a base signal that operates a first spectrum analyzer;

a step of generating a reference signal of a predetermined frequency;

a step of measuring second phase information serving as phase information of the reference signal with respect to a frequency of a base signal that operates a second spectrum analyzer; and

a step of deriving phase information of the detection signal at the predetermined frequency based on the first phase information and the second phase information,

wherein a frequency and a phase of the base signal of the first spectrum analyzer are synchronized with a frequency and a phase of the

base signal of the second spectrum analyzer.

[Claim 10]

The semiconductor device inspection method according to claim 9, wherein both of the frequency of the base signal of the first spectrum analyzer and the frequency of the base signal of the second spectrum analyzer are the predetermined frequency.

[Claim 11]

The semiconductor device inspection method according to claim 9 or 10, wherein the predetermined frequency is a frequency n times the frequency of the test signal, and

n is a positive integer.

[Claim 12]

The semiconductor device inspection method according to any one of claims 9 to 11, further comprising:

a step of scanning the light to a predetermined radiation position of the semiconductor device; and

a step of generating a phase image at the predetermined frequency based on the radiation position to which the light is scanned in the scanning of the light, and the phase information of the detection signal at the predetermined frequency derived in the deriving of the phase information of the detection signal.

[Claim 13]

The semiconductor device inspection method according to any one of claims 9 to 12, further comprising a step of measuring amplitude information of the detection signal at the predetermined frequency by the first spectrum analyzer.

[Claim 14]

The semiconductor device inspection method according to claim 13, further comprising:

a step of scanning the light to the predetermined radiation position of the semiconductor device; and

a step of generating an amplitude image at the predetermined frequency based on the radiation position to which the light is scanned in the scanning of the light, and the amplitude information of the detection signal at the predetermined frequency measured in the measuring of the amplitude information of the detection signal.

[Claim 15]

The semiconductor device inspection method according to claim 13 or 14, further comprising:

a step of scanning the light to the predetermined radiation position of the semiconductor device; and

a step of generating an image related to an in-phase component and a quadrature component at the predetermined frequency based on the radiation position to which the light is scanned in the scanning of the light, the phase information of the detection signal at the predetermined frequency derived in the deriving of the phase information of the detection signal, and the amplitude information of the detection signal at the predetermined frequency measured in the measuring of the amplitude information of the detection signal.

[Claim 16]

The semiconductor device inspection system according to claim 1, wherein the frequency of the base signal of the first spectrum analyzer and the frequency of the base signal of the second spectrum analyzer are the same frequency.

[Claim 17]

The semiconductor device inspection system according to claim 1, wherein the phase difference between the phase of the base signal of the first spectrum analyzer and the phase of the base signal of the second spectrum analyzer are zero.

[Claim 18]

The semiconductor device inspection system according to claim 1, wherein the phase difference between the phase of the base signal of the first spectrum analyzer and the phase of the base signal of the second spectrum analyzer are fixed to a specified phase difference.

[Claim 19]

The semiconductor device inspection system according to any one of claims 1 to 8, further comprising an amplifier amplifies an AC component of the detection signal.

[Claim 20]

The semiconductor device inspection system according to any one of claims 1 to 8, wherein the light generating unit is a beam source configured to generate coherent light.

[Claim 21]

The semiconductor device inspection system according to any one of claims 1 to 8, wherein the light generating unit is a beam source configured to generate incoherent light.

[Claim 22]

The semiconductor device inspection method according to claim 9, wherein the frequency of the base signal of the first spectrum analyzer and the frequency of the base signal of the second spectrum analyzer are the same frequency.

[Claim 23]

The semiconductor device inspection method according to claim 9, wherein the phase difference between the phase of the base signal of the first spectrum analyzer and the phase of the base signal of the second spectrum analyzer are zero.

[Claim 24]

The semiconductor device inspection method according to claim 9, wherein the phase difference between the phase of the base signal of the first spectrum analyzer and the phase of the base signal of the second spectrum analyzer are fixed to a specified phase difference.