(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 207 572 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
05.06.2019 Bulletin 2019/23

(21) Application number: **15886926.3**

(22) Date of filing: **01.04.2015**

(51) Int Cl.:
H01L 33/00 $^{(2010.01)}$ *H01L 25/075* $^{(2006.01)}$

(86) International application number:
PCT/CN2015/075642

(87) International publication number:
WO 2016/154956 (06.10.2016 Gazette 2016/40)

(54) TRANSFERRING METHOD AND MANUFACTURING METHOD OF MICRO-LED

ÜBERTRAGUNGSVERFAHREN UND HERSTELLUNGSVERFAHREN EINER MIKRO-LED

PROCÉDÉ DE TRANSFERT ET PROCÉDÉ DE FABRICATION D’UNE MICRO-DEL

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(43) Date of publication of application:
23.08.2017 Bulletin 2017/34

(73) Proprietor: **Goertek. Inc**
High Tech Industry District
Weifang
Shandong 261031 (CN)

(72) Inventors:
- **ZOU, Quanbo**
  Weifang
  Shandong 261031 (CN)
- **WANG, Zhe**
  Weifang
  Shandong 261031 (CN)

(74) Representative: **Twelmeier Mommer & Partner**
Patent- und Rechtsanwälte
Westliche Karl-Friedrich-Strasse 56-68
75172 Pforzheim (DE)

(56) References cited:

CN-A- 1 973 375	**CN-A- 101 281 948**
GB-A- 2 484 712	**US-A1- 2008 023 435**
US-A1- 2011 151 602	**US-A1- 2013 285 086**

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Printed by Jouve, 75001 PARIS (FR)

Description

FIELD OF THE INVENTION

[0001] The present invention relates to a method for transferring micro-LEDs and a method for manufacturing a micro-LED device.

BACKGROUND OF THE INVENTION

[0002] The micro-LED technology refers to the LED array of small size integrated on a substrate with high density. Currently, the micro-LED technology is starting development, and it is expected in the industry that a high-quality micro-LED product comes into the market. High-quality micro-LED will have a deep affection on the conventional display products such as LCD/OLED that have already been put into the market.

[0003] In the process of manufacturing micro-LEDs, micro-LEDs are first formed on a donor wafer, and then the micro-LEDs are transferred to a receiving substrate. The receiving substrate is a display screen, for example.

[0004] One difficulty during manufacturing a micro-LED lies in how to transfer a micro-LED from a donor wafer to a receiving substrate. In the prior art, the transfer is generally performed by means of electrostaticpick-up. A transfer head array will be needed during the electrostatic pick-up. The structure of the transfer head array is relatively complicated, and the stability thereof shall be considered. An extra cost shall be paid for manufacturing a transfer head array. A phase change shall be made before pick-up with the transfer head array. In addition, during manufacturing with a transfer head array, limitations apply to the thermo budget of a micro-LED for phase change, which is generally lower than 350°C, or more specifically, lower than 200°C; otherwise, the performance of the micro-LED will be degraded. It generally requires two transfers during the manufacturing with transfer head array, i.e., the transfer from a donor wafer to a carrier wafer and the transfer from the carrier wafer to a receiving substrate.

[0005] US patent No. 8,333,860 B1 discloses an array of transfer heads for transferring micro devices, in which a voltage is applied to the electrode in the transfer head to pick-up a micro device.

[0006] US patent No. 8,426,227B1 discloses a method of forming a micro light emitting diode array, in which a micro-LED array is transferred to a receiving substrate by using a transfer head array.

[0007] US application publication No. 2011/0151602 A1 discloses a method of manufacturing transferrable elements incorporating radiation enabled lift off for allowing transfer from host substrate.

[0008] US application publication No. 2008/0023435 A1 discloses a method for self-assembling microstructures.

[0009] GB application publication No. 2484712A discloses an illumination apparatus.

SUMMARY OF THE INVENTION

[0010] One object of this invention is to provide a new technical solution for transferring a micro-LED.

[0011] According to an embodiment of the present invention, there is provided a method for transferring a micro-LED, comprising: forming a micro-LED on a laser-transparent original substrate; bringing the micro-LED into contact with a pad preset on a receiving substrate; and irradiating the original substrate with laser from the original substrate side to lift-off the micro-LED from the original substrate, wherein the step of bringing the micro-LED into contact with a pad preset on a receiving substrate comprises: bringing the micro-LED into contact with a pad preset on a receiving substrate via liquid thin film, and the liquid thin film includes flux.

[0012] Preferably, the step of forming a micro-LED on a laser-transparent original substrate comprises forming a plurality of micro-LEDs on the laser-transparent original substrate. Preferably, the step of bringing the micro-LED into contact with a pad preset on a receiving substrate comprises bringing at least one micro-LED of the plurality of micro-LEDs into contact with at least one pad preset on the receiving substrate. Preferably, the step of irradiating the original substrate with laser from the original substrate side to lift-off the micro-LED from the original substrate comprises irradiating at least one area on the original substrate with laser from the original substrate side to lift-off the at least one micro-LED from the original substrate.

[0013] Preferably, the step of forming a micro-LED on a laser-transparent original substrate further comprises singulating the plurality of micro-LEDs, for example before transferring.

[0014] Preferably, the method further comprises: reflow soldering the lifted-off micro-LED on the receiving substrate; and depositing negative electrode on the micro-LED.

[0015] Preferably, the method further comprises: filling the soldered micro-LED with polymer.

[0016] Preferably, the method further comprises: offsetting the original substrate for transferring additional micro-LEDs.

[0017] Preferably, the method further comprises: forming a micro-LED on an additional laser-transparent backup substrate; bringing the micro-LED on the backup substrate into contact with a pad preset on a receiving substrate; and irradiating the backup substrate with laser from the backup substrate side to lift-off the micro-LED from the backup substrate. Alternatively, this backup substrate (e.g., partial wafer) can be from the original substrate which is singulated. For example, the micro-LED on the backup substrate can be of the same color.

[0018] Preferably, the pad is set for red pixel array, yellow pixel array or blue pixel array.

[0019] Preferably, the receiving substrate is a display screen panel.

[0020] According to another embodiment of the present invention, there is provided a method for manufacturing a micro-LED device, comprising transferring a micro-LED to a receiving substrate by using the method for transferring a micro-LED according to the present invention.

[0021] According to the disclosure, there is provided a micro-LED device, which is manufactured by using the method for manufacturing a micro-LED device according to the present invention.

[0022] According to the disclosure, there is provided an electronic apparatus, containing a micro-LED device, which is manufactured by using the method for manufacturing a micro-LED device according to the present invention.

[0023] The inventors of the present invention have found that, in the prior art, the approach of electrostatic pick-up is used in the process of manufacturing a micro-LED array to transfer a micro-LED from a donor wafer to a receiving substrate. However, in the present invention, a micro-LED (array) is formed on the original substrate, and then the micro-LED is directly transferred to a receiving substrate by means of laser lift-off. So, the task to be implemented by or the technical problem to be solved by the present invention has not been conceived or anticipated by a person skilled in the art and thus the present invention is a new solution.

[0024] In addition, it should be understood by a person skilled in the art that, although a lot of problems exist in the prior art, the solution of each embodiment or each claim could just improve in one or several aspects, and it is not necessary for it to solve all the technical problems listed in the Background of the Invention or in the prior art. It should be understood by a person skilled in the art that content which is not mentioned in a claim should not be regarded as a limitation to said claim.

[0025] Further features of the present invention and advantages thereof will become apparent from the following detailed description of exemplary embodiments according to the present invention with reference to the attached drawings.

BRIEF DISCRIPTION OF THE DRAWINGS

[0026] The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate embodiments of the invention and, together with the description thereof, serve to explain the principles of the invention.

Figure 1 shows a flow chart of an illustrative embodiment of the method according to the present invention.

Figure 2A to 2G shows an example for transferring a micro-LED according to the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0027] Various exemplary embodiments of the present invention will now be described in detail with reference to the drawings. It should be noted that the relative arrangement of the components and steps, the numerical expressions, and numerical values set forth in these embodiments do not limit the scope of the present invention unless it is specifically stated otherwise.

[0028] The following description of at least one exemplary embodiment is merely illustrative in nature and is in no way intended to limit the invention, its application, or uses.

[0029] Techniques, methods and apparatus as known by one of ordinary skill in the relevant art may not be discussed in detail but are intended to be part of the specification where appropriate.

[0030] In all of the examples illustrated and discussed herein, any specific values should be interpreted to be illustrative only and non-limiting. Thus, other examples of the exemplary embodiments could have different values.

[0031] Notice that similar reference numerals and letters refer to similar items in the following figures, and thus once an item is defined in one figure, it is possible that it need not be further discussed for following figures.

[0032] Embodiments and examples of the present invention will be described below with reference to the drawings.

[0033] Fig. 1 shows a flow chart of an illustrative embodiment of the method for transfer micro-LED according to the present invention.

[0034] As shown in Fig. 1, at step S1100, a micro-LED is formed on a laser-transparent original substrate.

[0035] The laser-transparent original substrate can be a sapphire substrate, SiC substrate and so on, for example. The micro-LED can be used for being mounted on a display screenpanel.

[0036] It should be understood by a person skilled in the art that one micro-LED could be formed on the original substrate, or a plurality of micro-LED could be formed on the original substrate. For example, a plurality of micro-LEDs can be formed on the laser-transparent original substrate. The plurality of micro-LEDs can form an array.

[0037] In an example, in a case where a plurality of micro-LEDs are formed on the laser-transparent original substrate, the original substrate can be singulated or divided into multiple pieces for more flexible transferring.

[0038] At step S 1200, the micro-LED is brought into contact with a pad preset on a receiving substrate.

[0039] For example, the receiving substrate is a display screen panel.

[0040] For example, the pad can be set for red pixel array, yellow pixel array or blue pixel array.

[0041] In an example, in a case where a plurality of micro-LED are formed, at least one micro-LED of the plurality of micro-LEDs can be brought into contact with at least one pad preset on the receiving substrate. The at least one micro-LED could be one, several or all of the plurality of micro-LEDs. It should be understood by a person skilled in the art that, although it is just described here that at least one micro-LED, which is expected to be lifted-off, is in contact with a pad, a remaining micro-LED of the plurality of micro-LEDs can also be in contact with a pad.

[0042] For example, in the step of contact (S 1200), the micro-LED can be brought into contact with the pad preset on the receiving substrate via a liquid thin film. For example, the liquid thin film can include flux. Herein, the lift-off of a micro-LED will be easy through the surface tension force of the liquid thin film (flux), and the successful rate is high.

[0043] At step S1300, the original substrate is irradiated with laser from the original substrate side to lift-off the micro-LED from the original substrate.

[0044] In an example, in a case where at least one micro-LED is in contact with pad, at least one area on the original substrate can be irradiated with laser from the original substrate side to lift-off the at least one micro-LED from the original substrate.For example, a technician can select the at least one area. For example, the at least one area corresponds to the at least micro-LED, respectively. The at least one area can be just partial area on the original substrate, or can be the whole area.

[0045] In another example, the original substrate can be offset for transferring additional micro-LEDs.

[0046] In another example, after the transferring using the original substrate, an additional laser-transparent backup substrate can be used to cope with a situation in which micro-LEDs are missing at some points on the display screen panel. For example, a micro-LED can be formed on an additional laser-transparent backup substrate; the micro-LED on the backup substrate is brought into contact with a pad preset on a receiving substrate; and the backup substrate is irradiated with laser from the backup substrate side to lift-off the micro-LED from the backup substrate. In such a way, the quality of a display screen can further be improved.

[0047] An array of micro-LEDs can be formed on the receiving substrate after the transferring of micro-LEDs to the receiving substrate.

[0048] After the transferring of micro-LEDs to the receiving substrate, the present invention can further include subsequent steps.

[0049] For example, the lifted-off micro-LEDs can be reflow-soldered on the receiving substrate. Anegative electrode can be deposited on the micro-LEDs. The reflow-soldering can be performed after micro-LEDs of each color are transferred. Alternatively, the reflow-soldering can be performed after micro-LEDs of all colors are transferred.

[0050] In addition, the soldered micro-LED can be filled with polymer. For example, a confocal dielectric deposition can be used in stead of polymer filling.

[0051] In another embodiment, the present invention further includes a method for manufacturing a micro-LED device. The manufacturing method comprises transferring a micro-LED to a receiving substrate by using the method for transferring a micro-LED according to the present invention.

[0052] In another embodiment, the present invention further includes a micro-LED device, such as a display screen device. The micro-LED device can be manufactured by using the method for manufacturing a micro-LED device according to the present invention.

[0053] In comparison with the prior art, under the similar conditions, the micro-LED manufactured by using the solution of the present invention is relatively simple and reliable while maintaining a high quality, and the through put thereof is relatively high with low cost.

[0054] In another embodiment, the present invention further includes an electronic apparatus. The electronic apparatus contains a micro-LED device according to the present invention. For example, the electronic apparatus can be a mobile phone, a pad computer and so on.

[0055] In the solution of the present invention, a micro-LED is formed directly on the original substrate and it is transferred to a receiving substrate by means of laser lift-off. The solution of this invention have not been conceived by the prior art.

[0056] In addition, the micro-LED can be selectively transferred through the present invention.

[0057] In addition, in the solution of the present invention, the transfer can be performed only once while two transfers are needed in the prior art.

[0058] In addition, in comparison with the prior art, the solution of the present invention is relatively efficient, the cost is relatively low and product performance degrade due to an extra thermal budget will not occur.

[0059] In addition, in comparison with the prior art using a pick-up head, the present invention does not need a complicated pick-up system, and thus the cost of product manufactured using the present invention will relatively low and reliable.

[0060] In addition, since it does not need the temporary bonding in the prior art between the micro-LED and the intermediate carrier substrate, the cost can be further decreased by this invention.

[0061] Since it is not necessary to consider the phase change of bonding layer considered in the prior art using pick-up head, the manufacturing method of the present invention can have a relatively high through put and the extra thermal load limitation will be less. Consequently, under the similar conditions, the manufactured micro-LED will have a higher performance.

[0062] An example for transferring a micro-LED according to the present invention will be described below with reference to Figs. 2A to 2G.

[0063] As shown in Fig. 2A, micro-LEDs 2 are formed on a laser-transparent original substrate 1 such as sapphire substrate. The micro-LEDs 2 have a vertical micro-LED structure, for example. The micro-LEDs 2 contains, for example, a n-doped GaN layer, a multiple quantum well structure, a p-doped GaN layer, a p metal electrode, a bump, and so on.

[0064] As shown in Fig. 2A, the plurality of micro-LEDs 2 can be singulated.

[0065] As shown in Fig. 2B, the original substrate 1 is flipped over, and is aligned with a receiving substrate 4 with liquid thin film 5, which contains flux according to the invention. The micro bumps on the micro-LEDs are in contact with the flux. Pads 3 are preset on the receiving substrate 4. For example, the pads 3 include pad 3r for receiving red micro-LED, pad 3b for receiving blue micro-LED and pad 3g for receiving green micro-LED.

[0066] As shown in Fig. 2C, partial areas 7 on the original substrate are selectively irradiated with laser 7, to lift off the selected micro-LEDs 2a, 2b of the plurality of formed micro-LEDs from the original substrate.

[0067] As shown in Fig. 2D, the original substrate 1 is lifted up. Because of the function of the surface tension force of the liquid thin film, the selected micro-LEDs 2a, 2b are lifted-off easily, while the other micro-LEDs are remained on the original substrate 1.

[0068] Then, the original substrate is moved and the operations of Figs. 2C to 2D are repeated, so that a plurality of micro-LEDs are transferred to the receiving substrate.

[0069] As shown in Fig. 2E, the plurality of micro-LEDs are transferred to the receiving substrate 4.

[0070] As shown in Fig. 2F, for example, the plurality of micro-LEDs are soldered onto the receiving substrate through reflow soldering. Then, the flux is cleaned.

[0071] As shown in Fig. 2G, the receiving substrate is filled with polymer 8 and is sealed. Then, n-metal electrode 9 is deposited, for example, using ITO material.

[0072] Although some specific embodiments of the present invention have been demonstrated in detail with examples, it should be understood by a person skilled in the art that the above examples are only intended to be illustrative but not to limit the scope of the present invention. It should be understood by a person skilled in the art that the above embodiments can be modified without departing from the scope of the present invention as defined by the attached claims.

Claims

1. A method for transferring micro-LED, comprising:

   forming a micro-LED (2) on a laser-transparent original substrate (1) (S1100) then
   bringing the micro-LED (2) into contact with a pad (3) preset on a receiving substrate (4) (S1200); and then
   irradiating the original substrate (1) with laser (6) from the original substrate side to lift-off the micro-LED (2) from the original substrate (1) (S1300),
   wherein the step of bringing the micro-LED into contact with a pad preset on a receiving substrate comprises: bringing the micro-LED into contact with a pad preset on a receiving substrate via liquid thin film (5),
   characterized in that, the liquid thin film (5) includes flux.

2. The method according to claim 1, **characterized in that**, the step of forming a micro-LED on a laser-transparent original substrate comprises forming a plurality of micro-LEDs on the laser-transparent original substrate;
   wherein the step of bringing the micro-LED into contact with a pad preset on a receiving substrate comprises bringing at least one micro-LED of the plurality of micro-LEDs into contact with at least one pad preset on the receiving substrate; and
   wherein the step of irradiating the original substrate with laser from the original substrate side to lift-off the micro-LED from the original substrate comprises irradiating at least one area (7) on the original substrate with laser from the original substrate side to lift-off the at least one micro-LED from the original substrate.

3. The method according to claim 2, **characterized in that**, the step of forming a micro-LED on a laser-transparent original substrate further comprises singulating the original substrate.

4. The method according to claim 1, **characterized by** further comprising:

   reflow soldering the lifted-off micro-LED on the receiving substrate; and
   depositing negative electrode (9) on the micro-LED.

5. The method according to claim 4, **characterized by** further comprising: filling the soldered micro-LED with polymer (8).

6. The method according to claim 1, **characterized by** further comprising: offsetting the original substrate for transferring additional micro-LEDs.

7. The method according to claim 1, **characterized by** further comprising:

   forming a micro-LED on an additional laser-transparent backup substrate;
   bringing the micro-LED on the backup substrate into contact with a pad preset on a receiving substrate; and
   irradiating the backup substrate with laser from the backup substrate side to lift-off the micro-LED from the backup substrate.

8. The method according to claim 1, **characterized in that**, the pad is set for red pixel array, yellow pixel array or blue pixel array.

9. The method according to claim 1, **characterized in that**, the receiving substrate is a display screen panel.

10. A method for manufacturing a micro-LED device, **characterized by** comprising transferring a micro-LED to a receiving substrate by using the method according to claim 1.

Patentansprüche

1. Verfahren zum Übertragen von Mikro-Leuchtdioden, umfassend:

(S1100): Bilden einer Mikro-Leuchtdiode (2) auf einem lasertransparenten Originalsubstrat (1), dann
(S1200): Bringen der Mikro-Leuchtdiode (2) in Kontakt mit einer auf einem Empfangssubstrat (4) voreingestellten Unterlage (3); und dann
(S1300): Bestrahlen des Originalsubstrats (1) mit einem Laser (6) von der Originalsubstratseite, um die Mikro-Leuchtdiode (2) vom Originalsubstrat (1) abzuheben;
wobei der Schritt des Inkontaktbringens der Mikro-Leuchtdiode mit der auf dem Empfangssubstrat voreingestellten Unterlage das Inkontaktbringen der Mikro-Leuchtdiode mit der auf dem Empfangssubstrat voreingestellten Unterlage über einen flüssigen Dünnfilm (5) umfasst,
dadurch gekennzeichnet, dass der flüssige Dünnfilm (5) Flussmittel enthält.

2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** der Schritt des Bildens einer Mikro-Leuchtdiode auf einem lasertransparenten Originalsubstrat das Bilden einer Vielzahl von Mikro-Leuchtdioden auf dem lasertransparenten Originalsubstrat umfasst;
wobei der Schritt des Inkontaktbringens der Mikro-Leuchtdiode mit einer auf einem Empfangssubstrat voreingestellten Unterlage das Inkontaktbringen mindestens einer der Vielzahl von Mikro-Leuchtdioden mit mindestens einer auf dem Empfangssubstrat voreingestellten Unterlage umfasst; und
wobei der Schritt des Bestrahlens des Originalsubstrats mit einem Laser von der Originalsubstratseite zum Abheben der Mikro-Leuchtdiode vom Originalsubstrat das Bestrahlen mindestens eines Bereichs (7) auf dem Originalsubstrat mit einem Laser von der Originalsubstratseite zum Anheben mindestens einer Mikro-Leuchtdiode vom Originalsubstrat umfasst.

3. Verfahren nach Anspruch 2, **dadurch gekennzeichnet, dass** der Schritt des Bildens einer Vielzahl von Mikro-Leuchtdioden auf dem lasertransparenten Originalsubstrat ferner das Vereinzeln des Originalsubstrats umfasst.

4. Verfahren nach Anspruch 1, ferner **gekennzeichnet durch**:

Reflowlöten der abgehobenen Mikro-Leuchtdiode auf dem Empfangssubstrat; und
Abscheiden der negativen Elektrode (9) auf der Mikro-Leuchtdiode.

5. Verfahren nach Anspruch 4, ferner **gekennzeichnet durch**:
Füllen der gelöteten Mikro-Leuchtdiode mit Polymer (8).

6. Verfahren nach Anspruch 1, ferner **gekennzeichnet durch**:
Versetzen des Originalsubstrats zum Übertragen zusätzlicher Mikro-Leuchtdioden.

7. Verfahren nach Anspruch 1, ferner **gekennzeichnet durch**:

Bilden einer Mikro-Leuchtdiode auf einem zusätzlichen lasertransparenten Unterstützungssubstrat;
Bringen der Mikro-Leuchtdiode auf dem Unterstützungssubstrat in Kontakt mit einer auf dem Empfangssubstrat voreingestellten Unterlage; und
Bestrahlen des Unterstützungssubstrats mit einem Laser von der Unterstützungssubstratseite, um die Mikro-Leuchtdiode vom Unterstützungssubstrat abzuheben.

8. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** die Unterlage für ein rotes Pixelarray, ein gelbes Pixelarray oder ein blaues Pixelarray eingestellt ist.

9. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** das Empfangssubstrat eine Bildschirmtafel ist.

10. Verfahren zum Herstellen einer Mikro-Leuchtdiode-Vorrichtung, **gekennzeichnet durch** Übertragen einer Mikro-Leuchtdiode auf ein Empfangssubstrat unter Verwendung des Verfahrens nach Anspruch 1.

Revendications

1. Procédé de transfert de micro-LED, comprenant:

formation d’une micro-LED (2) sur un substrat d’origine (1) transparent au laser (S1100); puis
mise en contact de la micro-LED (2) avec un

pad (3) préréglé sur un substrat de réception (4) (S 1200); et puis
irradiation du substrat d'origine (1) avec un laser (6) à partir du côté du substrat d'origine pour décoller la micro-LED (2) du substrat d'origine (1) (S1300),
dans lequel l'étape de mise en contact de la micro-LED avec un pad préréglé sur un substrat de réception comprend: la mise en contact de la micro-LED avec un pad préréglé sur un substrat de réception via un film mince liquide (5),
caractérisé en ce que le film mince liquide (5) comprend un fondant.

2. Procédé selon la revendication 1, **caractérisé en ce que** l'étape de formation d'une micro-LED sur un substrat d'origine transparent au laser comprend la formation d'une pluralité de micro-LEDs sur le substrat d'origine transparent au laser;
dans lequel l'étape de mise en contact de la micro-LED avec un pad préréglé sur un substrat de réception comprend la mise en contact d'au moins une micro-LED de la pluralité de micro-LEDs avec au moins un pad préréglé sur le substrat de réception; et
dans lequel l'étape d'irradiation du substrat d'origine avec laser à partir du côté du substrat d'origine pour décoller la micro-LED du substrat d'origine comprend l'irradiation de au moins une zone (7) sur le substrat d'origine avec laser à partir du côté du substrat d'origine pour décoller au moins une micro-LED du substrat d'origine.

3. Procédé selon la revendication 2, **caractérisé en ce que** l'étape de formation d'une micro-LED sur un substrat d'origine transparent au laser comprend en outre le coupage de la substrat d'origine.

4. Procédé selon la revendication 1, **caractérisé en ce qu'**il comprend en outre:

   brasage par refusion de la micro-LED décollée sur le substrat de réception; et
   dépôt d'électrode négative (9) sur la micro-LED.

5. Procédé selon la revendication 4, **caractérisé en ce qu'**il comprend en outre: remplissage de la micro-LED soudée avec le polymère (8).

6. Procédé selon la revendication 1, **caractérisé en ce qu'**il comprend en outre: décalage du substrat d'origine pour transfer des micro-LEDs additionnelles.

7. Procédé selon la revendication 1, **caractérisé en ce qu'**il comprend en outre:

   formation d'une micro-LED sur un substrat de sauvegarde transparent au laser additionnel;
   mise en contact de la micro-LED sur le substrat de sauvegarde avec un pad préréglé sur un substrat de réception; et
   irradiation le substrat de sauvegarde avec laser à partir du côté du substrat de sauvegarde pour décoller la micro-LED du substrat de sauvegarde.

8. Procédé selon la revendication 1, **caractérisé en ce que** le pad est réglé pour tableau de pixels rouge, tableau de pixels jaune ou tableau de pixels bleu.

9. Procédé selon la revendication 1, **caractérisé en ce que** le substrat de réception est un panneau d'écran.

10. Procédé de fabrication d'un dispositif à micro-LED, **caractérisé en ce qu'**il comprend le transfert d'une micro-LED à un substrat de réception en utilisant le procédé selon la revendication 1.

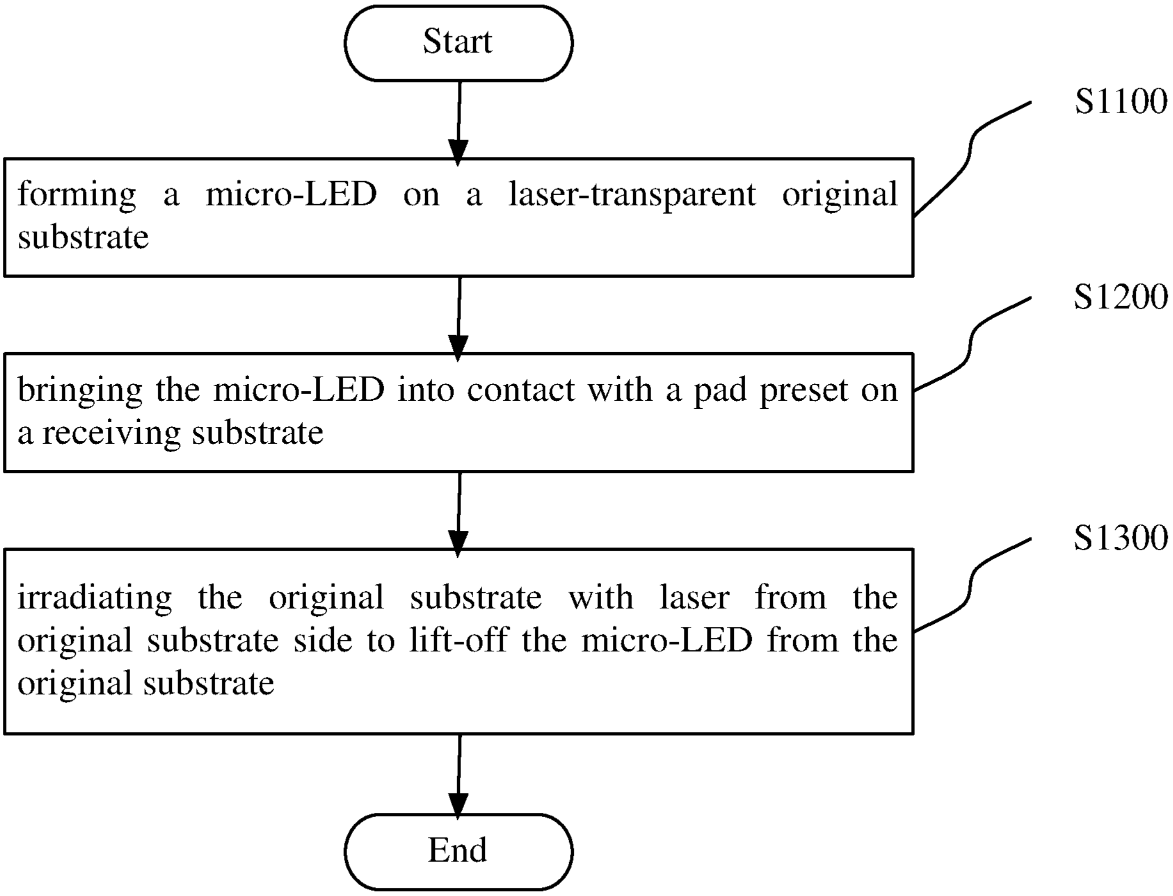
Start
forming a micro-LED on a laser-transparent original substrate
S1100
bringing the micro-LED into contact with a pad preset on a receiving substrate
S1200
irradiating the original substrate with laser from the original substrate side to lift-off the micro-LED from the original substrate
S1300
End

FIG. 1

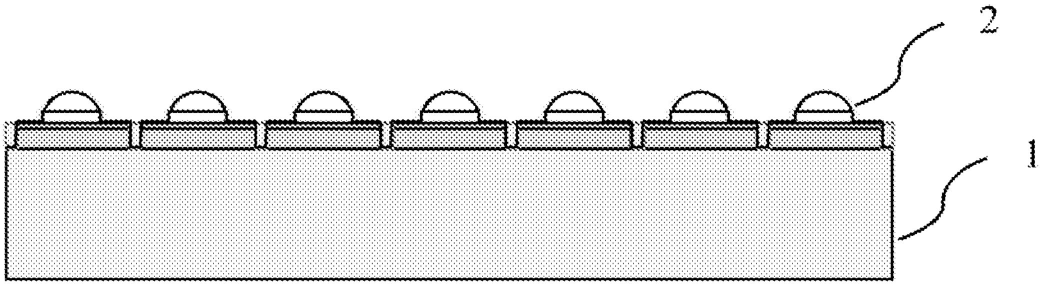

FIG. 2A

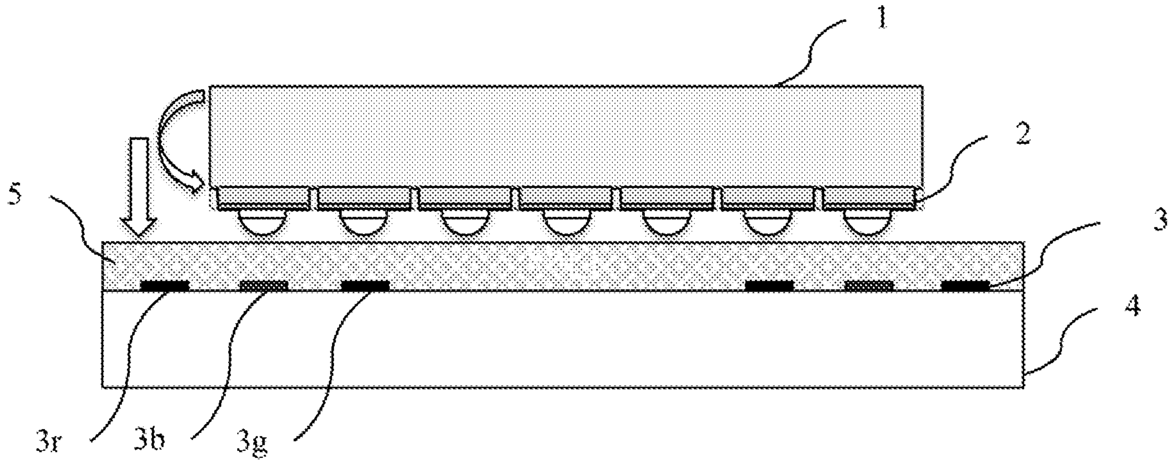

FIG. 2B

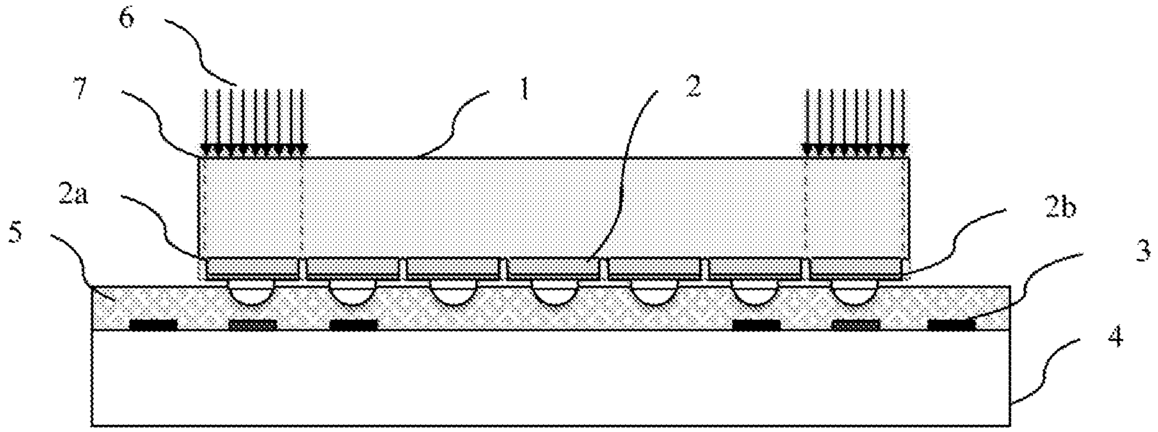

FIG. 2C

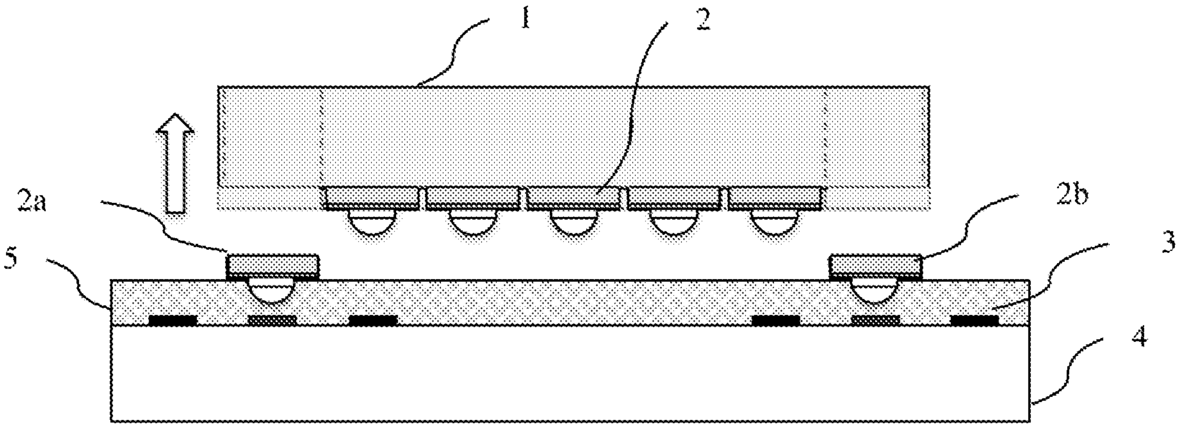

FIG. 2D

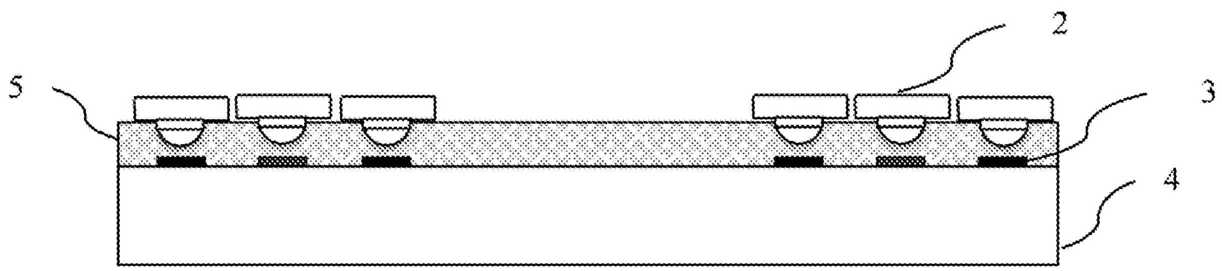

FIG. 2E

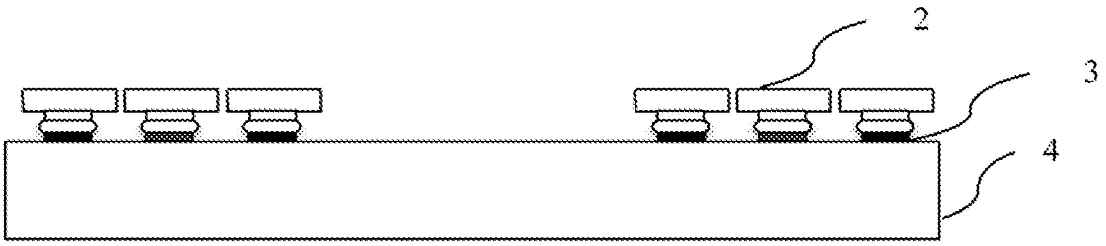

FIG. 2F

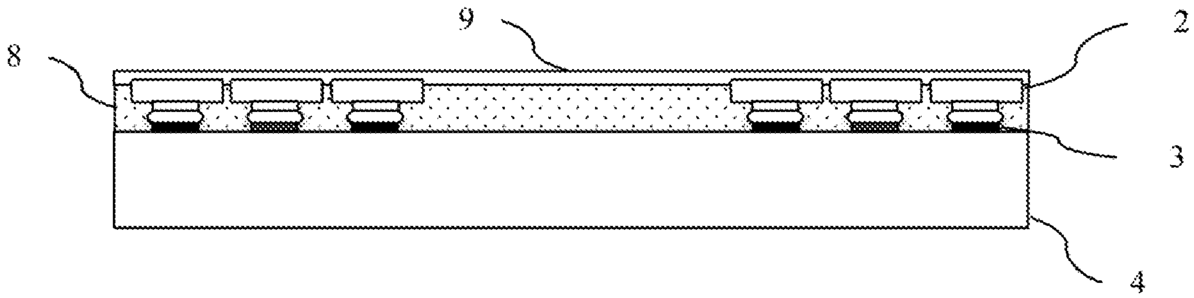

FIG. 2G

REFERENCES CITED IN THE DESCRIPTION

Patent documents cited in the description

- US 8333860 B1 **[0005]**
- US 8426227 B1 **[0006]**
- US 20110151602 A1 **[0007]**
- US 20080023435 A1 **[0008]**
- GB 2484712 A **[0009]**

专利名称(译)	微型led的转移方法和制造方法		
公开(公告)号	EP3207572B1	公开(公告)日	2019-06-05
申请号	EP2015886926	申请日	2015-04-01
[标]申请(专利权)人(译)	歌尔声学股份有限公司		
申请(专利权)人(译)	歌尔声学. INC		
当前申请(专利权)人(译)	歌尔声学. INC		
[标]发明人	ZOU QUANBO WANG ZHE		
发明人	ZOU, QUANBO WANG, ZHE		
IPC分类号	H01L33/00 H01L25/075		
CPC分类号	H01L25/0753 H01L33/0093 H01L33/0095 H01L2224/16225 H01L2933/0066 H01L33/62		
其他公开文献	EP3207572A1 EP3207572A4		
外部链接	Espacenet		

摘要(译)

本发明公开了一种微型LED的转移方法，制造方法，装置和电子设备。传输微型LED的方法包括：在激光透明的原始基板上形成微型LED;使微型LED与预设在接收基板上的垫接触;用来自原始基板侧的激光照射原始基板，以从原始基板上剥离微型LED。

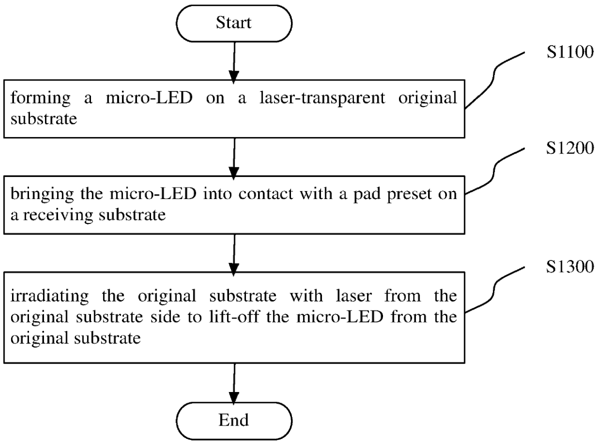

FIG. 1