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(54) **SURFACE SHAPE MEASURING SYSTEM AND SURFACE SHAPE MEASURING METHOD USING THE SAME**

SYSTEM ZUR MESSUNG DER OBERFLÄCHENFORM UND VERFAHREN ZUR MESSUNG DER OBERFLÄCHENFORM DAMIT

SYSTÈME DE MESURE D'UNE FORME SUPERFICIELLE ET PROCÉDÉ DE MESURE D'UNE FORME SUPERFICIELLE UTILISANT LE SYSTÈME

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Description

Technical Field

[0001] The present invention relates to a surface shape measuring system and a surface shape measuring method using the same, and more particularly to a surface shape measuring system, in which both two-dimensional data and three-dimensional data of a target object to be measured are obtained using a single apparatus using white-light scanning interferometry and three-dimensional inspection is performed only for specific regions of the target object rather than the overall dimensions of the target object, and a surface shape measuring method using the same.

Background Art

[0002] Recently, in order to inspect the processed and manufactured state of a fine structure having a complicated stepped structure due to miniaturization and refinement of electronic and mechanical parts, a high measurement accuracy to size, shape, and surface roughness has been required.

[0003] Therefore, a size measuring method using an optical two-dimensional measuring apparatus and a shape or a thickness (surface roughness) measuring method using an optical three-dimensional measuring apparatus are used now in measurement of small-sized electronic and mechanical parts.

[0004] As one of conventional optical three-dimensional measuring apparatuses, white-light scanning interferometry (WSI) has been proposed.

[0005] US 2005/0206889 A1 discloses an optical fiber inspection device capable of performing a 2D visual inspection and a 3D interferometric measurement by operating a shutter associated with a reference mirror.

[0006] US 7095507 B1 discloses an optical wafer inspection device capable of performing a 2D visual inspection and a 3D interferometric measurement by operating a shutter associated with a reference mirror.

[0007] With reference to FIG. 7, the WSI uses a principle, in which when a reference beam and an object beam obtained by splitting light generated from a light source 100 by a beam splitter 200 are respectively reflected by a reference surface of a reference mirror 400 and a measurement surface (P) of a target object 300 to be measured, and generate an interference signal, a light detecting element 500 captures the interference signal and then analyzes the signal. That is, the WSI measures a three-dimensional shape by detecting a position using a characteristic, in which the interference signal is generated only when the reference beam and the object beam pass through the same optical path.

[0008] When interference signals at respective measurement points within a measurement region are observed using the above principle while moving the object at minute intervals in the optical axial direction with a transfer unit, such as a PZT actuator, a short interference signal is generated at a position of each of the points, where the measurement beam has the same optical path as that of the reference beam.

[0009] Therefore, when the interference signal generating positions of all the measurement points within the measurement region are calculated, data regarding the three-dimensional shape of the measurement surface are obtained, and thickness and shape of a thin film layer are measured from the obtained three-dimensional shape data.

[0010] A measuring apparatus using white-light scanning interferometry is used in the measurement of the film thickness of a dielectric multi-layered film or the analysis of the structure of a continuum (diffuser), for example, the eye ground or the skin, as well as in the measurement of the three-dimensional shape of a fine structure.

[0011] However, with the conventional measuring apparatuses, the two-dimensional measuring apparatus to measure the size of a target object to be measured and the three-dimensional measuring apparatus to measure the shape and thickness (surface roughness) of the object are independently designed and separately used, and thus are alternately used to measure the two-dimensional size and the three-dimensional shape of the object, thereby causing troublesomeness.

[0012] Further, in case that the conventional three-dimensional measuring apparatus is used, the three-dimensional measuring apparatus obtains an interference pattern by scanning the overall dimensions of a target object to be measured and detects whether or not the object is defective using the interference pattern, and thus has a low inspection speed.

Disclosure of Invention

Technical Problem

[0013] Therefore, the present invention has been made in view of the above problems, and it is an object of the present invention to provide a surface shape measuring system using white-light scanning interferometry, in which two-dimensional data through the size measurement and surface defect inspection of a target object to be measured are obtained and three-dimensional data regarding the shape and thickness of the target object are obtained using a single apparatus, and a surface shape measuring method using the same.

[0014] It is another object of the present invention to provide a surface shape measuring system using white-light scanning interferometry, in which two-dimensional data of a target object to be measured are obtained by selectively irradiating coaxial illumination and coaxial/falling illumination using a single apparatus, three-dimensional inspection regions of the target object are abstracted from the obtained two-dimensional data, and three-dimensional measurement is selectively performed only for the abstracted inspection regions, so as to simplify the apparatus and increase an inspection speed, and a surface shape measuring method using the same.

Technical Solution

[0015] In accordance with an aspect of the present invention, the above and other objects can be accomplished by the provision of a surface shape measuring system according to claim 1.

[0016] In accordance with another aspect of the present invention, there is provided a surface shape measuring method according to claim 10.

Brief Description of Drawings

[0017] The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a schematic view of a surface shape measuring system in accordance with the present invention

FIGS. 2 to 4 are schematic views illustrating modified embodiments of an illumination unit of the system of FIG. 1;

FIG. 5 is a perspective view illustrating an embodiment of a subsidiary light source of the system of FIG. 1;

FIG. 6 is an exemplary view illustrating an embodiment of a surface shape measuring method in accordance with the present invention and

FIG. 7 is a schematic view of a conventional surface shape measuring system using white-light scanning interferometry.

Best Mode for Carrying out the Invention

[0018] Now, preferred embodiments of the present invention will be described in detail with reference to the annexed drawings.

[0019] FIG. 1 is a schematic view of a surface shape measuring system in accordance with the present invention.

[0020] With reference to FIG. 1, the surface shape measuring system of the present invention includes an illumination unit 1, a beam splitter 2, a light detecting element 5, and a subsidiary light source 7.

[0021] The illumination unit 1 includes a main light source 11, a focusing lens 12 to focus light from the main light source 11, and a projection lens 13 to project the focused light from the focusing lens 12 to the beam splitter 2.

[0022] FIG. 2 is a schematic view illustrating another embodiment of the illumination unit 1 of FIG. 1. Here, the illumination unit 1 includes a main light source 11 including an illumination panel 11 and a plurality of light emitting diodes 111 arranged in a matrix shape on the illumination panel 11'.

[0023] The light emitting diodes 111 are divided into groups according to layers in the outward direction from the central light emitting diode 111a, and the turning-on of the light emitting diodes 111 is controlled according to the groups.

[0024] Further, the central light emitting diode 111a has a brightness value, which is higher than that of other peripheral light emitting diodes 111.

[0025] That is, two-dimensional inspection requires coaxial illumination having an area larger than that of an inspection region, and thus in the two-dimensional inspection, all the light emitting diodes 111 are turned on, or the plural layers of the light emitting diodes 111 are turned on.

[0026] Further, in three-dimensional inspection, in order to supply illumination near to a point light source, which favorably generates an interference pattern, only the light emitting diode 111a is preferably turned on.

[0027] FIG. 3 is a schematic view illustrating a further embodiment of the illumination unit 1 of FIG. 1. Here, the illumination unit 1 includes a main light source 11, a focusing lens 12, a projection lens 13, and an illumination panel 14.

[0028] A plurality of light emitting diodes 142 arranged in a matrix shape is provided on the illumination panel 14, and a pin hole 141 is formed through the center of the illumination panel 14.

[0029] In the above configuration, two-dimensional inspection requires coaxial illumination having an area larger than that of an inspection region, and thus in the two-dimensional inspection, the main light source 11 and all the light emitting diodes 142 of the illumination panel 14 are turned on, or the plural layers of the light emitting diodes 142 are selectively turned on.

[0030] Further, in three-dimensional inspection, in order to supply illumination near to a point light source, which favorably generates an interference pattern, only the main light source 11 is preferably turned on.

[0031] FIG. 4 is a schematic view illustrating a still further embodiment of the illumination unit 1 of FIG. 1. Here, the illumination unit 1 includes a main light source 11, a microscope objective lens 12, and an illumination panel 14.

[0032] A plurality of light emitting diodes 142 arranged in a matrix shape is provided on the illumination panel 14, and a pin hole 141 is formed through the center of the illumination panel 14.

[0033] In two-dimensional inspection, the main light source 11 and all the light emitting diodes 142 of the illumination panel 14 are turned on, and thus irradiate illumination light having an area larger than that of an inspection region onto the region.

[0034] Further, in three-dimensional inspection, only the main light source 11 is preferably turned on such that light emitted from the main light source 11 passes through the microscope objective lens 12' thus increasing the visibility of an interference pattern while maintaining resolution.

[0035] That is, when a light source emits light having a narrow wavelength or is near to a point light source, such as a laser source, an interference pattern is favorably generated, and when the light source emits light having a high wavelength, resolution is lowered. Thus, the microscope objective lens 12' which effectively focuses light on one point, is preferably used.

[0036] The beam splitter 2 splits illumination light emitted from the illumination unit1 into beams respectively irradiated onto a reference surface (R) and a surface (R) of a target object to be measured, and the light detecting element 5 captures an image with an interference pattern.

[0037] That is, the light detecting element 5 captures the image with the interference pattern obtained by the interference of a reference beam and an object beam, which are respectively reflected by the reference surface (R) and the surface (R) of the object, and includes a projection lens 13.

[0038] Further, a control computer 6 obtains surface shape data through the analysis of the white-light interference pattern from the image captured by the light detecting element 5, and detects whether or not the object 3 is defective through the analysis of the obtained data.

[0039] The subsidiary light source 7 is provided between the object 3 and the beam splitter 2, and provides falling illumination to the object 3.

[0040] The subsidiary light source 7, as shown in FIG. 5, includes a ring-shaped body 71, and a plurality of light emitting diodes 72 provided along the inner circumferential surface of the ring-shaped body 71.

[0041] Preferably, a mechanical shutter 8 to selectively intermit the irradiation of light onto the reference surface (R) is further provided between the beam splitter 2 and a reference mirror 4.

[0042] The above surface shape measuring system obtains size data from an image captured after the irradiation of coaxial illumination through the turning-on of the main light source 11, and obtains surface defect data from an image captured after the irradiation of coaxial/falling illumination through the turning-on of the main light source 11 and the subsidiary light source 7, thus obtaining two-dimensional data regarding size and surface defect.

[0043] Further, three-dimensional inspection regions of the object are abstracted using the obtained two-dimensional data, and three-dimensional measurement only for the abstracted three-dimensional inspection regions is performed.

[0044] That is, three-dimensional data are obtained by generating an interference pattern through the formation of a reference beam and an object beam only for the abstracted three-dimensional inspection regions and capturing the interference pattern.

[0045] Hereinafter, a surface shape measuring method using the surface shape measuring system of the present invention will be described.

[0046] First, two-dimensional data of a target object to be measured are obtained by selectively intermitting the turning-on of the main light source 11 and the subsidiary light source 7.

[0047] That is, only coaxial illumination is irradiated onto the surface (P) of the target object 3 by turning on the main light source 11, a first image is obtained by capturing the image of the surface (P) of the target object 3 using the light detecting element 5, and then a size of the target object is measured by analyzing the captured first image. At this time, the subsidiary light source 7 is turned off, and the irradiation of light onto the reference surface (R) is cut off using the mechanical shutter 8.

[0048] Thereafter, coaxial/falling illumination is irradiated onto the surface (P) of the target object 3 by turning on the main light source 11 and the subsidiary light source 7 simultaneously, a second image is obtained by capturing the image of the surface (P) of the target object 3 using the light detecting element 5, and then whether or not the surface (P) of the target object 3 is defective is detected by analyzing the captured second image. At this time, the irradiation of light onto the reference surface (R) is cut off using the mechanical shutter 8.

[0049] Here, in case that any one of the illumination units 1 of FIGS. 2 to 4 is used, since the light emitting diodes arranged in a matrix shape are divided into groups according to layers, it is preferable that the turning-on of the light emitting diodes in the respective groups is selectively controlled according to a desired area or brightness.

[0050] Inspection regions, for which three-dimensional inspection is performed, is abstracted using the above obtained two-dimensional data regarding the size and surface defect of the target object.

[0051] For example, as shown in FIG. 6, two-dimensional data for the overall surface of the target object are obtained, and regions requiring three-dimensional inspection, such as regions "A", are abstracted, and an interference pattern of a reference beam and an object beam for the corresponding regions is generated and then three-dimensional shape inspection is performed. Thereby, an inspection speed is increased.

[0052] Now, the three-dimensional shape inspection using white-light scanning interferometry, which analyzes an interference pattern generated by the interference of the reference beam and the object beam respectively reflected by the reference surface (R) and the measurement surface (P), will be described in brief.

[0053] First, the subsidiary light source 7 is turned off and only the main light source 11 is turned on, and the mechanical shutter 8 is opened such that light emitted from the main light source 11 is respectively irradiated onto the reference surface (R) and the measurement surface (P).

[0054] Then, the light is reflected by the reference surface (R) and the measurement surface (P), and thus produces a reference beam and an object beam. An interference pattern formed by the interference of the reference beam and the object beam is captured by the light detecting element 5.

[0055] Since the interference pattern formed by the interference of the reference beam and the object beam is obtained when the interference beam and the object beam have the same optical path, it is preferable that the height of the target object 3 or the distance of the reference mirror is properly adjusted using a fine driving unit (not shown), such as a PZT actuator.

[0056] In case that the main light source 11 includes a plurality of the light emitting diodes 111 arranged in a matrix shape, as shown in FIG. 2, only the central light emitting diode 111a having a brightness value, which is higher than that of other peripheral light emitting diodes 111, is preferably turned on in three-dimensional inspection so as to increase an interference pattern generating capacity.

Industrial Applicability

[0057] As described above, the surface shape measuring system of the present invention includes the main light source and the subsidiary light source respectively providing coaxial illumination and falling illumination to a target object to be measured, obtains two-dimensional data by selectively intermitting the turning-on of the respective light sources and cutting off the irradiation of light onto the reference surface, abstracts three-dimensional inspection regions of the target object from the obtained two-dimensional data, and performs three-dimensional inspection only for the abstracted inspection regions. Thus, the surface shape measuring system of the present invention obtains both the two-dimensional data and the three-dimensional data of the target object using a single apparatus, thereby being capable of simplifying the apparatus.

[0058] Further, the surface shape measuring system of the present invention obtains the two-dimensional data of the target object in advance, abstracts the three-dimensional inspection regions of the target object from the obtained two-dimensional data, and obtains three-dimensional data only for the corresponding regions, thereby being capable of improving an inspection speed.

Claims

1. A surface shape measuring system, comprising:

    an illumination unit (1) including a main light source (11), a focusing lens (12), and a projection lens (13);
    a beam splitter (2) to split illumination light emitted from the illumination unit (1) into beams respectively irradiated onto a reference surface (R) of a reference mirror and a measurement surface (P) of a target object to be measured;
    a light detecting element (5) to capture an interference pattern generated by the interference of a reference beam and an object beam respectively reflected by the reference surface (R) and the measurement surface (P);
    a control computer (6) to obtain surface shape data through white-light interference pattern analysis from an image captured by the light detecting element (5) and detect whether or not the measurement surface is defective from the obtained data, and:

    a subsidiary light source (7) to provide falling illumination to the target object (3), provided between the target object and the beam splitter (2);
    the control computer being configured to carry out the following steps :

    - obtaining two-dimensional data regarding the surface of the target object from size data through a first image captured using coaxial illumination, said coaxial illumination including the main light source being turned on and the subsidiary source being turned off, and from surface defect data through a second image captured using coaxial/falling illumination, said coaxial/falling illumination including the main light source and the subsidiary light source being turned on simultaneously, both the coaxial and the coaxial/falling illuminations including an irradiation of the illumination light onto the reference surface (R) being cut off (8);
    - abstracting three-dimensional inspection regions of the target object using the two-dimensional data; and
    - obtaining three-dimensional data regarding the surface shape of the target object by supplying the illumination light onto the reference surface (R),

    said obtaining of three-dimensional data being performed only for the abstracted three-dimensional inspection regions.

2. The surface shape measuring system according to claim 1, wherein a mechanical shutter (8) configured to selectively cut off the irradiation of the illumination light onto the reference surface (R) is provided between the beam splitter (2) and the reference mirror (4).

3. The surface shape measuring system according to claim 1 or 2, wherein the subsidiary light source (7)

includes:

a ring-shaped body (71); and
a plurality of light emitting diodes (72) provided along the inner circumferential surface of the ring-shaped body (71) .

4. The surface shape measuring system according to claim 1, wherein the main light source (11) includes:

an illumination panel (11'); and
a plurality of light emitting diodes (111) arranged in a matrix shape on the illumination panel.

5. The surface shape measuring system according to claim 4, wherein the plurality of light emitting diodes (111) is divided into groups according to layers in the outward direction from a central light emitting diode (111a) such that the turning-on of the plurality of light emitting diodes is controllable according to the groups.

6. The surface shape measuring system according to claim 5, wherein the central light emitting diode (111a) among the plurality of light emitting diodes (111) has a brightness value being higher than that of other peripheral light emitting diodes.

7. The surface shape measuring system according to claim 1, wherein the illumination unit (1) further includes:

an illumination panel (14) formed between the focusing lens (12) and the projection lens (13), and provided with a pin hole (141) formed through the center of the illumination panel (14); and
a plurality of light emitting diodes (142) arranged in a matrix shape on the illumination panel.

8. The surface shape measuring system according to claim 7, wherein the plurality of light emitting diodes (142) is divided into groups according to layers in the outward direction from a central light emitting diode such that the turning-on of the plurality of light emitting diodes is controllable according to the groups.

9. The surface shape measuring system according to claim 7 or 8, wherein the focusing lens (12) is a microscope objective lens (12').

10. A surface shape measuring method, in which illumination light emitted from a main light source (11) is split into beams, respectively irradiated onto a reference surface (R) of a reference mirror and a measurement surface (P) of a target object (3) to be measured, by a beam splitter (2), comprising:

obtaining two-dimensional data of the target object by cutting off the supply of the illumination light onto the reference surface, said obtaining of the two-dimensional data including : obtaining size data of the target object using coaxial illumination including the main light source being turned on and a subsidiary light source, provided between the beam splitter and the target object, being turned off ; and obtaining surface defect data using coaxial/falling illumination including the main light source and the subsidiary light source being turned on simultaneously ;
abstracting three-dimensional inspection regions from the obtained two-dimensional data; and
obtaining three-dimensional data of the target object by generating an interference pattern for each of the abstracted inspection regions and capturing the interference pattern, said interference pattern being generated by the interference of a reference beam and an object beam respectively reflected by the reference surface and the measurement surface.

11. The surface shape measuring method according to claim 10, wherein in the obtaining of the two-dimensional data, a cutting off of the supply of the illumination light onto the reference surface is selectively carried out through the intermission of a mechanical shutter (8).

Patentansprüche

1. System zum Messen einer Oberflächenform, umfassend:

eine Beleuchtungseinheit (1), die eine Hauptlichtquelle (11), eine Fokussierungslinse (12) und eine Projektionslinse (13) umfasst;
einen Strahlteiler (2) zum Teilen von Beleuchtungslicht, das von der Beleuchtungseinheit (1) emittiert wird, in Strahlen, die auf eine Referenzfläche (R) eines Referenzspiegels bzw. eine Messfläche (P) eines zu messenden Zielobjekts gestrahlt werden;
ein Lichtdetektionselement (5) zum Erfassen eines Interferenzmusters, das durch die Interferenz eines Referenzstrahls und eines Objektstrahls erzeugt wird, die durch die Referenzfläche (R) bzw. die Messfläche (P) reflektiert werden;
einen Steuercomputer (6) zum Erhalten von Oberflächenformdaten durch eine Weißlichtanalyse des Interferenzmusters aus einem Bild, das durch das Lichtdetektionselement (5) erfasst wird, und Detektieren aus den erhaltenen Daten, ob die Messfläche fehlerhaft ist oder

nicht; und
eine Hilfslichtquelle (7) zum Bereitstellen von fallender Beleuchtung für das Zielobjekt (3), die zwischen dem Zielobjekt und dem Strahlteiler (2) vorgesehen ist;
wobei der Steuercomputer zum Ausführen der folgenden Schritte ausgelegt ist:

- Erhalten von zweidimensionalen Daten in Bezug auf die Oberfläche des Zielobjekts aus Größendaten durch ein erstes Bild, das unter Verwendung von koaxialer Beleuchtung erfasst wird, wobei die koaxiale Beleuchtung umfasst, dass die Hauptlichtquelle eingeschaltet ist und die Hilfslichtquelle ausgeschaltet ist, und aus Oberflächenfehlerdaten durch ein zweites Bild, das unter Verwendung von koaxialer/fallender Beleuchtung erfasst wird, wobei die koaxiale/fallende Beleuchtung umfasst, dass die Hauptlichtquelle und die Hilfslichtquelle gleichzeitig eingeschaltet sind, wobei sowohl die koaxiale als auch die koaxiale/fallende Beleuchtung eine Strahlung des Beleuchtungslichts auf die Referenzfläche (R) umfassen, die unterbrochen wird (8);
- Abstrahieren von dreidimensionalen Prüfregionen des Zielobjekts unter Verwendung der zweidimensionalen Daten; und
- Erhalten von dreidimensionalen Daten in Bezug auf die Oberflächenform des Zielobjekts durch Zuführen des Beleuchtungslichts zur Referenzoberfläche (R),
wobei das Erhalten von dreidimensionalen Daten nur für die abstrahierten dreidimensionalen Prüfregionen durchgeführt wird.

2. System zum Messen einer Oberflächenform nach Anspruch 1, wobei eine mechanische Blende (8), die zum selektiven Unterbrechen der Strahlung des Beleuchtungslichts auf die Referenzfläche (R) ausgelegt ist, zwischen dem Strahlteiler (2) und dem Referenzspiegel (4) vorgesehen ist.

3. System zum Messen einer Oberflächenform nach Anspruch 1 oder 2, wobei die Hilfslichtquelle (7) umfasst:

einen ringförmigen Körper (71); und
eine Mehrzahl von Leuchtdioden (72), die entlang der Innenumfangsfläche des ringförmigen Körpers (71) vorgesehen ist.

4. System zum Messen einer Oberflächenform nach Anspruch 1, wobei die Hauptlichtquelle (11) umfasst:

eine Beleuchtungsplatte (11'); und
eine Mehrzahl von Leuchtdioden (111), die in einer Matrixform auf der Beleuchtungsplatte angeordnet ist.

5. System zum Messen einer Oberflächenform nach Anspruch 4, wobei die Mehrzahl von Leuchtdioden (111) gemäß Schichten in der Auswärtsrichtung von einer mittigen Leuchtdiode (111a) in Gruppen geteilt ist, derart dass das Einschalten der Mehrzahl von Leuchtdioden gemäß den Gruppen gesteuert werden kann.

6. System zum Messen einer Oberflächenform nach Anspruch 5, wobei die mittige Leuchtdiode (111a) unter der Mehrzahl von Leuchtdioden (111) einen Helligkeitswert aufweist, der höher als der von anderen peripheren Leuchtdioden ist.

7. System zum Messen einer Oberflächenform nach Anspruch 1, wobei die Beleuchtungseinheit (1) ferner umfasst:

eine Beleuchtungsplatte (14), die zwischen der Fokussierungslinse (12) und der Projektionslinse (13) ausgebildet und mit einem Stiftloch (141) versehen ist, das durch die Mitte der Beleuchtungsplatte (14) ausgebildet ist; und
eine Mehrzahl von Leuchtdioden (142), die in einer Matrixform auf der Beleuchtungsplatte angeordnet ist.

8. System zum Messen einer Oberflächenform nach Anspruch 7, wobei die Mehrzahl von Leuchtdioden (142) gemäß Schichten in der Auswärtsrichtung von einer mittigen Leuchtdiode in Gruppen geteilt ist, derart dass das Einschalten der Mehrzahl von Leuchtdioden gemäß den Gruppen gesteuert werden kann.

9. System zum Messen einer Oberflächenform nach Anspruch 7 oder 8, wobei die Fokussierungslinse (12) eine Mikroskop-Objektivlinse (12') ist.

10. Verfahren zur Messung einer Oberflächenform, wobei Beleuchtungslicht, das von ein Hauptlichtquelle (11) emittiert wird, durch einen Strahlteiler (2) in Strahlen geteilt wird, die auf eine Referenzfläche (R) eines Referenzspiegels bzw. eine Messfläche (P) eines zu messenden Zielobjekts (3) gestrahlt werden, umfassend:

Erhalten von zweidimensionalen Daten des Zielobjekts durch Unterbrechen der Zufuhr des Beleuchtungslichts zur Referenzoberfläche, wobei das Erhalten der zweidimensionalen Daten umfasst: Erhalten von Größendaten des Zielobjekts unter Verwendung von koaxialer Beleuchtung, die umfasst, dass die Hauptlichtquelle eingeschaltet wird und eine Hilfslichtquelle, die zwischen dem Strahlteiler und dem Zielob-

jekt vorgesehen ist, ausgeschaltet wird; und Erhalten von Oberflächenfehlerdaten unter Verwendung von koaxialer/fallender Beleuchtung, die umfasst, dass die Hauptlichtquelle und die Hilfslichtquelle gleichzeitig eingeschaltet werden;
Abstrahieren von dreidimensionalen Prüfregionen aus den erhaltenen zweidimensionalen Daten; und
Erhalten von dreidimensionalen Daten des Zielobjekts durch Erzeugen eines Interferenzmusters für jede der abstrahierten Prüfregionen und Erfassen des Interferenzmusters, wobei das Interferenzmuster durch die Interferenz eines Referenzstrahls und eines Objektstrahls erzeugt wird, die durch die Referenzfläche bzw. die Messfläche reflektiert werden.

11. Verfahren zur Messung einer Oberflächenform nach Anspruch 10, wobei beim Erhalten der zweidimensionalen Daten ein selektives Unterbrechen der Zufuhr des Beleuchtungslichts zur Referenzfläche durch die Unterbrechung einer mechanischen Blende (8) selektiv durchgeführt wird.

Revendications

1. Système de mesure de forme superficielle, comprenant :

une unité d'éclairage (1) incluant une source de lumière principale (11), une lentille de focalisation (12) et une lentille de projection (13) ;
un diviseur de faisceau (2) pour diviser la lumière d'éclairage émise par l'unité d'éclairage (1) en faisceaux irradiés respectivement sur une surface de référence (R) d'un miroir de référence et sur une surface de mesure (P) d'un objet cible à mesurer ;
un élément de détection de lumière (5) pour capturer un diagramme d'interférence généré par l'interférence d'un faisceau de référence et d'un faisceau d'objet réfléchis respectivement par la surface de référence (R) et la surface de mesure (P) ;
un ordinateur pilote (6) pour obtenir des données de forme superficielle par analyse du diagramme d'interférence de lumière blanche à partir d'une image capturée par l'élément de détection de lumière (5) et détecter si la surface de mesure est défectueuse ou non à partir des données obtenues, et ;
une source de lumière auxiliaire (7) pour fournir un éclairage tombant à l'objet cible (3), prévue entre l'objet cible et le diviseur de faisceau (2) ;
l'ordinateur pilote étant configuré pour réaliser les étapes suivantes :

- obtention de données bidimensionnelles concernant la surface de l'objet cible à partir de données de taille par l'intermédiaire d'une première image capturée au moyen d'un éclairage coaxial, ledit éclairage coaxial incluant la source de lumière principale allumée et la source auxiliaire éteinte, et à partir de données de défauts de surface par le biais d'une seconde image capturée au moyen d'un éclairage coaxial/tombant, ledit éclairage coaxial/tombant incluant la source de lumière principale et la source de lumière auxiliaire allumées simultanément, les éclairages coaxiaux et coaxiaux/tombants incluant une irradiation de la lumière d'éclairage sur la surface de référence (R) coupée (8) ;
- abstraction des régions d'inspection tridimensionnelles de l'objet cible au moyen des données bidimensionnelles ; et
- obtention de données tridimensionnelles concernant la forme superficielle de l'objet cible en fournissant la lumière d'éclairage sur la surface de référence (R),

ladite obtention de données tridimensionnelles étant réalisée uniquement pour les régions d'inspection tridimensionnelles abstraites.

2. Système de mesure d'une forme superficielle selon la revendication 1, dans lequel un obturateur mécanique (8) configuré pour couper sélectivement l'irradiation de la lumière d'éclairage sur la surface de référence (R) est prévu entre le diviseur de faisceau (2) et le miroir de référence (4).

3. Système de mesure d'une forme superficielle selon la revendication 1 ou 2, dans lequel la source de lumière auxiliaire (7) inclut :

un corps de forme annulaire (71) ; et
une pluralité de diodes électroluminescentes (72) prévues le long de la surface circonférentielle interne du corps de forme annulaire (71).

4. Système de mesure d'une forme superficielle selon la revendication 1, dans lequel la source de lumière principale (11) inclut :

un panneau d'éclairage (11') ; et
une pluralité de diodes électroluminescentes (111) agencées en une forme matricielle sur le panneau d'éclairage.

5. Système de mesure d'une forme superficielle selon la revendication 4, dans lequel la pluralité de diodes électroluminescentes (111) est divisée en groupes en fonction des couches dans la direction extérieure par rapport à une diode électroluminescente centrale (111a) de telle sorte que l'activation de la pluralité de diodes électroluminescentes peut être contrôlée en fonction des groupes.

6. Système de mesure d'une forme superficielle selon la revendication 5, dans lequel la diode électroluminescente centrale (111a) parmi la pluralité de diodes électroluminescentes (111) a une valeur de luminosité supérieure à celle des autres diodes électroluminescentes périphériques.

7. Système de mesure d'une forme superficielle selon la revendication 1, dans lequel l'unité d'éclairage (1) inclut en outre :

un panneau d'éclairage (14) formé entre la lentille de focalisation (12) et la lentille de projection (13), et doté d'un trou d'aiguille (141) formé à travers le centre du panneau d'éclairage (14) ; et
une pluralité de diodes électroluminescentes (142) agencées selon une forme matricielle sur le panneau d'éclairage.

8. Système de mesure d'une forme superficielle selon la revendication 7, dans lequel la pluralité de diodes électroluminescentes (142) est divisée en groupes en fonction des couches dans la direction extérieure par rapport à une diode électroluminescente centrale de telle sorte que l'activation de la pluralité de diodes électroluminescentes peut être contrôlée en fonction des groupes.

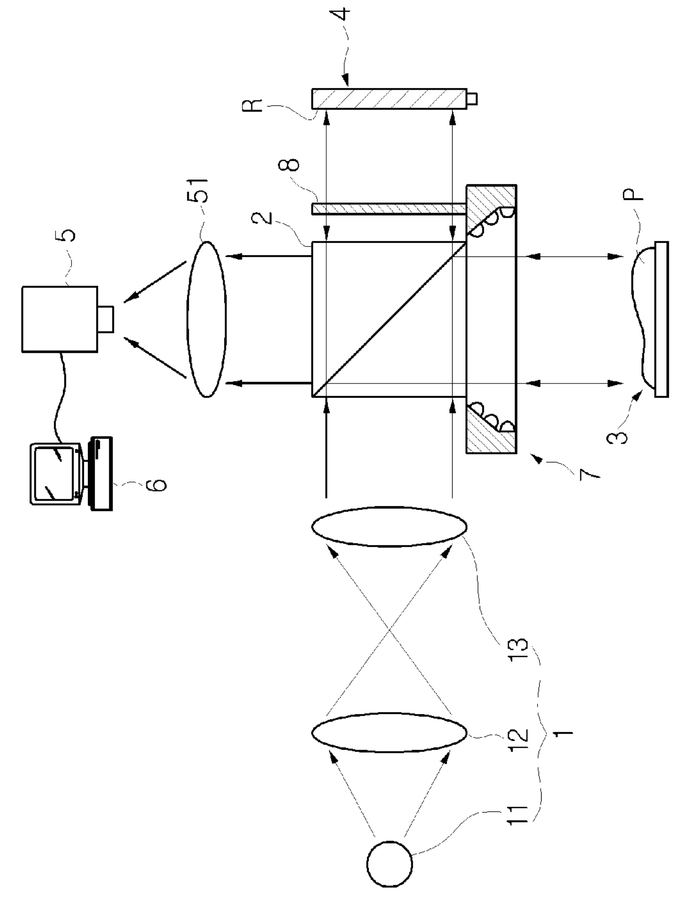
9. Système de mesure d'une forme superficielle selon la revendication 7 ou 8, dans lequel la lentille de focalisation (12) est un objectif de microscope (12').

10. Procédé de mesure d'une forme superficielle, dans lequel la lumière d'éclairage émise par une source de lumière principale (11) est divisée en faisceaux, irradiés respectivement sur une surface de référence (R) d'un miroir de référence et sur une surface de mesure (P) d'un objet cible (3) à mesurer, par un diviseur de faisceau (2), comprenant :

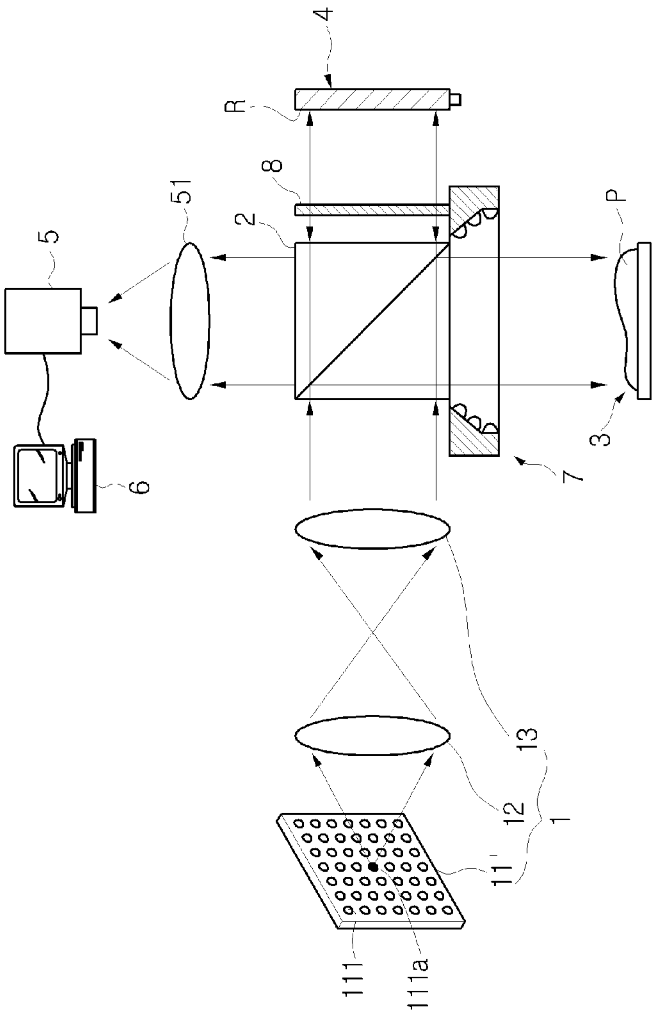
l'obtention de données bidimensionnelles de l'objet cible par coupure de la fourniture de la lumière d'éclairage sur la surface de référence, ladite obtention des données bidimensionnelles incluant : l'obtention de données de taille de l'objet cible au moyen de l'éclairage coaxial incluant la source de lumière principale allumée et une source de lumière auxiliaire, prévue entre le diviseur de faisceau et l'objet cible, éteinte ; et
l'obtention de données de défauts superficiels au moyen de l'éclairage coaxial/tombant incluant la source de lumière principale et la source de lumière auxiliaire allumées simultanément ;
l'abstraction de régions d'inspection tridimensionnelles des données bidimensionnelles obtenues ; et
l'obtention de données tridimensionnelles de l'objet cible en générant un diagramme d'interférence pour chacune des régions d'inspection abstraites et en capturant le diagramme d'interférence, ledit diagramme d'interférence étant généré par l'interférence d'un faisceau de référence et d'un faisceau d'objet réfléchis respectivement par la surface de référence et la surface de mesure.

11. Procédé de mesure de forme superficielle selon la revendication 10, dans lequel dans l'obtention des données bidimensionnelles, une coupure de la fourniture de la lumière d'éclairage sur la surface de référence est réalisée sélectivement par l'intermission d'un obturateur mécanique (8).

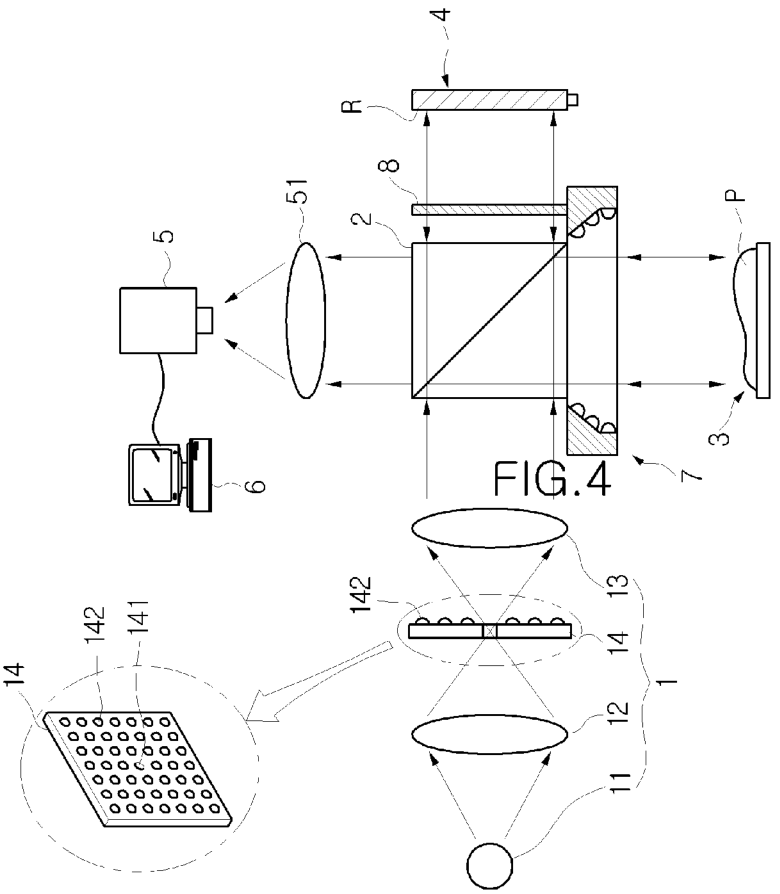
[Fig. 1]



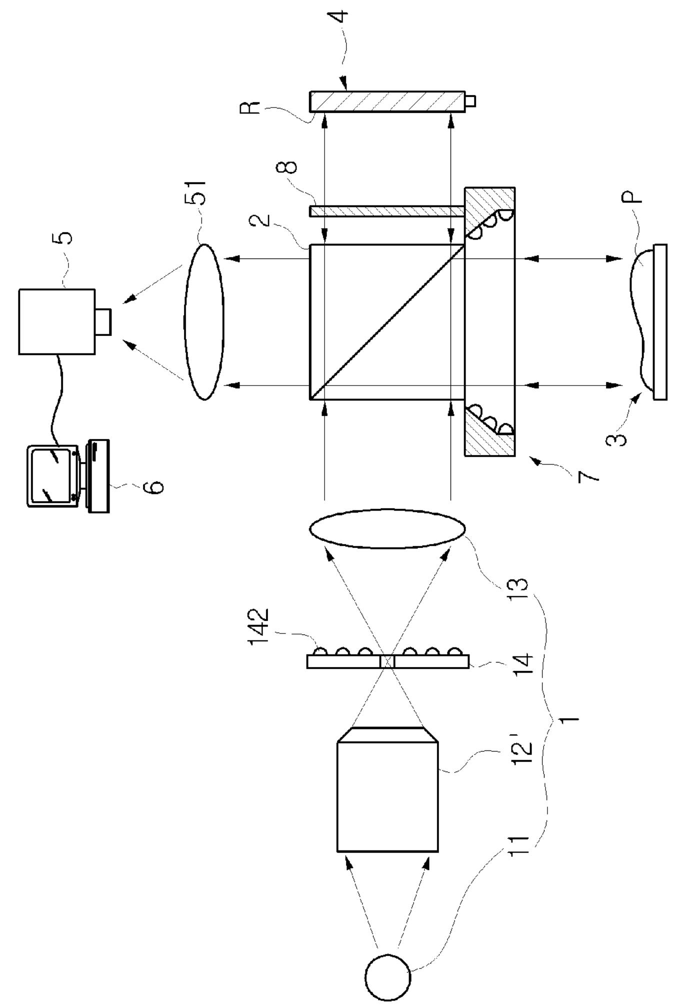
[Fig. 2]



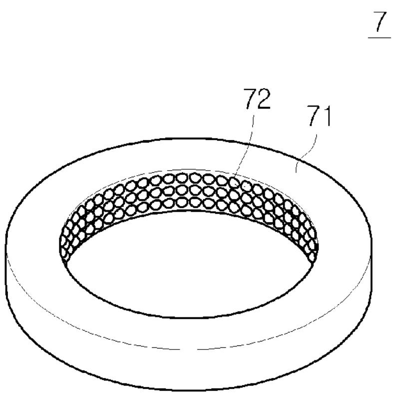
[Fig. 3]



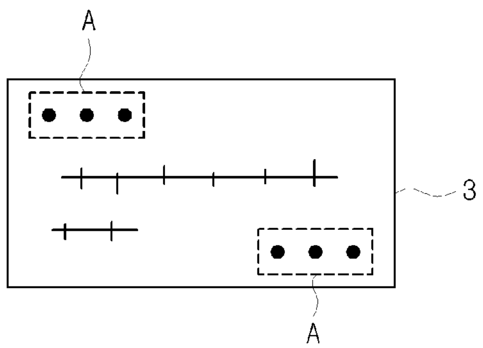
[Fig. 4]



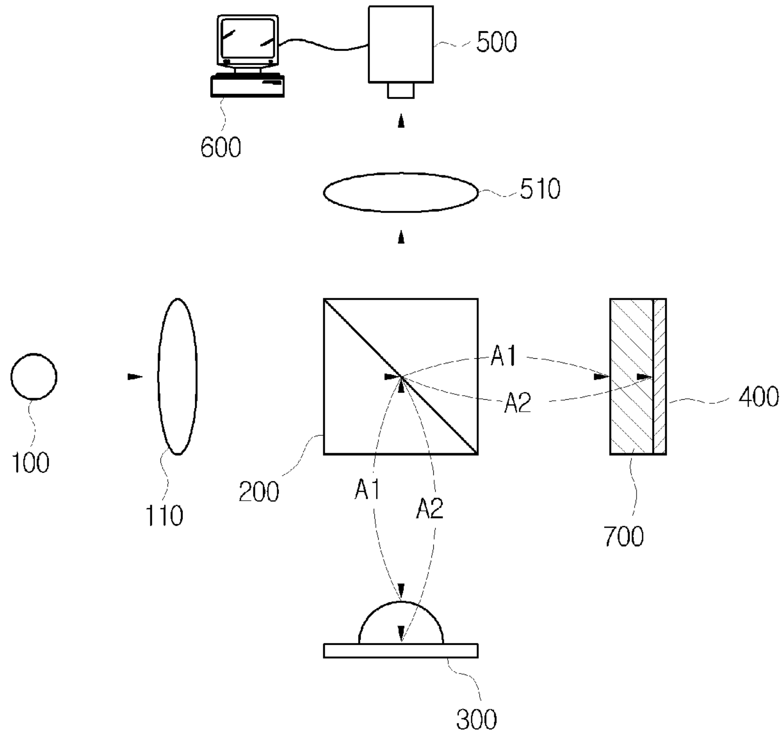
[Fig. 5]



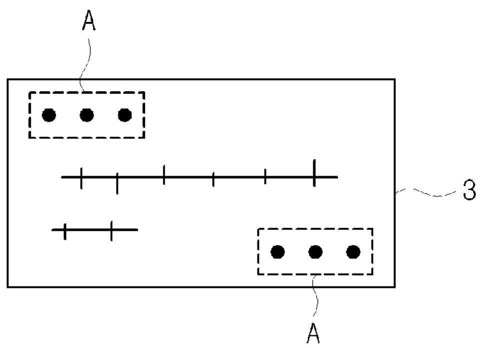
[Fig. 6]



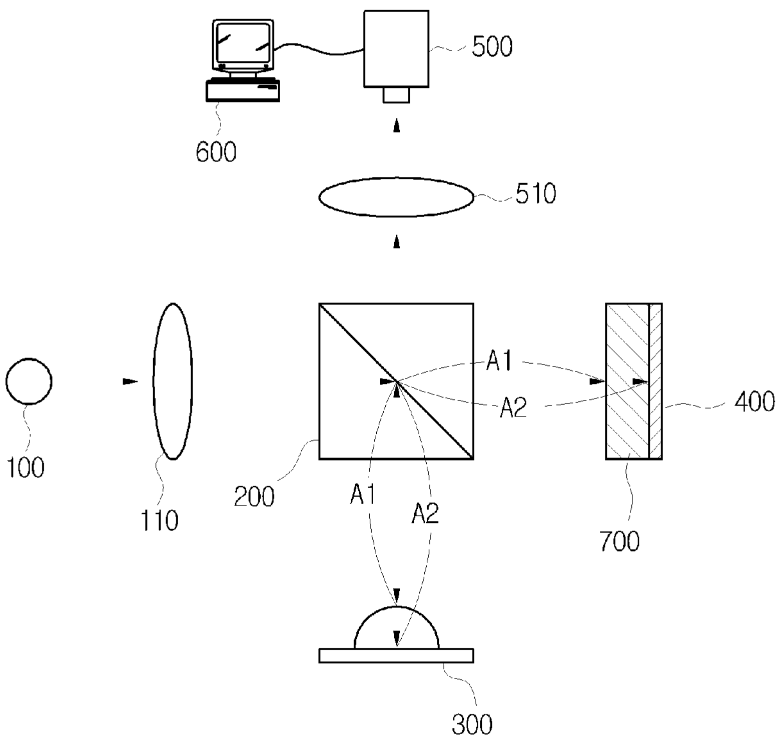
[Fig. 7]



[Fig. 6]



[Fig. 7]



REFERENCES CITED IN THE DESCRIPTION

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