

CLAIMS

1. A microscope device for inspecting structured objects (4), including:

- a camera (1),
- 5 - optical imaging means (2) capable of producing, on the camera (1), an image of the object (4) according to a field of view, which optical imaging means (2) include a distal lens (3) arranged on the side of the object (4), and
- a low-coherence infrared interferometer (5) including a
10 measurement beam (6) with a plurality of infrared wavelengths, capable of producing measurements by means of interferences between retroreflections of said measurement beam (6) and at least one separate optical reference,
 characterised in that:
- 15 - it further includes coupling means (7) for injecting the measurement beam into the optical imaging means (2) in such a way that it passes through the distal lens (3), and that it intercepts said object (4) according to a measurement region substantially included in the field of view of the imaging means (2), and
- 20 - the low-coherence infrared interferometer (5) is balanced in such a way that only the measurement beam retroreflections (6), taking place at optical distances close to the optical distance covered by said beam (6) to the object (4), defining a measurement range, produce measurements.

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2. The device according to claim 1, characterised in that the distal lens (3) is designed to produce images at visible wavelengths.

3. The device according to claim 1 or 2, characterised in that
30 the distal lens (3) includes a microscope lens.

4. The device according to one of the preceding claims, characterised in that the measurement beam (6) includes wavelengths between 1100 and 1700 nanometres.

5. The device according to one of the preceding claims, characterised in that it further includes first magnifying means (3, 8) for changing the magnification of the optical images means (2) so as to simultaneously modify the field of view and the dimension of the measurement region in substantially identical proportions.

6. The device according to claim 5, characterised in that said first magnifying means (3, 8) include at least one element from a turret equipped with optics having different magnifications, and a variable magnification optics.

7. The device according to one of the preceding claims, characterised in that it further includes second magnifying means (9) for modifying the magnification of the measurement beam (6), so as to modify the dimension of the measurement region relative to the field of view.

8. The device according to one of the preceding claims, characterised in that it further includes relative displacement means (10) of the object (4) and the optical imaging means (2).

9. The device according to one of the preceding claims, characterised in that it further includes relative displacement means (11) of the object (4) and the measurement beam (6).

10. The device according to one of the preceding claims, characterised in that it further includes lighting means (12), producing a lighting beam (25) with visible wavelengths, arranged in such a way as to illuminate the object (4) through the distal lens (3).

11. The device according to claim 10, characterised in that it further includes, at the distal lens (3), a full field interferometer (13) capable of producing on the camera (1), interference fringes superimposed with

the image of the object, so as to deduce therefrom a topography of the surface of the object (4).

12. The device according to claim 11, characterised in that the
5 full field interferometer includes a dichroic element (30, 31, 32) substantially transparent to the wavelengths of the measurement beam (6).

13. The device according to one of the preceding claims,
10 characterised in that it further includes lighting means (14) arranged opposite the object with respect to the imaging means, including a light source with wavelengths higher than one micrometre.

14. The device according to one of the preceding claims,
15 characterised in that the low-coherence infrared interferometer (5) allows to measure in the measurement range, at least one of the following elements:

- the optical thickness of at least one layer of material substantially transparent to wavelengths of the measurement beam,
- 20 - the height of patterns at least a high part of which and at least a low part of which are included in the measurement region,
- the absolute height, in the measurement range, of points of contact between the measurement beam (6) and the object (4).

15. The device according to one of the preceding claims,
25 characterised in that it further includes a viewing beam (15) superimposed with the measurement beam (6), which viewing beam (15) includes at least one wavelength detectable by the camera (1).

16. The device according to one of the preceding claims,
30 characterised in that it further includes digital processing and displaying means (16), capable of producing an image of the field of view including a display of the measurement region.

17. A method for inspecting structured objects (4) including:

- producing, on a camera (1), an image of the object (4) according to a field of view, implementing a distal lens (3) arranged on the side of the object (4), and

5 - producing measurements by interferences between retroreflections of a measurement beam (6) and at least one separate optical reference, from a low-coherence infrared interferometer (5) emitting this measurement beam (6) with a plurality of infrared wavelengths,

characterised in that:

10 - it further includes a coupling (7) for inserting the measurement beam into the optical imaging means (2) in such a way that it passes through the distal lens (3) and that it intercepts said object (4) according to a measurement region substantially included in the field of view of the imaging means (2), and

15 - the low-coherence infrared interferometer (5) is balanced in such a way that only the measurement beam retroreflections (6), taking place at optical distances close to the optical distance covered by said beam (6) to the object (4), defining a measurement range, produce measurements.

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18. The method according to claim 17, characterised in that the location of the measurement region in the image of the field of view is stored during a prior calibration.

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19. The method according to one of claims 17 and 18, characterised in that the information from the camera (1) and the low-coherence infrared interferometer (5) is combined to produce a three-dimensional representation of the object (4).

CLAIMS

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- a camera (1),

5 - optical imaging means (2) capable of producing, on the camera (1), an image of the object (4) according to a field of view, which optical imaging means (2) include a distal lens (3) arranged on the side of the object (4),

10 - a low-coherence infrared interferometer (5), comprising a measurement beam (6) with a plurality of infrared wavelengths, capable of producing measurements by means of interferences between retroreflections of said measurement beam (6) and at least one optical reference,

15 - a collimator (20) and optical coupling means (7) for injecting the measurement beam issued from an optical fiber (21) of the interferometer (5) into the optical imaging means (2) in such a way that it passes through the distal lens (3), and that it intercepts said object (4) according to a measurement region substantially included in the field of view of the imaging means (2),
20 characterized in that:

- the optical fiber (21) and the collimator (20) are arranged so that part of the measurement beam is reflected in the optical fiber (21) at the collimator (21) to generate the optical reference, and

25 - the low-coherence infrared interferometer (5) is balanced in such a way that only the measurement beam retroreflections (6), taking place at optical distances close to the optical distance covered by said beam (6) to the object (4), defining a measurement range, produce measurements.

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2. The device according to claim 1, characterised in that the distal lens (3) is designed to produce images at visible wavelengths.

35 3. The device according to claim 1 or 2, characterised in that the distal lens (3) includes a microscope lens.

4. The device according to one of the preceding claims, characterised in that the measurement beam (6) includes wavelengths between 1100 and 1700 nanometres.

5. The device according to one of the preceding claims, characterised in that it further includes first magnifying means (3, 8) for changing the magnification of the optical images means (2) so as to simultaneously modify the field of view and the dimension of the measurement region in substantially identical proportions.

6. The device according to claim 5, characterised in that said first magnifying means (3, 8) include at least one element from a turret equipped with optics having different magnifications, and a variable magnification optics.

7. The device according to one of the preceding claims, characterised in that it further includes second magnifying means (9) for modifying the magnification of the measurement beam (6), so as to modify the dimension of the measurement region relative to the field of view.

8. The device according to one of the preceding claims, characterised in that it further includes relative displacement means (10) of the object (4) and the optical imaging means (2).

9. The device according to one of the preceding claims, characterised in that it further includes relative displacement means (11) of the object (4) and the measurement beam (6).

10. The device according to one of the preceding claims, characterised in that it further includes lighting means (12), producing a lighting beam (25) with visible wavelengths, arranged in such a way as to illuminate the object (4) through the distal lens (3).

11. The device according to claim 10, characterised in that it further includes, at the distal lens (3), a full field interferometer (13) capable of producing on the camera (1), interference fringes superimposed with

the image of the object, so as to deduce therefrom a topography of the surface of the object (4).

12. The device according to claim 11, characterised in that the
5 full field interferometer includes a dichroic element (30, 31, 32) substantially transparent to the wavelengths of the measurement beam (6).

13. The device according to one of the preceding claims,
10 characterised in that it further includes lighting means (14) arranged opposite the object with respect to the imaging means, including a light source with wavelengths higher than one micrometre.

14. The device according to one of the preceding claims,
15 characterised in that the low-coherence infrared interferometer (5) allows to measure in the measurement range, at least one of the following elements:

- the optical thickness of at least one layer of material substantially transparent to wavelengths of the measurement beam,
- 20 - the height of patterns at least a high part of which and at least a low part of which are included in the measurement region,
- the absolute height, in the measurement range, of points of contact between the measurement beam (6) and the object (4).

15. The device according to one of the preceding claims,
25 characterised in that it further includes a viewing beam (15) superimposed with the measurement beam (6), which viewing beam (15) includes at least one wavelength detectable by the camera (1).

16. The device according to one of the preceding claims,
30 characterised in that it further includes digital processing and displaying means (16), capable of producing an image of the field of view including a display of the measurement region.

17. A method for inspecting structured objects (4), comprising:
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- producing, on a camera (1), an image of the object (4) according to a field of view, implementing a distal lens (3) arranged on the side of the object (4), and

5 - producing measurements by interferences between retroreflections of a measurement beam (6) and at least one optical reference, from a low-coherence infrared interferometer (5) emitting this measurement beam (6) with a plurality of infrared wavelengths,

10 - providing an optical coupling (7) for inserting the measurement beam issued from an optical fiber (21) of the interferometer (50) and a collimator (20) into the optical imaging means (2) in such a way that it passes through the distal lens (3) and that it intercepts said object (4) according to a measurement region substantially included in the field of view of the imaging
15 means (2), and

characterized in that it further comprises:

- generating the optical reference by reflecting part of the measurement beam in the optical fiber (21) at the collimator (20), and

20 - balancing the low-coherence infrared interferometer (5) in such a way that only the measurement beam retroreflections (6), taking place at optical distances close to the optical distance covered by said beam (6) to the object (4), defining a measurement range, produce measurements.

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18. The method according to claim 17, characterised in that the location of the measurement region in the image of the field of view is stored during a prior calibration.

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19. The method according to one of claims 17 and 18, characterised in that the information from the camera (1) and the low-coherence infrared interferometer (5) is combined to produce a three-dimensional representation of the object (4).