Claims

1. A semiconductor device inspection system comprising:

a light generating unit for generating light to be irradiated a semiconductor device;

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

a light detection unit for detecting the generated light reflected by the semiconductor device and outputting a detection signal;

a first spectrum analyzer for measuring first phase information representing a phase of the detection signal from the light detection unit at the predetermined frequency;

a second spectrum analyzer for measuring second phase information representing a phase of the reference signal at the predetermined frequency; and

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

wherein the detection signal is input to the first spectrum analyzer, and

the first spectrum analyzer and the second spectrum analyzer are synchronized.

2. The semiconductor device inspection system according to claim 1, further comprising a reference signal generating unit for generating the reference signal of the predetermined frequency and outputting the reference signal to the second spectrum analyzer.

3. The semiconductor device inspection system according to claim 1, wherein a frequency and a phase of a base signal of the first spectrum analyzer and the second spectrum analyzer are correspondingly synchronized.

4. The semiconductor device inspection system according to claim 3, 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.

5. The semiconductor device inspection system according to claim 1 or claim 3 or claim 4, further comprising a synchronization unit electrically coupled to the first spectrum analyzer and the second spectrum analyzer and for synchronizing the first spectrum

analyzer and the second spectrum analyzer.

6. The semiconductor device inspection system according to claim 1 or any one of claims 3 to 5, wherein the predetermined frequency is a frequency n times the frequency of the test signal, and n is a positive integer.

7. The semiconductor device inspection system according to claim 1 or any one of claims 3 to 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 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 at the predetermined frequency derived from the analysis unit.

8. The semiconductor device inspection system according to claim 1 or any one of claims 3 to 7, wherein the first spectrum analyzer measures amplitude information at the predetermined frequency.

9. The semiconductor device inspection system according to claim 8, 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 at the predetermined frequency measured by the first spectrum analyzer.

10. The semiconductor device inspection system according to claim 8 or claim 9, 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 at the predetermined frequency derived by the analysis unit, and the amplitude information at the predetermined frequency measured by the first spectrum

analyzer.

11. The semiconductor device inspection system according to claim 3, 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.

12. The semiconductor device inspection system according to claim 3, 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.

13. The semiconductor device inspection system according to claim 3, 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.

14. The semiconductor device inspection system according to claim 1 or any one of claims 3 to 13, further comprising an amplifier amplifies an AC component of the detection signal.

15. The semiconductor device inspection system according to claim 1 or any one of claims 3 to 14, wherein the light generating unit is a beam source configured to generate coherent light.

16. The semiconductor device inspection system according to claim 1 or any one of claims 3 to 15, wherein the light generating unit is a beam source configured to generate incoherent light.

17. A semiconductor device inspection method comprising:

a step of irradiating light to a semiconductor device;

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

a step of detecting the generated light reflected by the semiconductor device and outputting the detection signal;

a step of measuring first phase information (representing a phase of the detection signal from the light detection unit at the predetermined frequency) by a first spectrum analyzer;

a step of measuring second phase information (representing a phase of the

reference signal from a reference signal generating unit at the predetermined frequency); by a second spectrum analyzer; and

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

wherein the detection signal is input to the first spectrum analyzer, and the first spectrum analyzer and the second spectrum analyzer are synchronized.

18. The semiconductor device inspection method according to claim 17, further comprising: a step of generating a reference signal of the predetermined frequency and outputting the reference signal to the second spectrum analyzer.

19. The semiconductor device inspection method according to claim 17, wherein a frequency and a phase of a base signal of the first spectrum analyzer and the second spectrum analyzer are correspondingly synchronized.

20. The semiconductor device inspection method according to claim 19, 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.

21. The semiconductor device inspection method according to claim 17 or claim 19 or claim 20, wherein the predetermined frequency is a frequency n times the frequency of the test signal, and n is a positive integer.

22. The semiconductor device inspection method according to claim 17 or any one of claims 19 to 21, 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 at the predetermined frequency.

23. The semiconductor device inspection method according to claim 17 or any one of claims 19 to 22, further comprising a step of measuring amplitude information at the predetermined frequency by the first spectrum analyzer.

24. The semiconductor device inspection method according to claim 23, 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 at the predetermined frequency measured in the measuring of the amplitude information.

25. The semiconductor device inspection method according to claim 23 or claim 24, 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 at the predetermined frequency, and the amplitude information of the detection signal at the predetermined frequency measured in the measuring of the amplitude information.

26. The semiconductor device inspection method according to claim 19, 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.

27. The semiconductor device inspection method according to claim 19, 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.

28. The semiconductor device inspection method according to claim 19, 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.