CLAIMS

1. An optical examination device (100) for rectangular semiconductor components (2) detached from a substrate (40), comprising:

an extraction device, which comprises a first receiving unit (60), which receives a single rectangular semiconductor component (2) detached from a substrate (40), and a second receiving unit (62), which conveys the semiconductor component into an examination position,

a first illumination arrangement (4, 6), a second illumination arrangement (8, 10) and an imaging device (12, 14), wherein

the imaging device (12, 14) comprises at least a first imaging sensor (12) and a second imaging sensor (14), wherein the first imaging sensor (12) and the second imaging sensor (14) are pointed at different surfaces respectively of the semiconductor component (2) located in the examination position, and

the first illumination arrangement (4, 6) consists of one or more LEDs, which emit infrared light perpendicularly onto two surfaces respectively facing away from the imaging device (12, 14) and adjoining one another perpendicularly of the semiconductor component (2) located in the examination position, wherein the infrared light fully penetrates the semiconductor component (2) at least proportionally, and

the second illumination arrangement (8, 10) consists of one or more LEDs, which emit visible light perpendicularly onto two surfaces respectively facing the imaging device (12, 14) and adjoining one another perpendicularly of the semiconductor component located in the examination position, which surfaces lie respectively opposite the surfaces onto which infrared light from the first illumination arrangement (4, 6) is directed,

the first illumination arrangement (4, 6) and the second illumination arrangement (8, 10) illuminate the semiconductor component (2) simultaneously, and

the first imaging sensor (12) and a second imaging sensor (14) are each configured and arranged to detect both the light spectrum emitted by the first illumination arrangement (4, 6) and the light spectrum emitted by the second illumination arrangement (8, 10), and

to provide respectively for downstream evaluation on the basis of both the visible and the infrared light spectrum a separate image capture in each case for determining property defects or damage of the semiconductor component (2), wherein the imaging sensors (12, 14) use the same optical beam path, at least in sections, to record the visible light reflected by the component (2) and to record the infrared light penetrating the component (2).

2. An optical examination device (200) for rectangular semiconductor components (2) detached from a substrate, comprising:

a turning device, which comprises at least one pick-up, which holds a rectangular semiconductor component (2) by means of negative pressure,

a first illumination arrangement (4, 6), a second illumination arrangement (8, 10) and an imaging device (12, 14), wherein

the imaging device (12, 14) comprises at least a first imaging sensor (12) and a second imaging sensor (14), wherein the first imaging sensor (12) and the second imaging sensor (14) are pointed at different surfaces respectively of the semiconductor component (2) held by the at least one pick-up, and

the first illumination arrangement (4, 6) consists of several LEDs, which emit infrared light perpendicularly onto two opposing surfaces respectively facing away from the imaging device (12, 14) of the semiconductor component (2) held by the at least one pick-up, wherein the infrared light fully penetrates the semiconductor component (2) at least proportionally, and

the second illumination arrangement (8, 10) consists of several LEDs, which emit visible light perpendicularly onto two opposing surfaces respectively facing the imaging device (12, 14) of the semiconductor component (2) held

by the at least one pick-up, wherein the first illumination arrangement (4, 6) and

the second illumination arrangement (8, 10) illuminate the semiconductor component (2) simultaneously, and

the first imaging sensor (12) and a second imaging sensor (14) are each configured and arranged to detect both the light spectrum emitted by the first illumination arrangement (4, 6) and the light spectrum emitted by the second illumination arrangement (8, 10), and

to provide respectively for downstream evaluation on the basis of both the visible and the infrared light spectrum a separate image capture in each case for determining property defects or damage of the semiconductor component (2), wherein the imaging sensors (12, 14) use the same optical beam path, at least in sections, to record the visible light reflected by the component (2) and to record the infrared light penetrating the component (2), and wherein

both the visible and the infrared light is to be conducted respectively by an optically active element (22, 24), which is configured and arranged to have a predetermined degree of permeability for visible and infrared light in the respectively common emission direction of the first and second illumination arrangement (4, 6, 8, 10) and to have a predetermined degree of reflection of visible and infrared light from the direction opposed by 180° in each case, wherein

the reflection direction of the visible light and of the infrared light is unequal to the common emission directions of the first and second illumination arrangement (4, 6, 8, 10) and the direction opposed to it by 180°, and

the imaging device comprises a first camera (12) and a second camera (14), wherein both cameras are configured and arranged to provide image captures on the basis of visible and infrared light, wherein

each of the two cameras (12, 14) is pointed at one of the surfaces of the semiconductor component (2) onto which light is directed by the first and second illumination arrangement (4, 6, 8, 10).

3. The optical examination device (100) according to Claim 1, wherein the examination device (100) comprises a number of optically active elements.

4. The optical examination device (100, 200) according to Claim 1 or 2, wherein the examination device (100, 200) comprises at least one half mirror (22, 24), wherein

the half mirror (22, 24) is arranged at an angle of 45° to the optical axis of the imaging device (12, 14) and serves to couple light of the first and/or second illumination arrangement (4, 6, 8, 10) optically and to direct it onto the component (2), and wherein

the half mirror (22, 24) is suitable and arranged to direct the visible light reflected by the component (2) and the infrared light penetrating the component (2) onto the imaging device (12, 14).

5. The optical examination device (100, 200) according to Claim 1 or 2, wherein the first and/or the second illumination arrangement (4, 6, 8, 10) consists/consist of one or more LED(s), wherein

the LED(s) of the first illumination arrangement (4, 6) emits/emit infrared light – 1200 nm plus minus 100 nm -, and/or

the LED(s) of the second illumination arrangement (8, 10) emits/emit red light – 630 nm plus minus 30 nm -.

6. The optical examination device (100, 200) according to Claim 1 or 2, wherein the LED(s) of the first and/or the second illumination arrangement (4, 6, 8, 10) are arranged so that they illuminate respectively a plurality of surfaces of the semiconductor component (2), and/or

the light emitted by the first and/or the second illumination arrangement (4, 6, 8, 10) is reflected/directed by optically active elements onto a plurality of surfaces of the semiconductor component.

7. The optical examination device (100, 200) according to Claim 1 or 2, wherein the first illumination arrangement (4, 6) and/or the second illumination arrangement (8, 10) and/or a single or a plurality of optically active element(s) are configured and arranged to be respectively oriented and/or calibrated/focused independently of the others.

8. The optical examination device (100) according to Claim 1, wherein

the visible light of the second illumination arrangement (8, 10) is conducted by an optically active element (22, 24), which is respectively configured and arranged to have a predetermined degree of permeability for visible light in the emission direction of the second illumination arrangement (8, 10) and to have a predetermined degree of reflection of visible and infrared light from the direction opposed by 180° in each case, wherein

the reflection direction of the visible light and of the infrared light is unequal to the emission directions of the second illumination arrangement (8, 10) and the directions opposed to it by 180°, and

the imaging device consists of a first camera (12) and a second camera (14), wherein both cameras are configured and arranged to provide image captures on the basis of visible and infrared light, wherein

each of the two cameras (12, 14) is pointed at one of the surfaces of the semiconductor component (2) onto which visible light is directed by the second illumination arrangement (8, 10).

9. A method for the optical examination of semiconductor components (2) with a device according to Claim 1 or a device according to Claim 2, comprising the following method steps:

- illumination of two different surfaces of a semiconductor component (2) held by a receiving unit or a pick-up with infrared light, which fully penetrates the semiconductor component (2) at least proportionally,
- illumination of two different surfaces of the semiconductor component (2) held by the receiving unit or the pick-up with visible light, wherein

the surfaces illuminated with visible light lie respectively opposite the surfaces illuminated with infrared light,

- detection of the visible light reflected by the two surfaces of the component (2) held by a receiving unit or a pick-up that are illuminated by visible light and of the infrared light penetrating the component (2) from the two surfaces illuminated by infrared light by at least one imaging device (12, 14), which uses at least partially the same optical beam path for this,
- production of at least two image captures respectively of the surfaces of the component illuminated by visible light, wherein one of the two image captures is produced on the basis of the visible light reflected by the component surface and one is produced on the basis of the infrared light penetrating the component (2),
- examination of the component for defectiveness by downstream image evaluation by means of the image captures.