CLAIMS

1. A surface position detecting apparatus comprising a light projection system which projects a beam from an oblique direction onto a detection target surface, and a light reception system which receives a beam reflected on the detection target surface, said surface position detecting apparatus being adapted to detect a surface position of the detection target surface on the basis of an output from the light reception system,

wherein at least one of the light projection system and the light reception system comprises a total reflection prism member including an internal reflection surface which totally reflects an incident beam, and

wherein, for restraining influence of a relative positional deviation between polarization components of the beam totally reflected on the internal reflection surface of the total reflection prism member, on detection of the surface position of the detection target surface, a refractive index of an optical material forming the total reflection prism member and an angle of incidence of the incident beam to the internal reflection surface of the total reflection prism member are set so as to satisfy a predetermined relation.

2. The surface position detecting apparatus according to claim 1, wherein the total reflection prism member is made of an optical material with a predetermined refractive index, and

wherein the angle of incidence of the incident beam to the internal reflection surface of the total reflection prism member is determined so that an amount of the relative positional deviation

between the polarization components of the beam totally reflected on the internal reflection surface of the total reflection prism member becomes substantially zero.

3. The surface position detecting apparatus according to claim 1, wherein the total reflection prism member is arranged to totally reflect the incident beam incident at a predetermined angle of incidence to the internal reflection surface, and

wherein the refractive index of the optical material forming the total reflection prism member is determined so that an amount of the relative positional deviation between the polarization components of the beam totally reflected on the internal reflection surface of the total reflection prism member becomes substantially zero.

4. The surface position detecting apparatus according to any one of claims 1 to 3, which satisfies the following relation:

[Math 16]

$$\frac{\lambda \tan\theta}{\pi\sqrt{n^2\sin^2\theta-1}}\left(\frac{1}{n^2\sin^2\theta+\sin^2\theta-1}-1\right)\cdot\cos\theta \le 0.3\ (\mu m)$$

where λ (μm) is a wavelength of the beam, n the refractive index of the total reflection prism member, and θ ($0° \le \theta \le 90°$) an angle of incidence of an axial principal ray incident to the internal reflection surface.

5. The surface position detecting apparatus according to any one of claims 1 to 3, which satisfies the following relation:

[Math 17]

$$-0.05\ (\mu m) \le \frac{\lambda \tan\theta}{\pi\sqrt{n^2\sin^2\theta-1}}\left(\frac{1}{n^2\sin^2\theta+\sin^2\theta-1}-1\right)\cdot\cos\theta \le 0.05\ (\mu m)$$

where λ (μm) is a wavelength of the beam, n the refractive index of the total reflection prism member, and θ ($0° \leq \theta \leq 90°$) an angle of incidence of an axial principal ray incident to the internal reflection surface.

6. The surface position detecting apparatus according to any one of claims 1 to 3, wherein the total reflection prism member includes N internal reflection surfaces,

the surface position detecting apparatus satisfying the following relation:

[Math 18]

$$-0.3N(\mu m) \leq \sum_{a=1}^{N} \frac{\lambda \tan\theta_a}{\pi\sqrt{n^2 \sin^2\theta_a - 1}} \left(\frac{1}{n^2 \sin^2\theta_a + \sin^2\theta_a - 1} - 1 \right) \cdot \cos\theta_a \leq 0.3N(\mu m)$$

where λ (μm) is a wavelength of the beam, n the refractive index of the total reflection prism member, and θa ($0° \leq \theta a \leq 90°$) an angle of incidence of an axial principal ray incident to an a-th internal reflection surface.

7. The surface position detecting apparatus according to any one of claims 1 to 3, wherein the total reflection prism member includes N internal reflection surfaces,

the surface position detecting apparatus satisfying the following relation:

[Math 19]

$$-0.05N(\mu m) \leq \sum_{a=1}^{N} \frac{\lambda \tan\theta_a}{\pi\sqrt{n^2 \sin^2\theta_a - 1}} \left(\frac{1}{n^2 \sin^2\theta_a + \sin^2\theta_a - 1} - 1 \right) \cdot \cos\theta_a \leq 0.05N(\mu m)$$

where λ (μm) is a wavelength of the beam, n the refractive index of the total reflection prism member, and θa ($0° \leq \theta a \leq 90°$) an angle of

incidence of an axial principal ray incident to an a-th internal reflection surface.

8. The surface position detecting apparatus according to any one of claims 1 to 7, wherein the light projection system comprises a projection-side prism member including an internal reflection surface which effects a substantial parallel shift of an optical path of an incident beam, as the total reflection prism member, and

wherein the light reception system comprises a reception-side prism member arranged corresponding to the projection-side prism member and including an internal reflection surface which effects a substantial parallel shift of an optical path of an incident beam from the detection target surface, as the total reflection prism member.

9. The surface position detecting apparatus according to any one of claims 1 to 8, wherein the light projection system comprises a projecting optical system which forms a primary image of a predetermined pattern on the detection target surface, and

wherein the light reception system comprises a condensing optical system which condenses the beam reflected on the detection target surface, to form a secondary image of the predetermined pattern, and a detection unit which detects the secondary image of the predetermined pattern formed through the condensing optical system,

the surface position detecting apparatus detecting the surface position of the detection target surface on the basis of an output from the detection unit.

10. An exposure apparatus which projects a predetermined pattern through a projection optical system onto a photosensitive

substrate to effect exposure thereof, comprising:

the surface position detecting apparatus as set forth in any one of claims 1 to 9, which detects a surface position of a surface of the predetermined pattern or an exposed surface of the photosensitive substrate relative to the projection optical system, as the surface position of the detection target surface; and

positioning means which positions the surface of the predetermined pattern or the exposed surface of the photosensitive substrate relative to the projection optical system, based on a detection result by the surface position detecting apparatus.

11. A device manufacturing method comprising:

an exposure step of effecting exposure of the photosensitive substrate with the predetermined pattern, using the exposure apparatus as set forth in claim 10; and

a development step of developing the photosensitive substrate exposed in the exposure step.

12. An optical apparatus in which an optical member including a total reflection surface is disposed in an optical path,

wherein a refractive index of the optical member and an angle of incidence of light to the total reflection surface are set so as to restrain a relative positional deviation between polarization components of light totally reflected on the total reflection surface of the optical member.

13. The optical apparatus according to claim 12, wherein the optical member is made of an optical material having a predetermined refractive index, and

wherein the angle of incidence of the light to the total reflection

surface of the optical member is set so that an amount of the relative positional deviation between the polarization components of the light totally reflected on the total reflection surface of the optical member becomes substantially zero.

14. The optical apparatus according to claim 12 or 13, which satisfies the following relation:

[Math 20]

$$\frac{\lambda \tan\theta}{\pi\sqrt{n^2\sin^2\theta-1}}\left(\frac{1}{n^2\sin^2\theta+\sin^2\theta-1}-1\right)\cdot\cos\theta \le 0.3\ (\mu m)$$

where λ (μm) is a wavelength of the light, n the refractive index of the optical member, and θ ($0° \le \theta \le 90°$) an angle of incidence of an axial principal ray incident to the total reflection surface.

15. The optical apparatus according to claim 12 or 13, which satisfies the following relation:

[Math 21]

$$-0.05\ (\mu m) \le \frac{\lambda \tan\theta}{\pi\sqrt{n^2\sin^2\theta-1}}\left(\frac{1}{n^2\sin^2\theta+\sin^2\theta-1}-1\right)\cdot\cos\theta \le 0.05\ (\mu m)$$

where λ (μm) is a wavelength of the light, n the refractive index of the optical member, and θ ($0° \le \theta \le 90°$) an angle of incidence of an axial principal ray incident to the total reflection surface.

16. The optical apparatus according to claim 12 or 13, wherein the optical member includes N total reflection surfaces,

the optical apparatus satisfying the following relation:

[Math 22]

$$-0.3N(\mu m) \le \sum_{a=1}^{N}\frac{\lambda \tan\theta_a}{\pi\sqrt{n^2\sin^2\theta_a-1}}\left(\frac{1}{n^2\sin^2\theta_a+\sin^2\theta_a-1}-1\right)\cdot\cos\theta_a \le 0.3N(\mu m)$$

where λ (μm) is a wavelength of the light, n the refractive index of the optical member, and θa ($0° \leq \theta a \leq 90°$) an angle of incidence of an axial principal ray incident to an a-th total reflection surface.

17. The optical apparatus according to claim 12 or 13, wherein the optical member includes N total reflection surfaces,

the optical apparatus satisfying the following relation:

[Math 23]

$$-0.05N(\mu m) \leq \sum_{a=1}^{N} \frac{\lambda \tan\theta_a}{\pi\sqrt{n^2 \sin^2\theta_a - 1}} \left(\frac{1}{n^2 \sin^2\theta_a + \sin^2\theta_a - 1} - 1 \right) \cdot \cos\theta_a \leq 0.05N(\mu m)$$

where λ (μm) is a wavelength of the light, n the refractive index of the optical member, and θa ($0° \leq \theta a \leq 90°$) an angle of incidence of an axial principal ray incident to an a-th total reflection surface.

18. An optical apparatus comprising N internal reflection surfaces in an optical path,

wherein angles of incidence of light to the respective N internal reflection surfaces and refractive indices of respective optical members forming the N internal reflection surfaces are set so that relative positional deviation between polarization components of light totally reflected on the N internal reflection surfaces becomes substantially zero.

19. The optical apparatus according to claim 18, which satisfies the following relation:

[Math 24]

$$-0.3N(\mu m) \leq \sum_{a=1}^{N} \frac{\lambda \tan\theta_a}{\pi\sqrt{n_a^2 \sin^2\theta_a - 1}} \left(\frac{1}{n_a^2 \sin^2\theta_a + \sin^2\theta_a - 1} - 1 \right) \cdot \cos\theta_a \leq 0.3N(\mu m)$$

where λ (μm) is a wavelength of the light, na a refractive index

of an optical member forming an a-th internal reflection surface, and θa ($0° \leq \theta a \leq 90°$) an angle of incidence of an axial principal ray incident to the a-th internal reflection surface.

20. The optical apparatus according to claim 18, which satisfies the following relation:

[Math 25]

$$-0.05N(\mu m) \leq \sum_{a=1}^{N} \frac{\lambda \tan\theta_a}{\pi\sqrt{n_a^2 \sin^2\theta_a - 1}} \left(\frac{1}{n_a^2 \sin^2\theta_a + \sin^2\theta_a - 1} - 1 \right) \cdot \cos\theta_a \leq 0.05N(\mu m)$$

where λ (μm) is a wavelength of the light, na a refractive index of an optical member forming an a-th internal reflection surface, and θa ($0° \leq \theta a \leq 90°$) an angle of incidence of an axial principal ray incident to the a-th internal reflection surface.

21. A measuring apparatus in which an optical member including a total reflection surface is disposed in a measurement optical path,

wherein a refractive index of the optical member and an angle of incidence of measurement light to the total reflection surface are set so as to restrain a relative positional deviation between polarization components of the measurement light totally reflected on the total reflection surface of the optical member.

22. A measuring apparatus which measures a measurement target surface, comprising:

a detector which detects measurement light from the measurement target surface; and

an optical member with a total reflection surface disposed in an optical path between the measurement target surface and the detector,

wherein, for restraining a relative positional deviation between polarization components of the measurement light totally reflected on the total reflection surface of the optical member, a refractive index of the optical member and an angle of incidence of the measurement light to the total reflection surface are set.

23. A measuring apparatus which measures a measurement target surface, comprising:

a light projection system which guides measurement light to the measurement target surface;

a light reception system which receives the measurement light from the measurement target surface; and

an optical member with a total reflection surface disposed in at least one of an optical path of the light projection system and an optical path of the light reception system,

wherein, for restraining a relative positional deviation between polarization components of the measurement light totally reflected on the total reflection surface of the optical member, a refractive index of the optical member and an angle of incidence of the measurement light to the total reflection surface of the optical member are set.

24. The measuring apparatus according to claim 22 or 23, said measuring apparatus measuring a position of the measurement target surface.

25. The measuring apparatus according to claim 22 or 23, said measuring apparatus measuring a surface position of the measurement target surface.

26. The measuring apparatus according to claim 22 or 23, said

measuring apparatus measuring a surface shape of the measurement target surface.

27. The measuring apparatus according to any one of claims 21 to 26, wherein, for restraining influence of the relative positional deviation between the polarization components on accuracy of measurement, the refractive index of the optical member and the angle of incidence of the measurement light to the total reflection surface are set so as to satisfy a predetermined relation.

28. The measuring apparatus according to any one of claims 21 to 27, wherein the optical member is made of an optical material having a predetermined refractive index, and

wherein the angle of incidence of the measurement light to the total reflection surface of the optical member is set so that an amount of the relative positional deviation between the polarization components of the measurement light totally reflected on the total reflection surface becomes substantially zero.

29. The measuring apparatus according to any one of claims 21 to 28, which satisfies the following relation:

[Math 26]

$$\frac{\lambda \tan\theta}{\pi\sqrt{n^2 \sin^2\theta - 1}}\left(\frac{1}{n^2 \sin^2\theta + \sin^2\theta - 1} - 1\right)\cdot\cos\theta \leq 0.3\ (\mu m)$$

where λ (μm) is a wavelength of the measurement light, n the refractive index of the optical member, and θ ($0° \leq \theta \leq 90°$) an angle of incidence of an axial principal ray incident to the total reflection surface.

30. The measuring apparatus according to any one of claims 21 to 28, which satisfies the following relation:

[Math 27]

$$-0.05\ (\mu m) \leq \frac{\lambda \tan\theta}{\pi\sqrt{n^2\sin^2\theta - 1}}\left(\frac{1}{n^2\sin^2\theta + \sin^2\theta - 1} - 1\right)\cdot\cos\theta \leq 0.05\ (\mu m)$$

where λ (μm) is a wavelength of the measurement light, n the refractive index of the optical member, and θ ($0° \leq \theta \leq 90°$) an angle of incidence of an axial principal ray incident to the total reflection surface.

31. The measuring apparatus according to any one of claims 21 to 28, wherein the optical member includes N total reflection surfaces,

the measuring apparatus satisfying the following relation:

[Math 28]

$$-0.3N(\mu m) \leq \sum_{a=1}^{N} \frac{\lambda \tan\theta_a}{\pi\sqrt{n^2\sin^2\theta_a - 1}}\left(\frac{1}{n^2\sin^2\theta_a + \sin^2\theta_a - 1} - 1\right)\cdot\cos\theta_a \leq 0.3N(\mu m)$$

where λ (μm) is a wavelength of the measurement light, n the refractive index of the optical member, and θa ($0° \leq \theta a \leq 90°$) an angle of incidence of an axial principal ray incident to an a-th total reflection surface.

32. The measuring apparatus according to any one of claims 21 to 28, wherein the optical member includes N total reflection surfaces,

the measuring apparatus satisfying the following relation:

[Math 29]

$$-0.05N(\mu m) \leq \sum_{a=1}^{N} \frac{\lambda \tan\theta_a}{\pi\sqrt{n^2 \sin^2\theta_a - 1}} \left(\frac{1}{n^2 \sin^2\theta_a + \sin^2\theta_a - 1} - 1 \right) \cdot \cos\theta_a \leq 0.05N(\mu m)$$

where λ (μm) is a wavelength of the measurement light, n the refractive index of the optical member, and θa ($0° \leq \theta a \leq 90°$) an angle of incidence of an axial principal ray incident to an a-th total reflection surface.

33. A measuring apparatus comprising N internal reflection surfaces in an optical path,

wherein angles of incidence of light to the respective N internal reflection surfaces and refractive indices of respective optical members forming the N internal reflection surfaces are set so that a relative positional deviation between polarization components of light totally reflected on the N internal reflection surfaces becomes substantially zero.

34. The measuring apparatus according to claim 33, which satisfies the following relation:

[Math 30]

$$-0.3N(\mu m) \leq \sum_{a=1}^{N} \frac{\lambda \tan\theta_a}{\pi\sqrt{n_a^2 \sin^2\theta_a - 1}} \left(\frac{1}{n_a^2 \sin^2\theta_a + \sin^2\theta_a - 1} - 1 \right) \cdot \cos\theta_a \leq 0.3N(\mu m)$$

where λ (μm) is a wavelength of the light, na a refractive index of an optical member forming an a-th internal reflection surface, and θa ($0° \leq \theta a \leq 90°$) an angle of incidence of an axial principal ray incident to the a-th internal reflection surface.

35. The measuring apparatus according to claim 33, which satisfies the following relation:

[Math 31]

$$-0.05N(\mu m) \leq \sum_{a=1}^{N} \frac{\lambda \tan\theta_a}{\pi\sqrt{n_a^2 \sin^2\theta_a - 1}} \left(\frac{1}{n_a^2 \sin^2\theta_a + \sin^2\theta_a - 1} - 1 \right) \cdot \cos\theta_a \leq 0.05N(\mu m)$$

where λ (μm) is a wavelength of the light, na a refractive index of an optical member forming an a-th internal reflection surface, and θa ($0° \leq \theta a \leq 90°$) an angle of incidence of an axial principal ray incident to the a-th internal reflection surface.

36. An exposure apparatus which effects exposure of a photosensitive substrate with a predetermined pattern, comprising:

the measuring apparatus as set forth in any one of claims 21 to 35, which measures a position of the photosensitive substrate.

37. A device manufacturing method comprising:

an exposure step of effecting exposure of the photosensitive substrate with the predetermined pattern, using the exposure apparatus as set forth in claim 36; and

a development step of developing the photosensitive substrate exposed in the exposure step.

38. An optical apparatus comprising: at least one optical member disposed in an optical path and including a total reflection surface; and an adjusting device which adjusts a relative positional deviation between polarization components of light totally reflected on the total reflection surface of said at least one optical member.

39. The optical apparatus according claim 38, comprising:

a detecting device which detects the relative positional deviation between the polarization components of the light totally reflected on the total reflection surface of said at least one optical member, based on the light having traveled via the total reflection surface of said at least one

optical member,

wherein the adjusting device adjusts said at least one optical member, based on output information from the detecting device.

40. The optical apparatus according claim 38 or 39, wherein the adjusting device changes an angle of incidence of the light incident to the total reflection surface of said at least one optical member.

41. The optical apparatus according to any one of claims 38 to 40, wherein an optical path of light incident to or exited from the total reflection surface of said at least one optical member passes via an object with a polarizing property.

42. An adjustment method comprising:

a step of disposing at least one optical member including a total reflection surface, in an optical path; and

a step of adjusting a relative positional deviation between polarization components of light caused at the total reflection surface of said at least one optical member.

43. The adjustment method according to claim 42, further comprising: a step of detecting the light having traveled via the total reflection surface of said at least one optical member.

44. The adjustment method according to claim 42 or 43, further comprising a step of letting the light incident to or exited from the total reflection surface of said at least one optical member, travel via an object with a polarizing property.

45. An adjustment method comprising:

a step of guiding light to at least one optical member including a total reflection surface;

a step of detecting a relative positional deviation between polarization components of the light caused at the total reflection surface of said at least one optical member; and

a step of adjusting an angle of incidence of the light incident to the total reflection surface of said at least one optical member.

46. The adjustment method according to claim 45, further comprising a step of letting the light incident to or exited from the total reflection surface of said at least one optical member, travel via an object with a polarizing property.

Claims

1. A surface position detecting apparatus adapted to detect a surface position of a detection target surface to be detected with respect to a direction crossing the detection target surface on the basis of a light reception result of a light which is projected from an oblique direction onto the detection target surface and is reflected on the detection target surface, comprising;,

a first total reflection surface and a second total reflection surface provided in a prism member arranged in a optical path of the light for totally reflect the light in side of the prism member,

wherein, a refractive index of an optical material forming the prism member and incident angle of the light with which the light enter on the first and second total reflection surfaces are set so that, with respect to a relative positional deviation caused by a total reflection between a first polarization component of the light and a second polarization component which have polarization directions perpendicular to each other in the light, a first positional deviation amount caused in the first total reflection surface and a second positional deviation amount caused in the second total reflection surface cancel each other.

2. A surface position detecting apparatus adapted to detect a surface position of a detection target surface to be detected with respect to a direction crossing the detection target surface on the basis of a light reception result of a light which is projected from an oblique

direction onto the detection target surface and is reflected on the detection target surface, comprising;,

a first total reflection surface and a second total reflection surface provided in a prism member arranged in a optical path of the light for totally reflect the light in side of the prism member,

wherein, a refractive index of an optical material forming the prism member is made and incident angle of the light with which the light enter on the first and second total reflection surfaces are set so that, with respect to a relative positional deviation caused by a total reflection between a first polarization component of the light and a second polarization component which have polarization directions perpendicular to each other in the light, a first positional deviation amount caused in the first total reflection surface and a second positional deviation amount caused in the second total reflection surface have different positive and negative values each other

3. The surface position detecting apparatus according to claim 1 or 2, wherein the prism member comprises two prism members, and the first total reflection surface is provided in one of the two prism member and the second total reflation surface is the other of the two prism members.

4. The surface position detecting apparatus according to claim 3, wherein a refractive index of an optical material of the one of the two prism members is different from that of the other of the two prism members.

5. The surface position detecting apparatus according to claim 3, wherein a refractive index of an optical material of the one of the two prism members is identical to that of the other of the two prism members and an incident angle with which the light enters on the first total reflection surface is different from that which the light enters on the second total reflection surface.

6. The surface position detecting apparatus according to claim 1 or 2, wherein the first and second total reflection surfaces are provide in the single prism member, and the incident angle of the light to the first total reflection surface is different from the incident angle of the light to the second total reflection surface.

7. The surface position detecting apparatus according to any one of claims 1-6, wherein the prism member effects a substantial parallel shift of an optical path of an incident light, by the first and second total reflection surfaces.

8. The surface position detecting apparatus according to any one of claims 1-5, further comprising;

a projection optical system for forming a primary image of the predetermined pattern on the detection target surface by projecting the light through a predetermined pattern from an oblique direction onto the detection target surface;

light condensing optical system for condensing the light

reflected by the detection target surface to form a secondary image of the predetermined pattern; and

a detecting unit for receiving the light forming the secondary image of the predetermined patter,

wherein the first total reflection surface is arranged in an optical path of the light in the projection optical system and the second total reflection surface is arranged in an optical path of the light in the light condensing optical system.

9. The surface position detecting apparatus according to any one of claims 1-5, further comprising;

a projection optical system for forming a primary image of the predetermined pattern on the detection target surface by projecting the light through a predetermined pattern from an oblique direction onto the detection target surface;

light condensing optical system for condensing the light reflected by the detection target surface to form a secondary image of the predetermined pattern; and

a detecting unit for receiving the light forming the secondary image of the predetermined patter,

wherein the first and second total reflection surfaces are arranged in an optical path of the light in the projection optical system or an optical path of the light in the light condensing optical system.

10. An exposure apparatus which projects a pattern formed on a

mask through a projection optical system onto a photosensitive substrate to effect exposure thereof, comprising:

the surface position detecting apparatus as set forth in any one of claims 1 to 9, which detects a surface position of a surface of the pattern of the mask or an exposed surface of the photosensitive substrate relative to the projection optical system, as the surface position of the detection target surface; and

positioning means which positions the surface of the predetermined pattern or the exposed surface of the photosensitive substrate relative to the projection optical system, based on a detection result by the surface position detecting apparatus.

11. A device manufacturing method comprising:

an exposure step of effecting exposure of the photosensitive substrate with the predetermined pattern, using the exposure apparatus as set forth in claim 10; and

a development step of developing the photosensitive substrate exposed in the exposure step.

12. An exposure method of projecting and effective exposure of a photosensitive substrate with a pattern formed on a mask through a projection optical system, comprising:

detecting a surface position of a surface of the pattern of the mask or an exposed surface of the photosensitive substrate relative in an optical direction of the projection optical system, using an surface position detection apparatus according to any one of claims 1-9, and

positioning the surface of a surface of the pattern or the exposed surface of the photosensitive substrate on the basis of a detection result by the surface position detecting apparatus

13. A device manufacturing method comprising:

an exposure step of effecting exposure of the photosensitive substrate with a predetermined pattern formed on a mask, using the exposure method according to claim 12; and

a development step of developing the photosensitive substrate exposed in the exposure step.

14. A measuring apparatus adapted to measuring a detection target surface to be detected on the basis of a light reception result of a light which is projected onto the detection target surface and is reflected on the detection target surface, comprising;,

a plurality of total reflection surfaces in a optical path of the light for totally reflect the light,

wherein, a refractive index of an optical material forming the plurality of the total reflection surfaces and incident angle of the light with which the light enter on the plurality of the total reflection surfaces are set so that, with respect to a relative positional deviation caused by total reflections between a first polarization component of the light and a second polarization component which have polarization directions perpendicular to each other in the light, positional deviation amounts caused in at least two total reflection surfaces cancel each other.

15. A measuring apparatus adapted to measuring a detection target surface to be detected on the basis of a light reception result of a light which is projected onto the detection target surface and is reflected on the detection target surface, comprising;,

a plurality of total reflection surfaces in a optical path of the light for totally reflect the light,

wherein, a refractive index of an optical material forming the plurality of the total reflection surfaces and incident angle of the light with which the light enter on the plurality of the total reflection surfaces are set so that, with respect to a relative positional deviation caused by total reflections between a first polarization component of the light and a second polarization component which have polarization directions perpendicular to each other in the light, positional deviation amounts caused in at least two total reflection surfaces have different positive and negative values each other.

16. The measuring apparatus according to claim 14 or 15, wherein the measuring apparatus measures a position of the detection target surface to be detected on the basis of a light reception result of a light.

17. The measuring apparatus according to claim 14 or 15, wherein the measuring apparatus measures a surface position of the detection target surface to be detected on the basis of a light reception result of a light.

18. The measuring apparatus according to claim 14 or 15, wherein the measuring apparatus measures a surface shape of the detection target surface to be detected on the basis of a light reception result of a light.

19. The measuring apparatus according to any one of claims 14-18, further comprising; a projection optical system for projecting the light on the detection target surface; and an optical condensing system for condensing the light reflected on the detection target surface, wherein a one part of the plurality of the total reflection surfaces is arranged in an optical path of the projection optical system and the other part of the plurality of the plurality of the total reflection surfaces is arranged in an optical path of the optical condensing system.

20. An exposure apparatus for effecting an exposure of a photosensitive substrate with a predetermined pattern, comprising;

the measuring apparatus according to any one of claims 14-19, for measuring the photosensitive substrate.

21. The exposure apparatus according to claim 20, further comprising;

a supporting unit for supporting the photosensitive substrate;

an projection optical system for projecting an image of the predetermined pattern on the photosensitive substrate supported by the supporting unit; and

aligning unit for driving/controlling the supporting unit which

supporting the photosensitive substrate on the basis of a measuring result obtained in the mearing apparatus to align the photosensitive substrate to the projection optical system.

22. A device manufacturing method comprising:

an exposure step of effecting exposure of the photosensitive substrate with the predetermined pattern, using the exposure apparatus according to claim 20 or 21; and

a development step of developing the photosensitive substrate exposed in the exposure step.

23. An exposure method for effecting a photosensitive substrate with a predetermined pattern through a projection optical system comprising:

measuring the photosensitive substrate using the measuring apparatus according to any one of claims 14-19;

aligning the photosensitive substrate to the projection optical system on the basis of a measuring result obtained in the measuring apparatus.

24. A device manufacturing method comprising:

an exposure step of effecting exposure of the photosensitive substrate with the predetermined pattern, using the exposure method according to claim 23; and

a development step of developing the photosensitive substrate exposed in the exposure step.