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(54) SUBSTRATE MOUNTING STAGE, INK-JET APPLYING DEVICE, LEVELING DEVICE, AND METHOD FOR MANUFACTURING ORGANIC EL DISPLAY DEVICE

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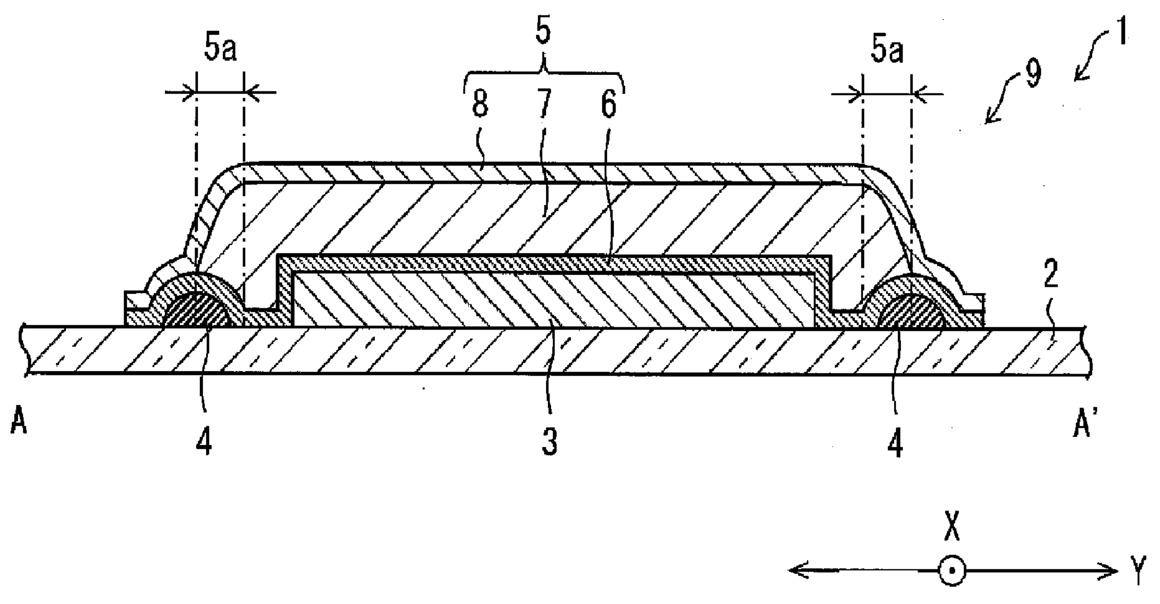
(57) **ABSTRACT**

A substrate mounting portion includes a low temperature portion whose temperature is adjusted to an atmospheric temperature or lower at a position corresponding to a frame-shaped bank surrounding a pixel formation region of a substrate. An edge width of a sealing layer is narrowed with this configuration.



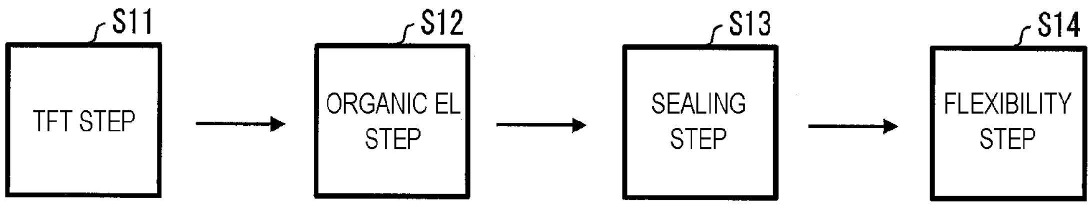

S11
TFT STEP
S12
ORGANIC EL STEP
S13
SEALING STEP
S14
FLEXIBILITY STEP

FIG. 1

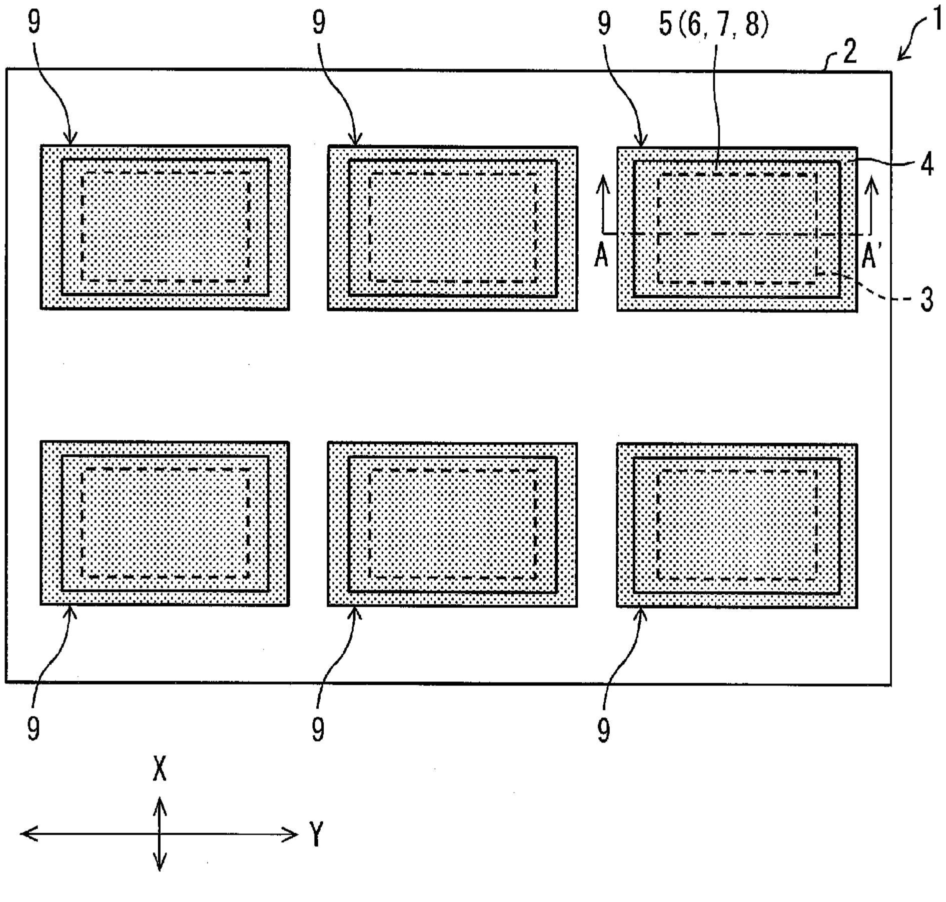

9
9
9
5 (6, 7, 8)
1
2
4
A
A'
3
9
9
9
X
Y

FIG. 2

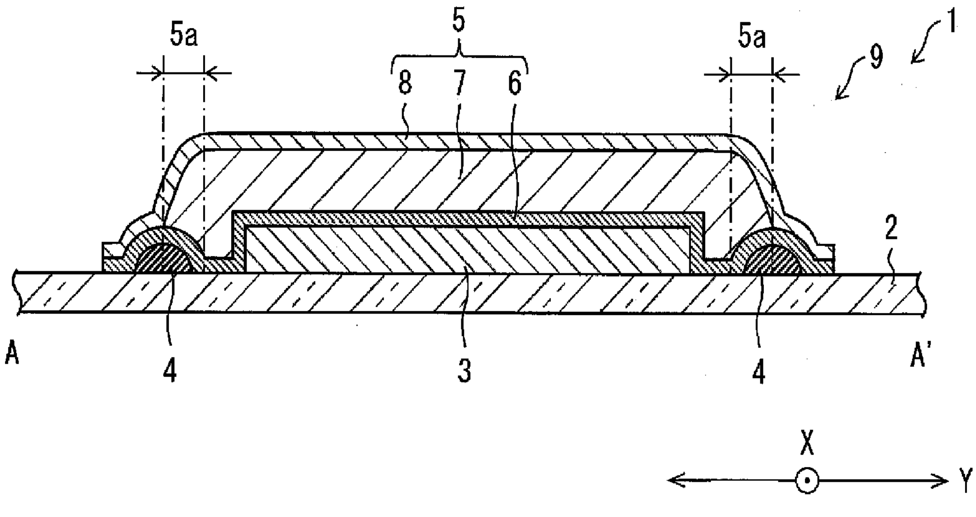


FIG. 3

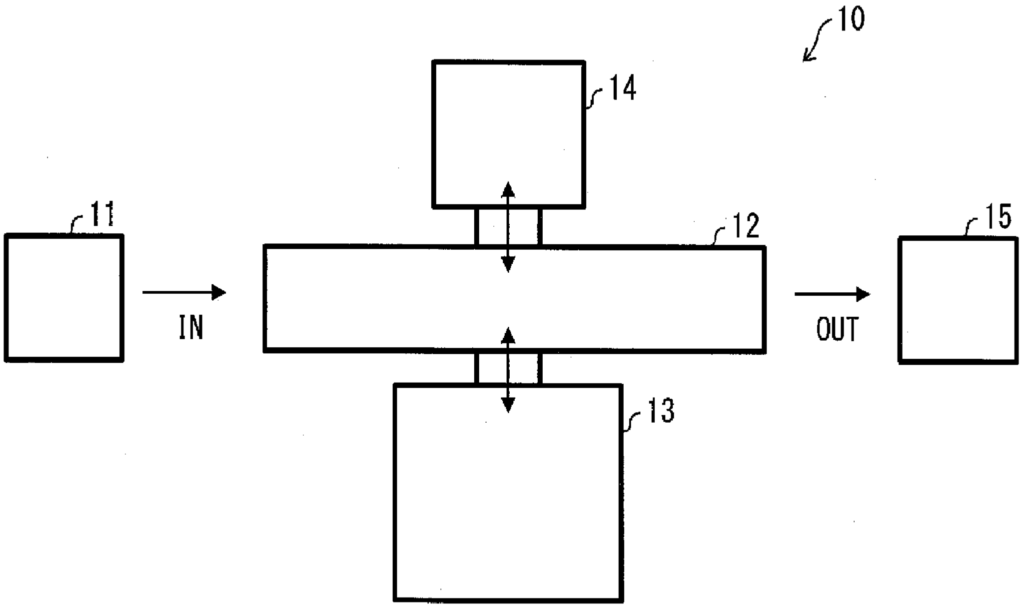


FIG. 4

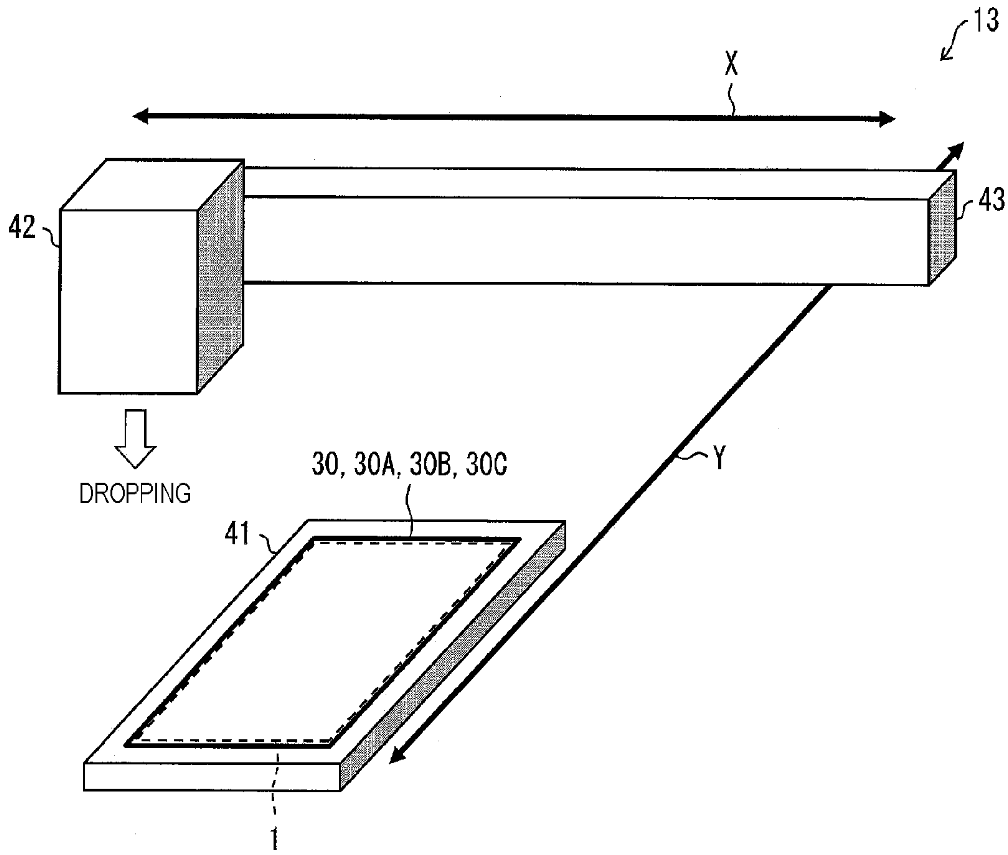

13
X
42
43
DROPPING
30, 30A, 30B, 30C
41
Y
1

FIG. 5

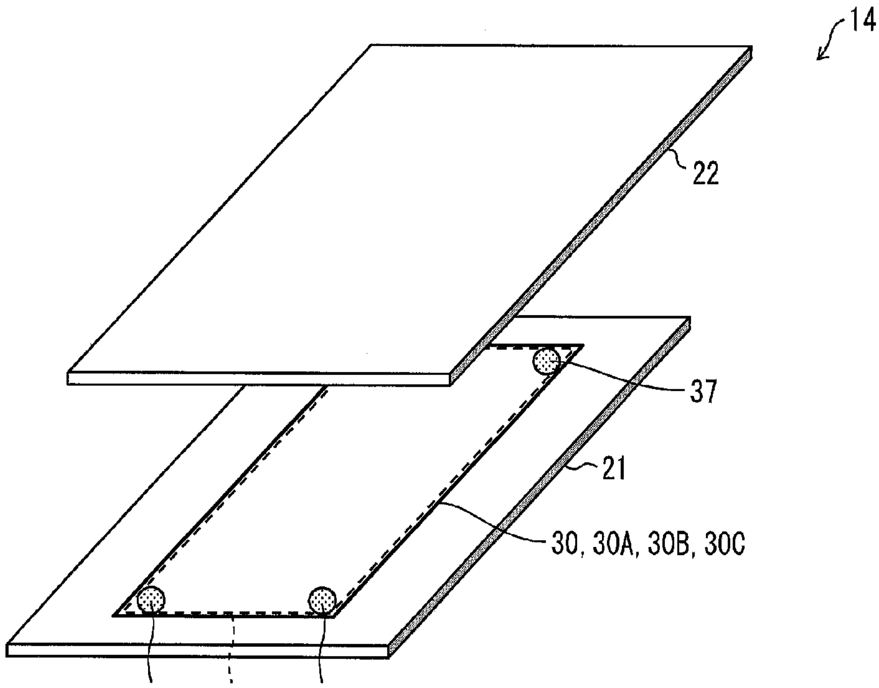

14
22
37
21
30, 30A, 30B, 30C
37
1
37

FIG. 6

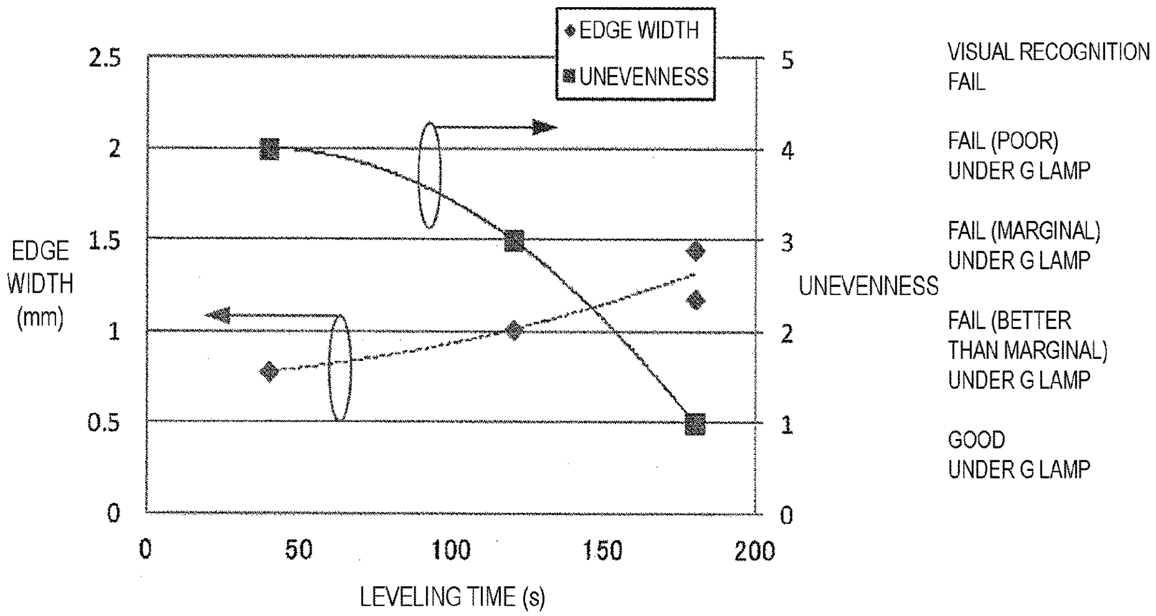

EDGE WIDTH
UNEVENNESS
2.5
2
1.5
1
0.5
0
EDGE WIDTH (mm)
5
4
3
2
1
0
UNEVENNESS
0
50
100
150
200
LEVELING TIME (s)
VISUAL RECOGNITION
FAIL
FAIL (POOR) UNDER G LAMP
FAIL (MARGINAL) UNDER G LAMP
FAIL (BETTER THAN MARGINAL) UNDER G LAMP
GOOD UNDER G LAMP

FIG. 7

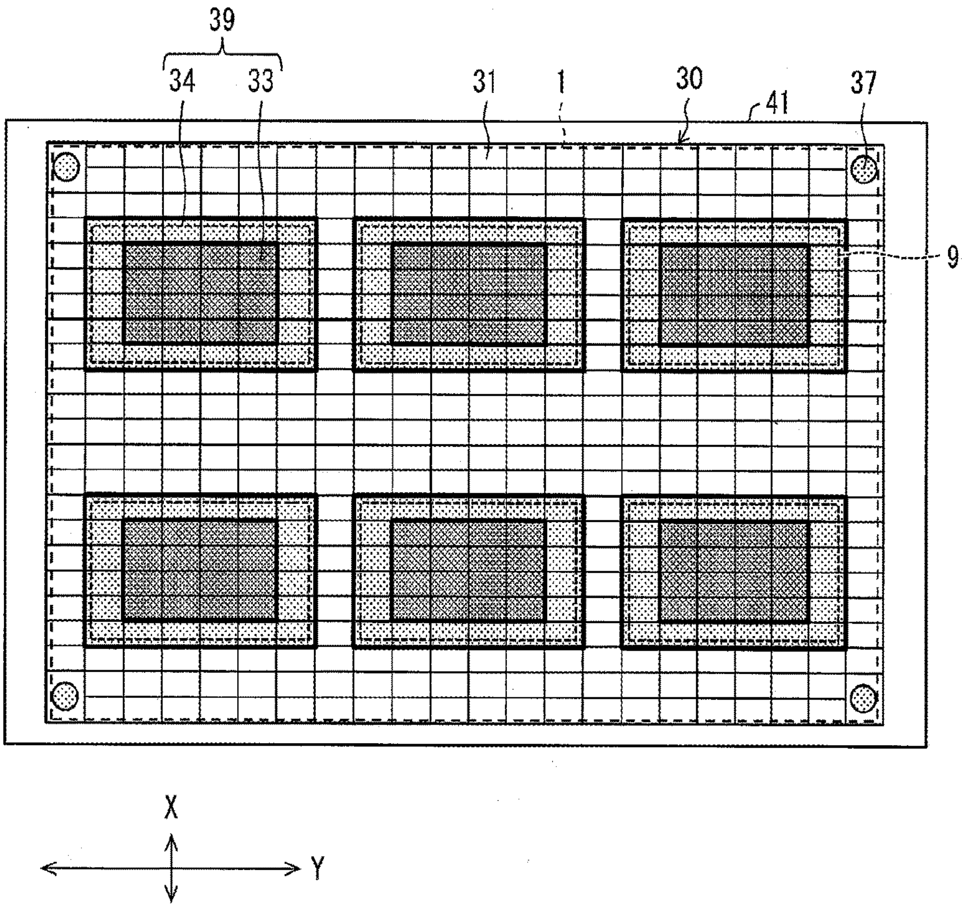

39
34
33
31
1
30
41
37
9
X
Y

FIG. 8

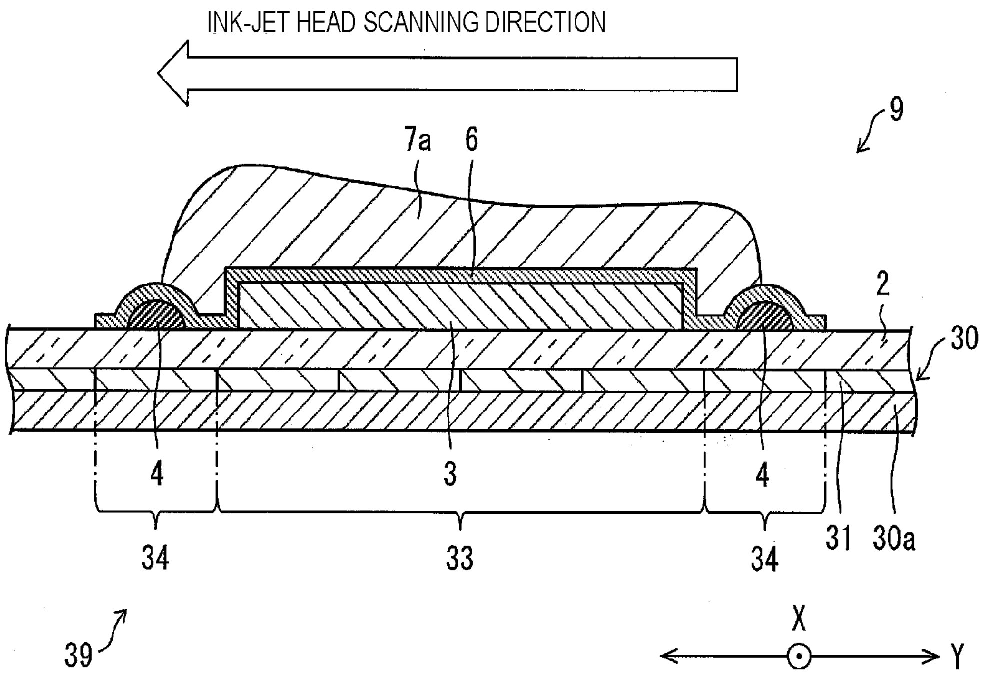

INK-JET HEAD SCANNING DIRECTION
9
7a
6
2
30
4
3
4
34
33
34
31
30a
39
X
Y

FIG. 9

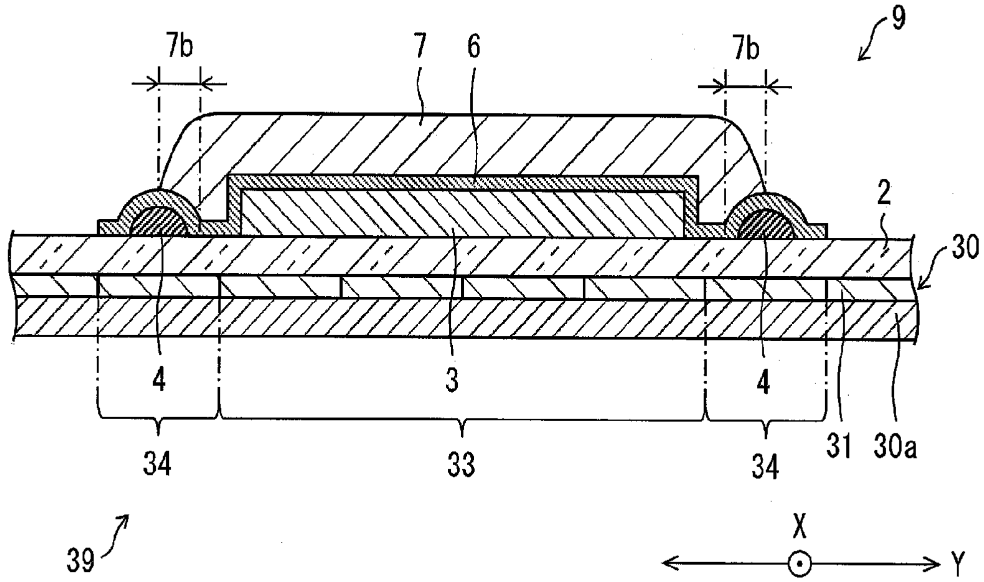

9
7b
7
6
7b
2
30
4
3
4
34
33
34
31
30a
39
X
Y

FIG. 10

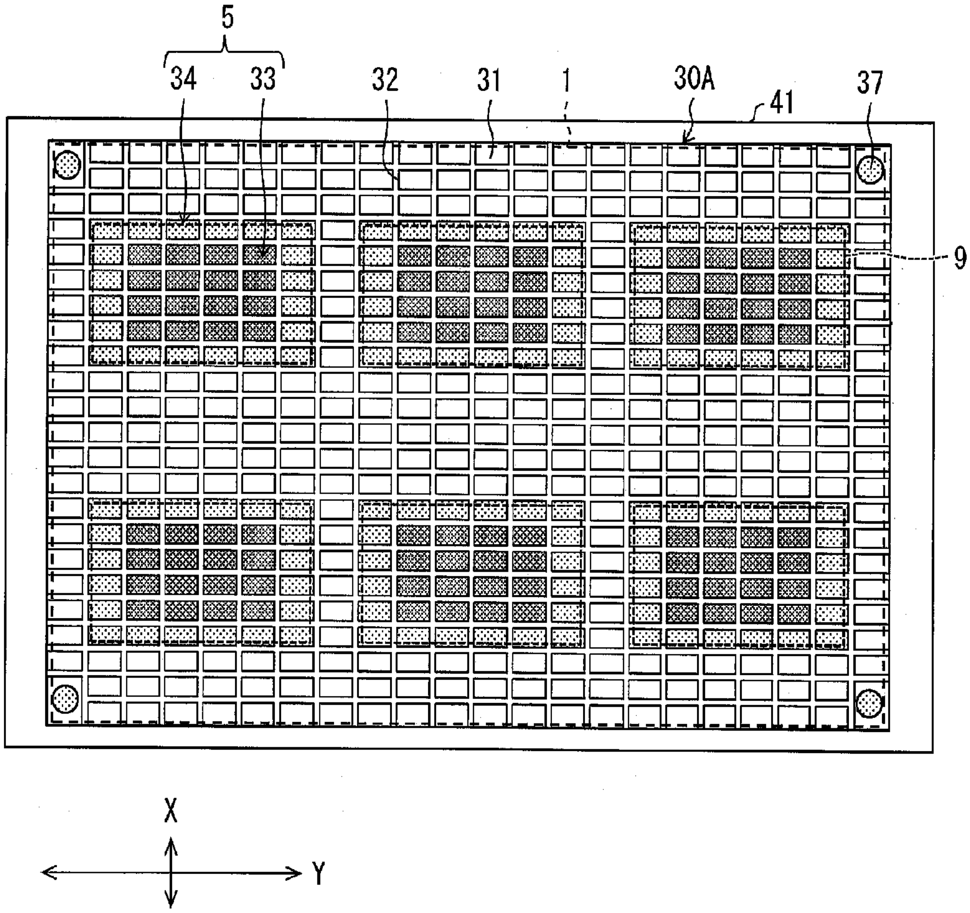

5
34
33
32
31
1
30A
41
37
9
X
Y

FIG. 11

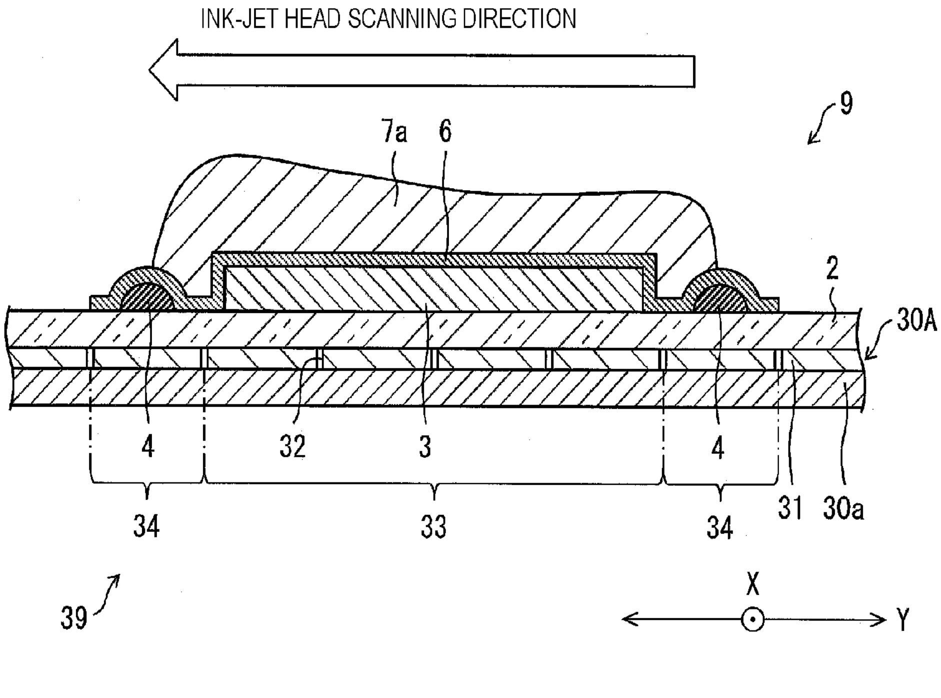

INK-JET HEAD SCANNING DIRECTION
9
7a
6
2
30A
4
32
3
4
31
30a
34
33
34
39
X
Y

FIG. 12

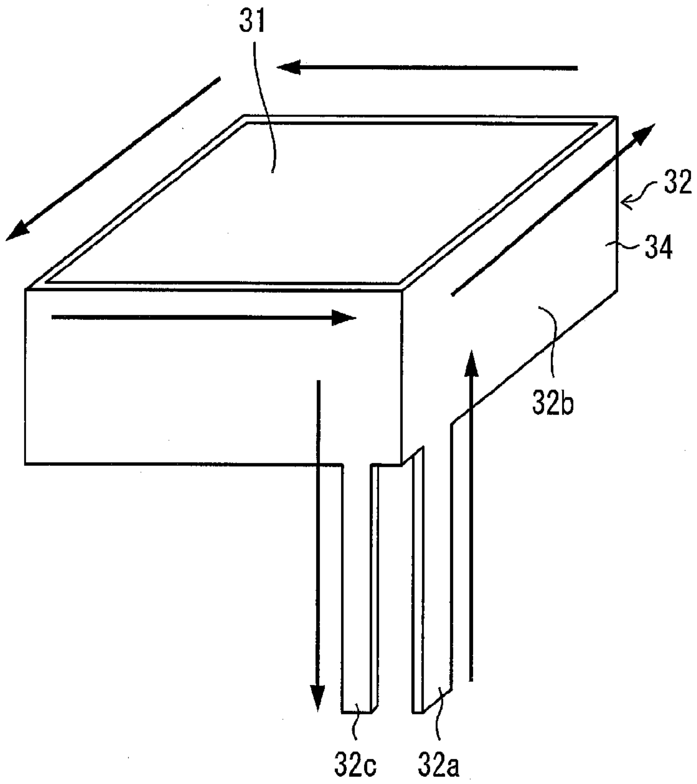


FIG. 13

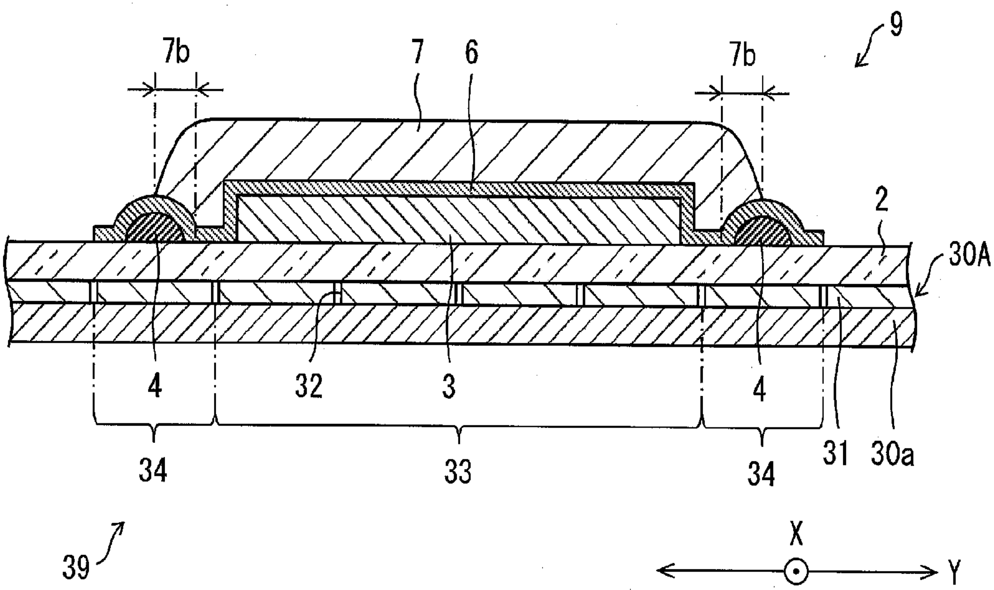


FIG. 14

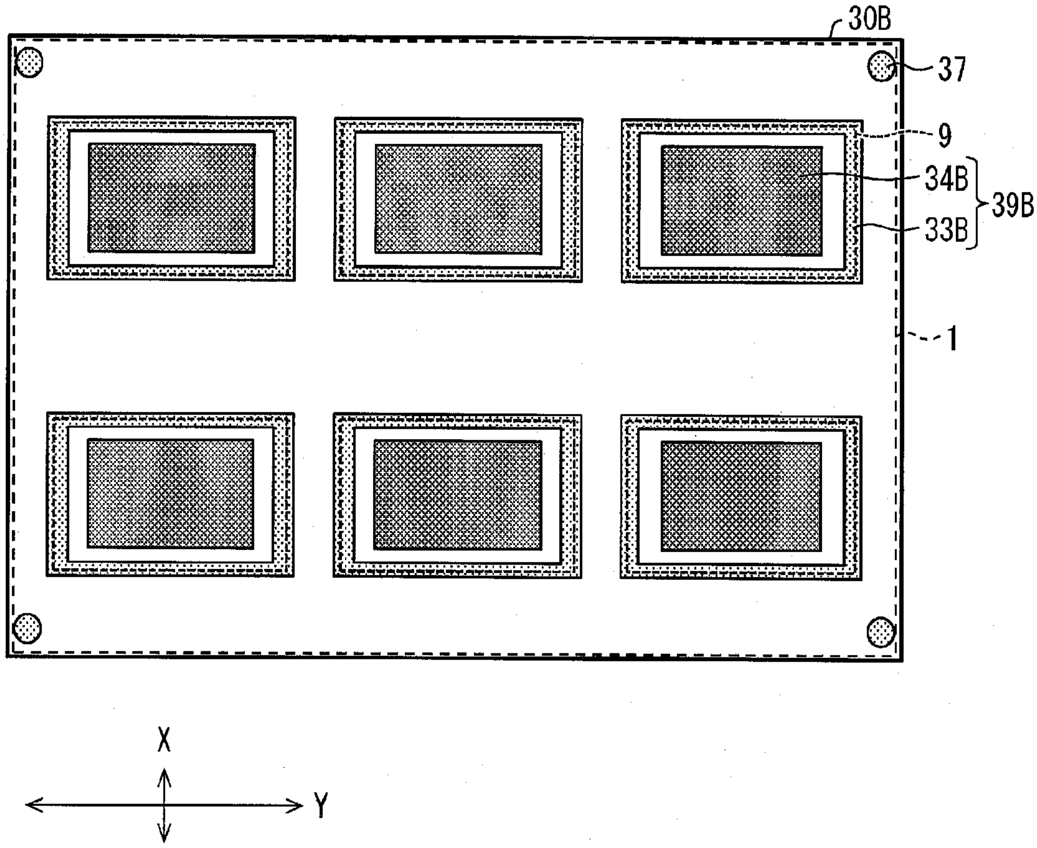

30B
37
9
34B
39B
33B
1
X
Y

FIG. 15

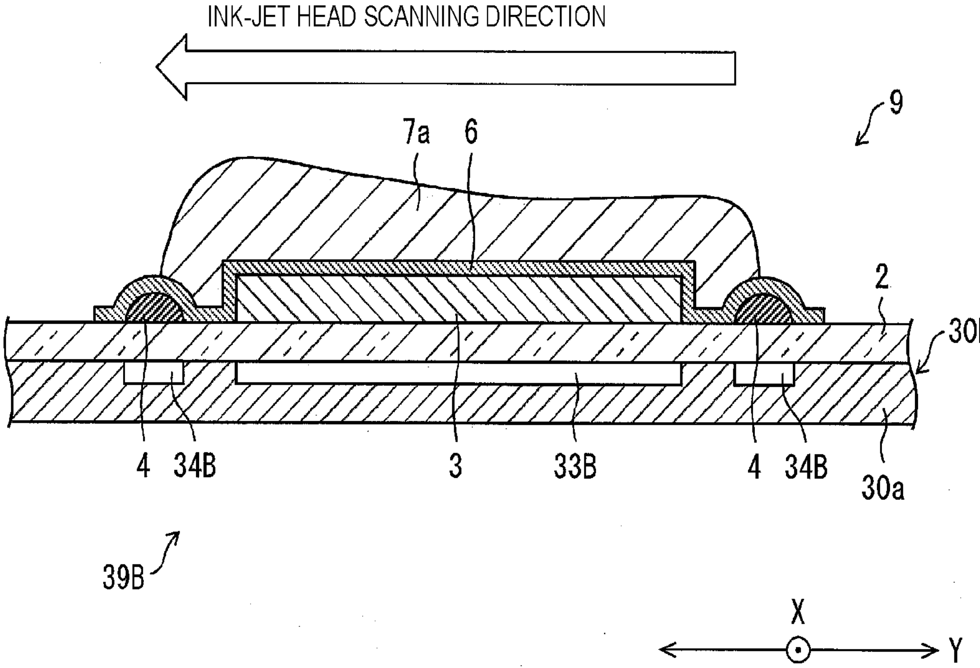

INK-JET HEAD SCANNING DIRECTION
9
7a
6
2
30B
4
34B
3
33B
4
34B
30a
39B
X
Y

FIG. 16

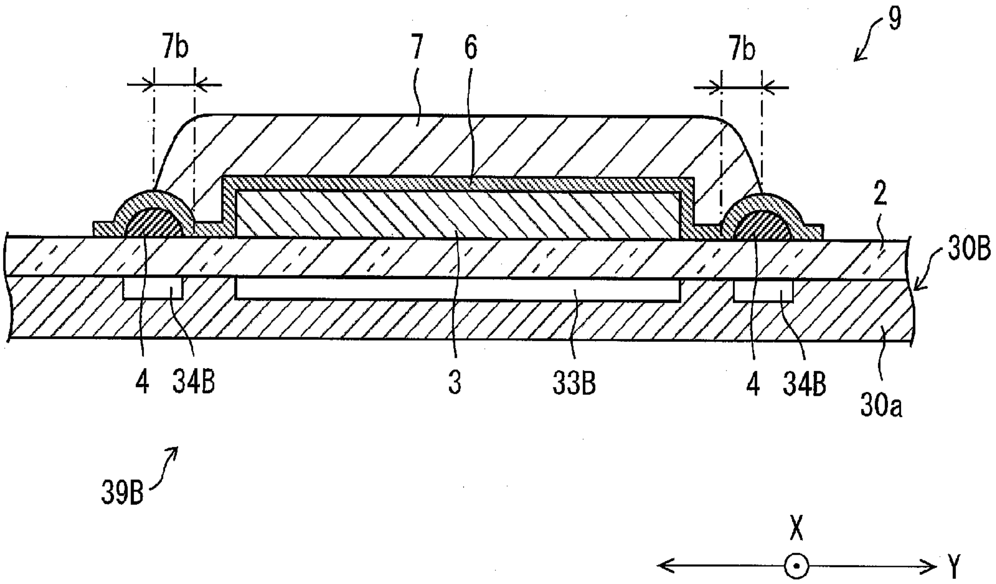

9
7b
7
6
7b
2
30B
4
34B
3
33B
4
34B
30a
39B
X
Y

FIG. 17

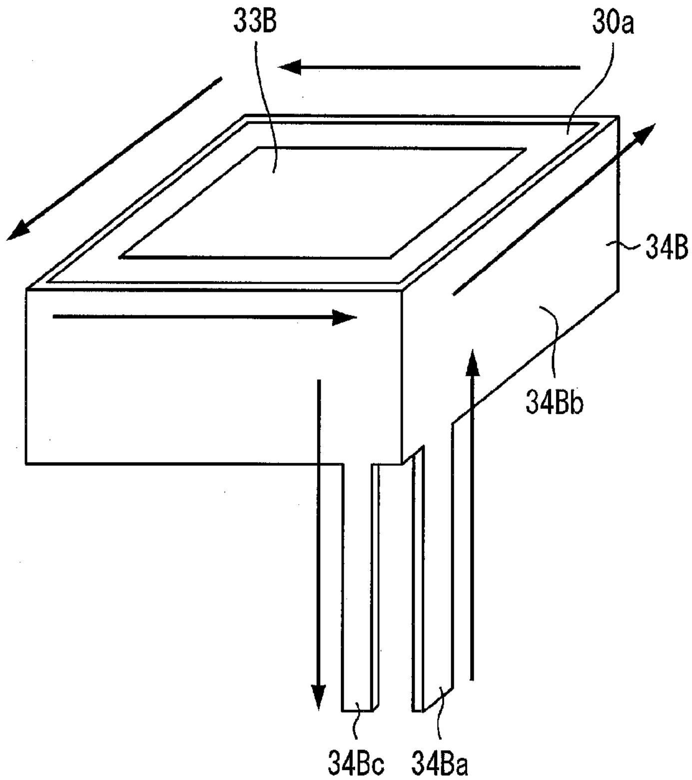

33B
30a
34B
34Bb
34Bc
34Ba

FIG. 18

FIG. 19A

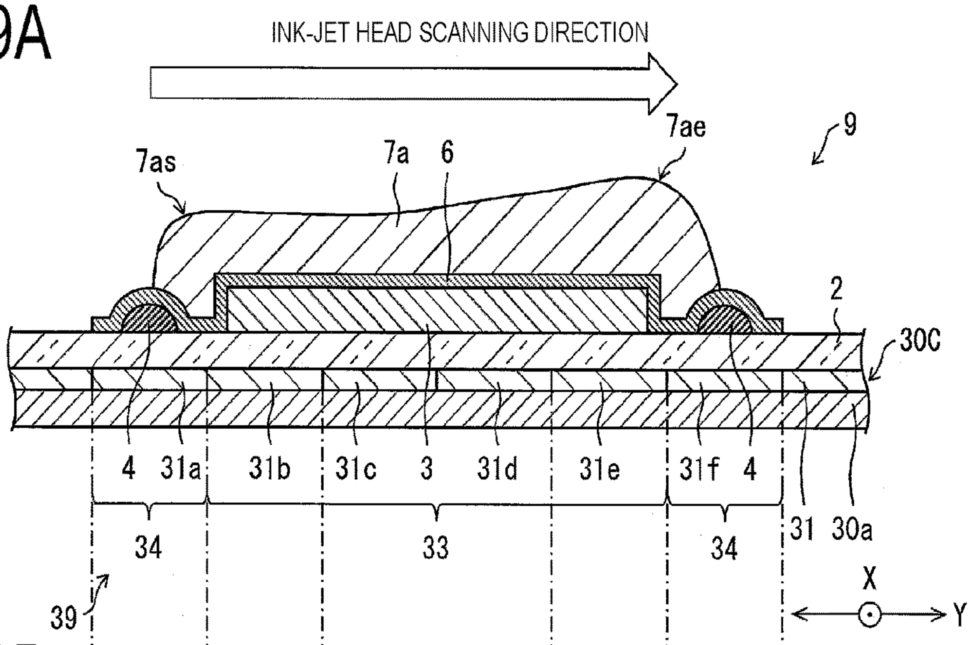


FIG. 19B

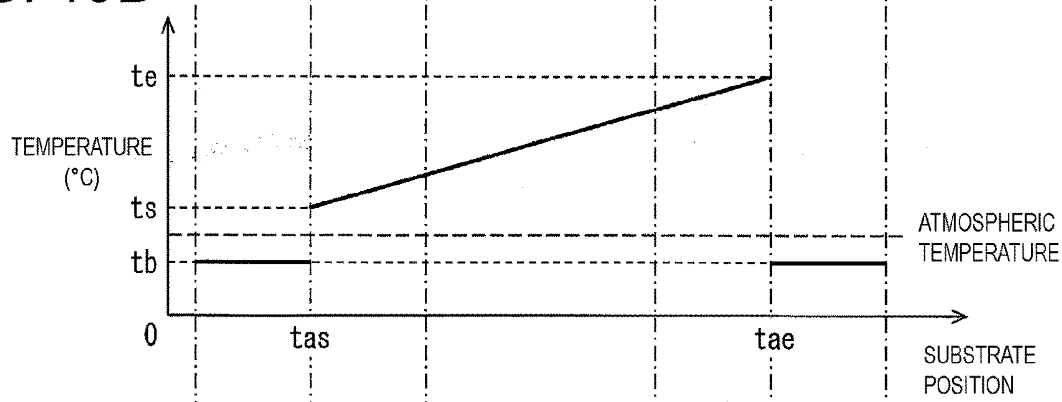
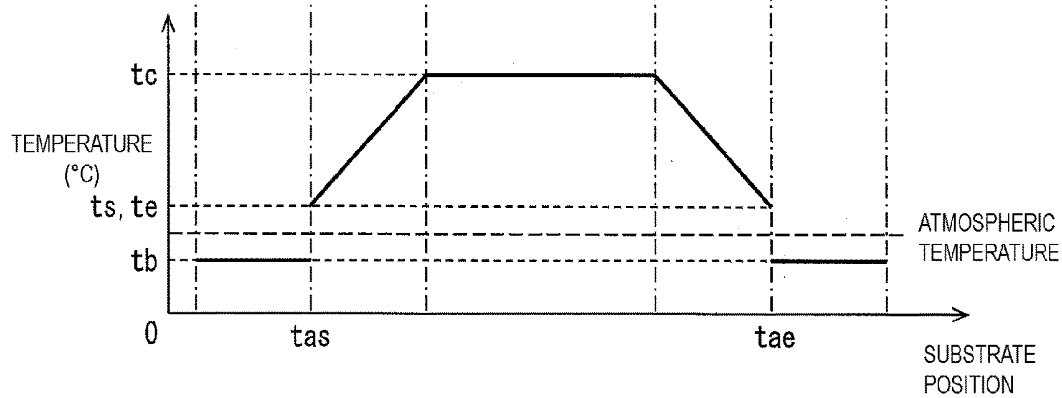


FIG. 19C



SUBSTRATE MOUNTING STAGE, INK-JET APPLYING DEVICE, LEVELING DEVICE, AND METHOD FOR MANUFACTURING ORGANIC EL DISPLAY DEVICE

TECHNICAL FIELD

[0001] The disclosure relates to a substrate mounting stage, an ink-jet applying device, a leveling device, and a method for manufacturing an organic EL display device.

BACKGROUND ART

[0002] PTL 1 discloses a configuration in which a substrate mounting stage is provided with a mechanism for heating a mounted substrate.

CITATION LIST

Patent Literature

[0003] PTL 1: JP 2010-131491 A

SUMMARY

Technical Problem

[0004] In an organic EL display device, in order to seal an organic EL layer of a pixel, a sealing layer is formed on the entire surface of a pixel formation region. In the sealing layer, after forming a frame-shaped bank surrounding the pixel formation region in a frame shape, an ink material is applied in the frame-shaped bank by an ink-jet method, and the ink material is cured. At this time, in order to form a flat sealing layer, the applied ink material is leveled (subjected to leveling) before being cured. However, when this ink material is subjected to leveling, in a case where a temperature in the vicinity of the frame-shaped bank is high, the ink tends to spread out over the frame-shaped bank, a width of an edge portion of the sealing layer with a nonuniform film thickness widens, and thus frame narrowing cannot be achieved.

[0005] The disclosure has been made in view of the above-described known problems, and an object thereof is to narrow an edge width of a sealing layer.

Solution to Problem

[0006] In order to solve the above-described problems, a substrate mounting stage according to one aspect of the disclosure is a substrate mounting stage mounted with organic EL display panel formation regions disposed in a matrix shape, a pixel formation region with pixels disposed in a matrix shape, a frame-shaped bank surrounding the pixel formation region in a frame shape, and an ink material before being cured applied by an ink-jet method configured to cover the pixel formation region in the frame-shaped bank being disposed in the organic EL display panel formation region, the substrate mounting stage includes temperature adjustment portions subjected to a temperature adjustment and disposed in a matrix shape, in which the temperature adjustment portion includes a low temperature portion disposed at a position corresponding to the frame-shaped bank in a frame shape and having a first temperature being an atmospheric temperature or lower.

[0007] In order to solve the above-described problems, a method for manufacturing an organic EL display device according to one aspect of the disclosure is a method for manufacturing an organic EL display device to manufacture an organic EL display device from a substrate with organic EL display panel formation regions disposed in a matrix shape, a pixel formation region with pixels disposed in a matrix shape, a frame-shaped bank surrounding the pixel formation region in a frame shape, and an ink material before being cured applied by an ink-jet method configured to cover the pixel formation region in the frame-shaped bank being disposed in the organic EL display panel formation region, the method includes temperature-adjusting a temperature of a position corresponding to the frame-shaped bank of the substrate to a first temperature being an atmospheric temperature or lower after the ink material is applied by the ink-jet method.

Advantageous Effects of Disclosure

[0008] According to one aspect of the disclosure, an effect that an edge width of a sealing layer can be narrowed is achieved.

BRIEF DESCRIPTION OF DRAWINGS

[0009] FIG. **1** is a diagram illustrating steps of manufacturing an organic EL display device according to a first embodiment of the disclosure.

[0010] FIG. **2** is a plan view of a substrate of the organic EL display device according to the first embodiment of the disclosure.

[0011] FIG. **3** is a cross-sectional view in a vicinity of an organic EL display panel formation region of the substrate in FIG. **2**.

[0012] FIG. **4** is a diagram illustrating an overview of a sealing system forming a sealing layer of the organic EL display device according to the first embodiment of the disclosure.

[0013] FIG. **5** is a diagram illustrating an overall configuration of an ink-jet applying device of the sealing system.

[0014] FIG. **6** is a diagram illustrating an overall configuration of a leveling device of the sealing system.

[0015] FIG. **7** is a graph illustrating a relationship between an edge width of the sealing layer of the organic EL display device and leveling time.

[0016] FIG. **8** is a plan view illustrating a configuration of a substrate mounting portion included in a device in the sealing system.

[0017] FIG. **9** is a cross-sectional view in the vicinity of the organic EL display panel formation region of a substrate mounted on the substrate mounting portion before an ink material is cured.

[0018] FIG. **10** is a cross-sectional view in the vicinity of the organic EL display panel formation region of the substrate mounted on the substrate mounting portion according to the first embodiment of the disclosure after the ink material is cured.

[0019] FIG. **11** is a plan view illustrating a configuration of the substrate mounting portion according to a second embodiment of the disclosure.

[0020] FIG. **12** is a cross-sectional view in the vicinity of the organic EL display panel formation region of the substrate mounted on the substrate mounting portion.

[0021] FIG. **13** is a diagram illustrating an overall configuration of a water cooling type heat insulating portion.

[0022] FIG. **14** is a cross-sectional view in the vicinity of the organic EL display panel formation region of the substrate mounted on the substrate mounting portion according to the second embodiment of the disclosure after the ink material is cured.

[0023] FIG. **15** is a plan view illustrating a configuration of the substrate mounting portion according to a third embodiment of the disclosure.

[0024] FIG. **16** is a cross-sectional view in the vicinity of the organic EL display panel formation region of the substrate mounted on the substrate mounting portion.

[0025] FIG. **17** is a cross-sectional view in the vicinity of the organic EL display panel formation region of the substrate mounted on the substrate mounting portion according to the third embodiment of the disclosure after the ink material is cured.

[0026] FIG. **18** is a diagram illustrating an overall configuration of a water cooling type low temperature portion.

[0027] FIGS. **19**A to **19**C are diagrams illustrating the substrate mounting portion and a set temperature according to a fourth embodiment of the disclosure.

DESCRIPTION OF EMBODIMENTS

First Embodiment

[0028] A first embodiment of the disclosure will be described with reference to FIG. **1** to FIG. **9**.

Overview of Method for Manufacturing Organic EL Display Device

[0029] FIG. **1** is a diagram illustrating steps of manufacturing an organic EL display device according to the first embodiment of the disclosure. FIG. **2** is a plan view of a substrate **1** of the organic EL display device according to the first embodiment of the disclosure. FIG. **3** is a cross-sectional view of an organic EL display panel formation region of the substrate in FIG. **2**. FIG. **2** illustrates a configuration of a case where six organic EL display panels are obtained from one sheet of a mother glass. Note that, the number of the organic EL display panels obtained from one sheet of the mother glass is not limited to six, and five or less, or seven or more panels may be obtained.

[0030] On the substrate **1**, six organic EL display panel formation regions **9** are disposed. The organic EL display panel formation region **9** is a region to be the organic EL display device after singulation by being cut out from the mother glass.

[0031] The substrate **1** includes a TFT substrate **2**, a pixel formation region **3**, a frame-shaped bank **4**, and a sealing layer **5**.

[0032] First, in TFT step S**11**, the TFT substrate **2** is prepared. The TFT substrate **2** is prepared by a thin film transistor (transistor, drive element) for pixel drive, a gate wiring and a source wiring, and other various wirings being formed, and a passivation film (protection film), an interlayer insulating film (flattening film), and the like being formed on the mother glass by a known method.

[0033] The passivation film prevents a metal film in the TFT from peeling, and protects the TFT. The passivation film is formed on the mother glass or via other layers, and covers the TFT. The passivation film is an inorganic insulation film formed from silicon nitride, silicon oxide, or the like.

[0034] The interlayer insulating film levels concaves and convexes on the passivation film. The interlayer insulating film is formed on the passivation film. The interlayer insulating film is an organic insulating film formed from a photosensitive resin such as acrylic and polyimide.

[0035] Next, in organic EL step S**12**, a reflective electrode and an organic EL layer are formed in each pixel of the TFT substrate **2**. Then, a transparent electrode opposing the reflective electrode via the organic EL layer is formed so as to cover the organic EL layer. With this, the pixel formation region **3** in which the pixels are disposed in a matrix shape in a region where an image is displayed is formed. Additionally, when forming this pixel formation region **3**, the frame-shaped bank **4** surrounding the pixel formation region **3** in a frame shape is also formed on the TFT substrate **2**. The frame-shaped bank **4** is formed from a photosensitive resin such as acrylic and polyimide. The frame-shaped bank **4** can be formed with a thick film thickness of, for example, 1.0 μm or greater, by being formed of acrylic. Furthermore, the frame-shaped bank **4** may be covered by an inorganic film such as a nitride film.

[0036] Subsequently, in sealing step S**13**, the sealing layer **5** is formed. The sealing layer **5** can have a three-layer structure, as an example, in which an inorganic film, an organic film, and an inorganic film are layered in this order.

[0037] FIG. **4** is a diagram illustrating an overview of a sealing system **10** for forming the sealing layer **5**. The sealing system **10** is an example of a device group for forming the sealing layer **5**.

[0038] The sealing system **10** includes a first CVD device **11**, a substrate transport robot **12**, an ink-jet applying device **13**, a leveling device **14**, and a second CVD device **15**.

[0039] First, an inorganic film **6** formed from silicon nitride, silicon oxide, or the like is film-formed on the substrate **1** transported from organic EL step S**12**, by the first CVD device **11**, in a region surrounded by the frame-shaped bank **4** including at least the upper portion of the frame-shaped bank **4**. The substrate on which the inorganic film **6** is film-formed is, next, carried into the ink-jet applying device **13** through the substrate transport robot **12**.

[0040] Then, by the ink-jet applying device **13**, in a region on the inorganic film **6** and surrounded by the frame-shaped bank **4**, an ink material including a photosensitive material such as an acrylic resin, an epoxy resin, polyimide, or the like is applied. The frame-shaped bank **4** functions as a bank for blocking this ink material. Next, the substrate on which the ink material is applied is carried into the leveling device **14** through the substrate transport robot **12**.

[0041] Then, in the leveling device **14**, the substrate on which the ink material is applied is left to stand on a substrate mounting stage for a predetermined period of time. With this, the ink material on the substrate flows and is leveled. Subsequently, after the predetermined period of time has passed, the ink material on the substrate is irradiated with UV light from a UV light source disposed in the leveling device **14**. With this, the ink material is cured and an organic film **7** is film-formed on the inorganic film **6**.

[0042] Next, the substrate on which the organic film **7** is film-formed is carried into the second CVD device **15** through the substrate transport robot **12**. Then, by the second CVD device **15**, an inorganic film **8** formed from silicon nitride, silicon oxide, or the like is film-formed so as to cover the organic film **7** and the inorganic film **6**. With this, as illustrated in FIG. **3**, the flat sealing layer **5** is formed.

[0043] The organic EL layer formed in the pixel formation region **3** is subjected to Thin Film Encapsulation (TFE) by the sealing layer **5**, which prevents the organic EL layer from deteriorating by moisture or oxygen entering from the outside.

[0044] After this sealing layer **5** is formed, flexibility step **S14** may be provided. In flexibility step **S14**, glass of the substrate is peeled and a film or the like to be a support body is bonded.

[0045] Subsequently, each of the organic EL display panel formation regions **9** is singulated by being cut out. With these steps, the organic EL display device is completed.

Ink-Jet Applying Device **13**

[0046] FIG. **5** is a diagram illustrating an overall configuration of the ink-jet applying device **13**. The ink-jet applying device **13** includes a substrate mounting stage **41** on which the substrate **1** is mounted, an ink-jet head **42** for dropping the ink material to be the organic film **7**, and a head support portion **43** which movably supports the ink-jet head **42**.

[0047] The substrate mounting stage **41** moves in a Y-axis direction. The ink-jet head **42** moves in an X-axis direction orthogonal to the Y-axis direction.

[0048] When the substrate **1** is placed on the substrate mounting stage **41**, the substrate mounting stage **41** moves relatively to the ink-jet head **42**. In the present embodiment, the substrate mounting stage **41** moves in the Y-axis direction. In other words, the Y-axis direction is an application direction of the ink material to the substrate **1**.

[0049] Then, the ink material is applied to the substrate **1** mounted on the substrate mounting stage **41** from the ink-jet head **42**.

[0050] In accordance with a width of the ink-jet head **42** and a width of the substrate **1**, as necessary, by the ink-jet head **42** moving in the X-axis direction by a predetermined distance, and the substrate mounting stage **41** moving again in the Y-axis direction, the ink material is applied on a predetermined region on the substrate **1** as a whole.

[0051] When the application of the ink material is completed, the substrate **1** on the substrate mounting stage **41** may be taken out from the ink-jet applying device **13** after leveling the ink material by leaving it to stand for a predetermined period of time, or may be taken out from the ink-jet applying device **13** immediately after the application of the ink material is completed.

[0052] The substrate mounting stage **41** preferably includes a substrate mounting portion **30**, which will be described later, in a region in which the substrate **1** is mounted. Alternatively, the substrate mounting stage **41** may include any one of substrate mounting portions **30**A to **30**C, which will be described in second to fourth embodiments, instead of the substrate mounting portion **30**.

Leveling Device **14**

[0053] FIG. **6** is a diagram illustrating an overall configuration of the leveling device **14**. In the present embodiment, it is assumed that the leveling device **14** also functions as an ink curing device for curing the ink material applied by an ink-jet method.

[0054] The leveling device **14** includes a substrate mounting stage **21** and a UV light source **22**. Note that, when an ink curing device is separately provided other than the leveling device **14**, the leveling device **14** may not include the UV light source **22**.

[0055] When the substrate **1** on which the ink material is applied by the ink-jet applying device **13** is transported from the substrate transport robot **12**, the substrate **1** is mounted on the substrate mounting stage **21**. Then, the substrate **1** is left to stand for a predetermined period of time, for example, three minutes or the like. With this, the ink material applied on the substrate **1** flows and is leveled.

[0056] When the predetermined period of time has passed, the UV light source **22** is lighted, and the ink material of the substrate **1** is irradiated with the UV light. With this, the ink material of the substrate **1** is cured and the organic film **7** is film-formed. Note that, when the substrate **1** is irradiated with the UV light, an unevenness reduction measure such as irradiating the substrate **1** being floated by air with the UV light is preferably carried out. After the ink material is cured to film-form the organic film **7**, the substrate **1** is taken out from the leveling device **14**, and carried into the second CVD device **15**, which is a post-step, through the substrate transport robot **12**.

[0057] The substrate mounting stage **21** preferably includes the substrate mounting portion **30**, which will be described later, in the region in which the substrate **1** is mounted. Alternatively, the substrate mounting stage **21** may include any one of the substrate mounting portions **30**A to **30**C, which will be described in the second to fourth embodiments, instead of the substrate mounting portion **30**.

Film Thickness Unevenness of Edge of Sealing Layer

[0058] Using FIG. **7**, problems to be solved by the substrate mounting portion **30** according to the present embodiment will specifically be described.

[0059] FIG. **7** is a graph illustrating a relationship among an edge width of the sealing layer of the organic EL display device manufactured by the known manufacturing method, unevenness of a display unit, and leveling time. The organic EL display device manufactured by the known manufacturing method is an organic EL display device in which the sealing layer is formed by an ink-jet applying device and a leveling device which do not include the substrate mounting portion **30**.

[0060] The edge width illustrated in FIG. **7** is the edge width of the sealing layer. As illustrated in FIG. **7**, when the leveling time of the ink material increases, the ink in the display unit is leveled, and display unevenness due to the nonuniform ink film thickness is difficult to be visually recognized. However, a gentle shape of an edge portion by leveling enlarges an edge width. Note that, the unevenness illustrated in FIG. **7** represents a result obtained by the substrate being irradiated with a Green lamp and visually recognized.

[0061] On the other hand, when the leveling time of the ink material is shortened, the ink in the display unit is not sufficiently leveled, and the display unevenness due to the nonuniform ink film thickness is easy to be visually recognized. However, since a steep shape is maintained in the edge portion, the edge width decreases.

[0062] Accordingly, as will be described later, forming the sealing layer by the ink-jet applying device **13** or the leveling device **14** including the substrate mounting portion

30 makes it possible to reduce the display unevenness, while reducing the leveling time, and thus, can reduce the edge width.

Configuration of Substrate Mounting Portion **30**

[0063] Next, using FIG. **8** to FIG. **10**, the configuration of the substrate mounting portion **30** included in at least one of the ink-jet applying device **13** and the leveling device **14** will be described.

[0064] The substrate mounting portion **30** may be provided on both the substrate mounting stage **41** of the ink-jet applying device **13** and the substrate mounting stage **21** of the leveling device **14**, or may be provided on one of them. The substrate mounting portion **30** may be provided on at least one of the substrate mounting stages **21** and **41**. Providing the substrate mounting portion **30** on both the substrate mounting stages **21** and **41** makes it possible to obtain effect of shortening the takt time in comparison with a case of providing on only one of them. Note that, the same applies to the substrate mounting portions **30**, **30**A to **30**C described in the second to fourth embodiments.

[0065] FIG. **8** is a plan view illustrating the configuration of the substrate mounting portion **30**. FIG. **9** is a cross-sectional view in the vicinity of the organic EL display panel formation region **9** of the substrate **1** mounted on the substrate mounting portion **30** before an ink material **7***a* is cured. FIG. **10** is a cross-sectional view in the vicinity of the organic EL display panel formation region **9** of the substrate **1** mounted on the substrate mounting portion **30** after the ink material **7***a* is cured.

[0066] Note that, FIG. **8** illustrates an example in which the substrate mounting portion **30** is provided on the substrate mounting stage **41**. Additionally, in FIG. **9**, a direction indicated by an arrow (a direction from right toward left in the diagram) is a scanning direction of an ink-jet head (an application direction of the ink material **7***a*).

[0067] As illustrated in FIG. **8**, in the substrate mounting portion **30**, temperature adjustment portions **39** are disposed in a matrix shape while being separated from each other.

[0068] The substrate mounting portion **30** inquires of a lookup table, before the substrate **1** being mounted, on information of the substrate **1** (a model number of the panel, a position of the frame-shaped bank, a position of the pixel formation region, the application direction, or the like) and adjusts temperature of the temperature adjustment portions **39** on the basis of the information of the substrate **1**.

[0069] On four corners of the substrate mounting portion **30**, lift pins **37** for lifting up the substrate **1** when transporting the substrate **1** are disposed. In the substrate mounting portion **30**, temperature adjustment elements **31** are disposed in a matrix shape on a stage base material **30***a* formed from a metal material. In the present embodiment, the temperature adjustment elements **31** are disposed on the entire surface of the substrate mounting portion **30** which is a region in which the substrate **1** is placed such that the adjacent temperature adjustment elements **31** in the X direction and the Y direction make contact with each other. The temperature of each of the temperature adjustment elements **31** can be individually adjusted.

[0070] The temperature adjustment element **31** may be set to have various sizes in accordance with the size of the substrate **1**. As one example, the temperature adjustment element **31** can be made to have a size of approximately 1 mm square. The temperature adjustment element **31** may be a heat source capable of being adjusted so as to have two different temperatures and maintaining the temperatures. In the present embodiment, it is assumed that the temperature adjustment element **31** is a Peltier element.

[0071] As illustrated in FIG. **8** and FIG. **9**, in the substrate mounting portion **30**, the temperature adjustment elements **31** whose temperatures are adjusted at a position at which the organic EL display panel formation region **9** of the substrate **1** is disposed are the temperature adjustment portion **39**. In the temperature adjustment portion **39**, a region in which the pixel formation region **3** of the substrate **1** is disposed configures a high temperature portion **33** whose temperature is higher than an atmospheric temperature, and a region in which the frame-shaped bank **4** is disposed configures a low temperature portion **34** whose temperature is lower than the atmospheric temperature.

[0072] In other words, the substrate mounting portion **30** forms the temperature adjustment portion **39** so as to overlap with the organic EL display panel formation region **9**.

[0073] Note that, the atmospheric temperature refers to a peripheral temperature of the substrate mounting portion **30**. In other words, the atmospheric temperature is the peripheral temperature of the substrate mounting stage **21** or the substrate mounting stage **41** in which the substrate mounting portion **30** is included. The atmospheric temperature is a temperature of approximately from no lower than 20° C. to no higher than 25° C., for example.

[0074] The high temperature portion **33** is configured of the plurality of temperature adjustment elements **31**. In the high temperature portion **33**, the temperature of the temperature adjustment element **31** is, as an example, approximately from no lower than 30° C. to no higher than 60° C.

[0075] The low temperature portion **34** is configured of the plurality of temperature adjustment elements **31**. In the low temperature portion **34**, the temperature of the temperature adjustment element **31** is, as an example, approximately from no lower than 10° C. to no higher than 25° C. Note that, the highest temperature of the low temperature portion **34** may be the atmospheric temperature.

[0076] The organic EL display panel formation regions **9** are disposed in a matrix shape on the substrate **1** mounted on the substrate mounting portion **30**. In the organic EL display panel formation region **9**, the pixel formation region **3** in which pixels are disposed in a matrix shape, the frame-shaped bank **4** surrounding the pixel formation region **3** in a frame shape, and the ink material **7***a* applied by the ink-jet applying device **13** so as to cover the pixel formation region **3** in the frame-shaped bank **4** are disposed.

[0077] The substrate mounting portion **30** includes the temperature adjustment portions **39** disposed in a matrix shape, each temperature of which being adjusted. The temperature adjustment portion **39** includes the low temperature portion **34** and the high temperature portion **33**, each temperature of which being adjusted.

[0078] The low temperature portion **34** is disposed in a frame shape at a position corresponding to the frame-shaped bank **4**, and has a first temperature which is the atmospheric temperature or lower. In other words, the low temperature portion **34** is disposed at a position overlapping with the frame-shaped bank **4**.

[0079] Accordingly, after the ink material **7***a* is dropped from a nozzle of the ink-jet head **42** and applied on the substrate **1**, it is possible to suppress the ink material **7***a* from flowing in the vicinity of the frame-shaped bank **4**. With this, it is possible to suppress the ink from flowing over the frame-shaped bank **4**, and as illustrated in FIG. **10**, a width of an edge portion *7b*, which is a portion having a different film thickness in an organic film **7** formed by the cured ink material *7a*, can be narrowed.

[0080] As illustrated in FIG. **3**, forming an inorganic film **8** on the organic film **7** makes it possible to form the sealing layer **5** in which a width of an edge portion *5a*, which is a portion having a different film thickness, is narrow.

[0081] Accordingly, a high quality sealing layer **5** can be formed by the ink-jet method. Additionally, the organic EL display device having a frame region with a narrow width in the periphery of the pixel formation region **3** can be formed.

[0082] Furthermore, as illustrated in FIG. **8** and FIG. **9**, the high temperature portion **33** is disposed at a position in a region surrounded by the low temperature portion **34** and corresponding to the pixel formation region **3**. In other words, the high temperature portion **33** is disposed at a position overlapping with the pixel formation region **3**. Additionally, the high temperature portion **33** has a second temperature higher than the atmospheric temperature. In other words, the high temperature portion **33** is adjusted to have a higher temperature than the low temperature portion **34**.

[0083] Accordingly, heating a portion covering the pixel formation region **3** in the ink material **7***a* applied on the substrate **1** promotes flowing and promotes leveling of the ink material **7***a*. With this, time in relation to a leveling process of the ink material **7***a* can be shortened. In other words, the leveling time of the ink material **7***a* can be shortened.

[0084] As a result, as illustrated in FIG. **10**, a flat organic film **7** can be formed in a short period of time.

[0085] Then, as illustrated in FIG. **3**, forming the inorganic film **8** on the organic film **7** makes it possible to form the flat sealing layer **5**.

[0086] Furthermore, as illustrated in FIG. **8** and FIG. **9**, in the substrate mounting portion **30**, the temperature adjustment elements **31** capable of being set to the first temperature and the second temperature are disposed in a matrix shape. In the present embodiment, particularly, in the substrate mounting portion **30**, the temperature adjustment elements **31** are disposed on almost the entire surface of the region excluding the region in which the lift pins **37** are disposed. As an example of the temperature adjustment element **31**, the Peltier element can be used.

[0087] As the temperature adjustment element **31** configuring the high temperature portion **33**, various heating mechanisms such as a heating mechanism for heating by flowing a current through a resistor, or the like can be used other than the Peltier element. However, as the temperature adjustment element **31**, the Peltier element is preferably used. This is because both the temperature adjustment element **31** configuring the high temperature portion **33** and the temperature adjustment element **31** configuring the low temperature portion **34** can be configured of the Peltier element and a high efficiency is obtained.

[0088] Additionally, the low temperature portion **34** and the high temperature portion **33** are each configured of the plurality of temperature adjustment elements **31**.

[0089] With this, in accordance with shapes of the frame-shaped bank **4** and the pixel formation region **3**, the temperature adjustment elements **31** on a required portion are set to the first temperature or the second temperature, thus, the low temperature portion **34** and the high temperature portion **33** can be provided. Accordingly, the substrate mounting portion **30** with high versatility can be obtained.

[0090] Note that, in the present embodiment, although the description has been given assuming that the substrate mounting portion **30** includes the low temperature portion **34** and the high temperature portion **33**, the configuration may be such that the high temperature portion **33** is not included and only the low temperature portion **34** is included.

[0091] Additionally, the lift pins **37** may be disposed, in the substrate mounting portion **30**, not only on the four corners of the substrate **1**, but also on positions overlapping with the region where the ink material **7***a* is applied in some cases. Accordingly, when the substrate mounting portion **30** is provided on the substrate mounting stage **21** and when the leveling device also functions as the ink curing device, it is preferable to make reflectivity in the ink material applying region uniform such that reflectivity of the UV light will not change despite the positions of the lift pins **37**, by plating in the same manner as the stage portion surface, applying a polyimide (PI) material having substantially the same UV reflectivity as the surface of the substrate mounting portion **30**, or the like on the surface of the lift pin **37**.

Second Embodiment

[0092] A second embodiment of the disclosure will be described with reference to FIG. **11** to FIG. **14**. FIG. **11** is a plan view illustrating a configuration of the substrate mounting portion **30**A according to the second embodiment of the disclosure. FIG. **12** is a cross-sectional view in the vicinity of the organic EL display panel formation region of the substrate **1** mounted on the substrate mounting portion **30**A. FIG. **14** is a cross-sectional view in the vicinity of the organic EL display panel formation region **9** of the substrate **1** mounted on the substrate mounting portion **30**A after the ink material **7***a* is cured. Note that, in FIG. **12**, a direction indicated by an arrow (a direction from right toward left in the diagram) is the scanning direction of the ink-jet head (the application direction of the ink material **7***a*).

[0093] The substrate mounting portion **30**A may be provided on at least one of the substrate mounting stage **41** of the ink-jet applying device **13** (FIG. **5**) and the substrate mounting stage **21** of the leveling device **14** (FIG. **6**).

[0094] As illustrated in FIG. **11** and FIG. **12**, the substrate mounting portion **30**A is configured such that a heat insulating portion **32** is disposed between the temperature adjustment elements **31** disposed in a matrix shape in the substrate mounting portion **30**. The other configurations of the substrate mounting portion **30**A are the same as those of the substrate mounting portion **30**.

[0095] The heat insulating portion **32** is provided in the periphery of the temperature adjustment element **31** in a grid shape. The heat insulating portion **32** can be configured of air, water, and other heat insulating materials. In a case where the heat insulating portion **32** is configured of air, it is sufficient for the heat insulating portion **32** to be a groove recessed from a surface of the substrate mounting portion **30**A (a mounting surface of the substrate **1**).

[0096] Additionally, the heat insulating portion **32** may have a water cooling type heat insulating mechanism; FIG. **13** is a diagram illustrating an overall configuration of the water cooling type heat insulating portion **32**. In FIG. **13**, the heat insulating portion **32** includes an inflow pipe **32***a*, a circulation portion **32***b*, and a discharge pipe **32***c*, the circulation portion **32***b* surrounds the temperature adjustment element **31**. The inflow pipe **32***a* and the discharge pipe **32***c* are connected to the circulation portion **32***b*. The temperature adjustment element **31** and the circulation portion **32***b* make contact with each other. Note that, the temperature adjustment element **31** and the circulation portion **32***b* may be separated from each other.

[0097] As illustrated by arrows in FIG. **13**, the water flowing into the circulation portion **32***b* from the inflow pipe **32***a* circulates in the circulation portion **32***b*, travels around the temperature adjustment element **31**, and is discharged from the discharge pipe **32***c*. The heat between the adjacent temperature adjustment elements **31** can be insulated in this manner. In a case where the heat insulating portion **32** is configured with the water cooling type, the configuration may be such that the water can flow in any desired position of the grid shaped heat insulating portion **32**. Particularly, by circulating the water in the heat insulating portion **32** between the low temperature portion **34** and the high temperature portion **33**, the heat between the low temperature portion **34** and the high temperature portion **33** is insulated. With this, it is possible to maintain the low temperature portion **34** at the first temperature and maintain the high temperature portion **33** at the second temperature with high precision.

[0098] As illustrated in FIG. **11** and FIG. **12**, in the substrate mounting portion **30**A, the low temperature portion **34** is disposed at a position overlapping with the frame-shaped bank **4**.

[0099] Accordingly, after the ink material **7***a* is dropped from the nozzle of the ink-jet head **42** and applied on the substrate **1**, it is possible to suppress the ink material **7***a* from flowing in the vicinity of the frame-shaped bank **4**. With this, it is possible to suppress the ink from flowing over the frame-shaped bank **4**, and as illustrated in FIG. **14**, a width of the edge portion **7***b*, which is a portion having a different film thickness in the organic film **7** formed by the cured ink material **7***a*, can be narrowed.

[0100] As illustrated in FIG. **3**, forming the inorganic film **8** on the organic film **7** makes it possible to form the sealing layer **5** in which a width of the edge portion **5***a*, which is a portion having a different film thickness, is narrow.

[0101] As illustrated in FIG. **11** and FIG. **12**, in the substrate mounting portion **30**A, the high temperature portion **33** is disposed at a position overlapping with the pixel formation region **3**. Additionally, the high temperature portion **33** has the second temperature higher than the atmospheric temperature.

[0102] Accordingly, heating the portion covering the pixel formation region **3** in the ink material **7***a* applied on the substrate **1** promotes flowing and promotes leveling of the ink material **7***a*. With this, the time in relation to the leveling process of the ink material **7***a* can be shortened. As a result, as illustrated in FIG. **14**, the flat organic film **7** can be formed in a short period of time.

[0103] Then, as illustrated in FIG. **3**, forming the inorganic film **8** on the organic film **7** makes it possible to form the flat sealing layer **5**.

Third Embodiment

[0104] A third embodiment of the disclosure will be described with reference to FIG. **15** to FIG. **18**. FIG. **15** is a plan view illustrating a configuration of the substrate mounting portion **30**B according to the third embodiment of the disclosure. FIG. **16** is a cross-sectional view in the vicinity of the organic EL display panel formation region of the substrate mounted on the substrate mounting portion **30**B. FIG. **17** is a cross-sectional view in the vicinity of the organic EL display panel formation region **9** of the substrate **1** mounted on the substrate mounting portion **30**B after the ink material **7***a* is cured. Note that, in FIG. **16**, a direction indicated by an arrow (a direction from right toward left in the diagram) is the scanning direction of the ink-jet head (the application direction of the ink material **7***a*).

[0105] The substrate mounting portion **30**B may be provided on at least one of the substrate mounting stage **41** of the ink-jet applying device **13** (FIG. **5**) and the substrate mounting stage **21** of the leveling device **14** (FIG. **6**).

[0106] As illustrated in FIG. **15** and FIG. **16**, the substrate mounting portion **30**B includes temperature adjustment portions **39**B disposed in a matrix shape, each temperature of which being adjusted. The temperature adjustment portion **39**B includes a low temperature portion **34**B and a high temperature portion **33**B, each temperature of which being adjusted.

[0107] Between the temperature adjustment portions **39**B, a stage base material **30***a*, which is a metal material configuring the substrate mounting stage **41** or the substrate mounting stage **21**, is disposed, and the heat source is not disposed.

[0108] The high temperature portion **33**B is disposed at a position in a region surrounded by the low temperature portion **34**B and corresponding to the pixel formation region **3**, and adjusted to the second temperature. The high temperature portion **33**B includes a metal plate and a heating mechanism such as a thermoelectric element for heating the metal plate.

[0109] In the substrate **1**, when the high temperature portion **33**B makes contact with the position of the pixel formation region **3**, heating a portion covering the pixel formation region **3** in the ink material **7***a* applied on the substrate **1** promotes flowing of the ink material **7***a*, and promotes leveling of the ink material **7***a*. With this, the time in relation to the leveling process of the ink material **7***a* can be improved.

[0110] The low temperature portion **34**B is disposed in a frame shape at a position corresponding to the frame-shaped bank **4**, and adjusted to the first temperature. The low temperature portion **34**B can be configured of air, water, and other heat insulating materials. In a case where the low temperature portion **34**B is configured of air, it is sufficient for the low temperature portion **34**B to be a groove recessed from a surface of the substrate mounting portion **30**B (the mounting surface of the substrate **1**).

[0111] Additionally, the low temperature portion **34**B may have a water cooling type heat insulating mechanism; FIG. **18** is a diagram illustrating an overall configuration of the water cooling type low temperature portion **34**B. In FIG. **18**, the low temperature portion **34**B includes an inflow pipe **34**Ba, a circulation portion **34**Bb, and a discharge pipe **34**Bc, the circulation portion **34**Bb surrounds the high temperature portion **33**B while being separated from the high temperature portion **33**B. The inflow pipe **34**Ba and the discharge pipe **34**Bc are connected to the circulation portion **34**Bb. As illustrated by arrows in FIG. **18**, the water flowing into the circulation portion **34**Bb from the inflow pipe **34**Ba passes through the circulation portion **34**Bb, travels around the high temperature portion **33**B, and is discharged from the discharge pipe **34**Bc. The vicinity of the frame-shaped bank **4** of the substrate **1** can be cooled in this manner.

[0112] Accordingly, after the ink material **7***a* is dropped from the nozzle of the ink-jet head **42** and applied on the substrate **1**, it is possible to suppress the ink material **7***a* from flowing in the vicinity of the frame-shaped bank **4**. With this, it is possible to suppress the ink from flowing over the frame-shaped bank **4**, and as illustrated in FIG. **17**, a width of the edge portion **7***b,* which is a portion having a different film thickness in the organic film **7** formed by the cured ink material **7***a,* can be narrowed.

[0113] As illustrated in FIG. **3**, forming the inorganic film **8** on the organic film **7** makes it possible to form the sealing layer **5** in which a width of the edge portion **5***a,* which is a portion having a different film thickness, is narrow. With this, a high quality sealing layer **5** can be formed by the ink-jet method. Additionally, the organic EL display device having a frame region with a narrow width in the periphery of the pixel formation region **3** can be formed.

[0114] As illustrated in FIG. **15** and FIG. **16**, in the substrate mounting portion **30**B, the high temperature portion **33**B is disposed at a position overlapping with the pixel formation region **3**. Additionally, the high temperature portion **33**B has the second temperature higher than the atmospheric temperature.

[0115] Accordingly, heating the portion covering the pixel formation region **3** in the ink material **7***a* applied on the substrate **1** promotes flowing and promotes leveling of the ink material **7***a*. With this, the time in relation to the leveling process of the ink material **7***a* can be shortened. As a result, as illustrated in FIG. **17**, the flat organic film **7** can be formed in a short period of time.

[0116] Then, as illustrated in FIG. **3**, forming the inorganic film **8** on the organic film **7** makes it possible to form the flat sealing layer **5**.

Fourth Embodiment

[0117] A fourth embodiment of the disclosure will be described with reference to FIGS. **19**A to **19**C. FIGS. **19**A to **19**C are diagrams illustrating the substrate mounting portion and a set temperature according to the fourth embodiment of the disclosure. FIG. **19**A is a cross-sectional view illustrating a configuration of the substrate mounting portion **30**C according to the fourth embodiment of the disclosure, FIG. **19**B is a graph illustrating an example of a first temperature gradient of the substrate mounting portion **30**C illustrated in FIG. **19**A, and FIG. **19**C is a graph illustrating an example of a second temperature gradient of the substrate mounting portion **30**C illustrated in FIG. **19**A.

[0118] The substrate mounting portion **30**C may be provided on at least one of the substrate mounting stage **41** of the ink-jet applying device **13** (FIG. **5**) and the substrate mounting stage **21** of the leveling device **14** (FIG. **6**).

[0119] The substrate mounting portion **30**C is configured such that the high temperature portion **33** has a temperature gradient in the substrate mounting portion **30** (FIG. **8** and FIG. **9**). In FIG. **19**A, a direction indicated by an arrow (a direction from right toward left in the diagram) is the scanning direction of the ink-jet head (the application direction of the ink material **7***a*).

[0120] As illustrated in FIG. **19**A, the ink material **7***a* applied by the ink-jet applying device **13** (FIG. **5**) has different heights at an application start position **7***as* and an application end position **7***ae* immediately after the application.

[0121] For example, since the residence time at the application start position **7***as* on the substrate is longer than that at the application end position **7***ae,* the height of the application start position **7***as* tends to be low by the leveling effect caused by the residence.

[0122] Here, in the cross section of the substrate mounting portion **30**C, the temperature adjustment elements **31** configuring the high temperature portion **33** are assumed to include a temperature adjustment element **31***b,* a temperature adjustment element **31***c,* a temperature adjustment element **31***d,* and a temperature adjustment element **31***e,* from the side closer to the application start position **7***as* toward the side closer to the application end position **7***ae,* in this order. Additionally, among the low temperature portions **34** sandwiching the high temperature portion **33**, a temperature adjustment element in the vicinity of the temperature adjustment element **31***b* is assumed to be a temperature adjustment element **31***a,* and a temperature adjustment element in the vicinity of the temperature adjustment element **31***e* is assumed to be a temperature adjustment element **31***f.*

[0123] As illustrated in FIGS. **19**A and **19**B, in the high temperature portion **33**, the temperature of each of the temperature adjustment elements **31** is adjusted so as to have a temperature gradient from the temperature adjustment element **31***b* to the temperature adjustment element **31***e* (in other words, in the scanning direction of ink-jet head).

[0124] This height of the ink material immediately after the application depends on ink material viscosity, setting value for the application of the ink-jet applying device **13**, or the like. FIG. **19**B illustrates an example in which a temperature gradient is provided such that the temperature in the vicinity of the application start position **7***as* is higher than that in the vicinity of the application end position **7***ae.*

[0125] As illustrated in FIG. **19**A, in a case where the height of the ink material **7***a* at the application end position **7***ae* is higher than that at the application start position **7***as,* as illustrated in FIG. **19**B, the temperature of the high temperature portion **33** is adjusted such that a temperature te in the vicinity of the application end position **7***ae* becomes higher than a temperature ts in the vicinity of the application start position **7***as* in the high temperature portion **33**. This is because it is necessary for the fluidity of the ink material where height is high to be increased in order to level the height of the ink material.

[0126] As described above, adjusting the temperature of the high temperature portion **33** to the temperature in accordance with the height of the ink material **7***a* from the application start position **7***as* to the application end position **7***ae* makes it possible to improve leveling speed of the ink material **7***a.*

[0127] Note that, in FIG. **19**B as well, the temperatures ts and te of the high temperature portion **33** (the temperature adjustment elements **31***b* to **31***e*) opposing the pixel formation region **3** are higher than the atmospheric temperature, the temperature tb of the low temperature portion **34** (the temperature adjustment element **31***a* and **31***f*) opposing the frame-shaped bank **4** is the atmospheric temperature or lower.

[0128] Additionally, as illustrated in FIG. **19**C, in the high temperature portion **33**, a central temperature tc may be made relatively high (for example, make the temperatures of the temperature adjustment elements **31***c* and **31***d* high), the temperatures ts and te of the edge portions may be made lower than the temperature tc (for example, make the temperatures of the temperature adjustment elements **31***b* and **31***f* low).

[0129] This makes it possible to flow and level the ink material **7***a* in the vicinity of the center of the pixel formation region **3**. Additionally, the fluidity of the edge portion of the pixel formation region **3** is relatively suppressed in comparison with that in the vicinity of the center and the ink fluidity in the vicinity of the low temperature portion **34** can be suppressed with ease. Accordingly, it is possible to suppress the ink material **7***a* from flowing over the frame-shaped bank **4** more securely.

[0130] Note that, in FIG. **19**C as well, the temperatures tc, ts, and to of the high temperature portion **33** (the temperature adjustment elements **31***b* to **31***e*) opposing the pixel formation region **3** are higher than the atmospheric temperature, and the temperature tb of the low temperature portion **34** (the temperature adjustment elements **31***a* and **31***f*) opposing the frame-shaped bank **4** is the atmospheric temperature or lower.

[0131] Furthermore, in the same manner as the organic film **7** illustrated in FIG. **10**, the flat organic film **7** in which the edge portion **7***b* has a narrow width can be formed by the substrate mounting portion **30**C illustrated in FIGS. **19**A, **19**B, and **19**C as well. As a result, as illustrated in FIG. **3**, the flat sealing layer **5** in which the edge portion **5***a* has a narrow width can be formed.

[0132] Note that, in the same manner in the substrate mounting portions **30**A and **30**B, the high temperature portions **33**A and **33**B may have a temperature gradient in accordance with the height from the application start position **7***as* to the application end position **7***ae* of the ink material **7***a*.

Supplement

[0133] A substrate mounting stage according to a first aspect of the disclosure is a substrate mounting stage mounted with organic EL display panel formation regions disposed in a matrix shape, a pixel formation region with pixels disposed in a matrix shape, a frame-shaped bank surrounding the pixel formation region in a frame shape, and an ink material before being cured applied by an ink-jet method configured to cover the pixel formation region in the frame-shaped bank being disposed in the organic EL display panel formation region, the substrate mounting stage includes temperature adjustment portions subjected to a temperature adjustment and disposed in a matrix shape, in which the temperature adjustment portion includes a low temperature portion disposed at a position corresponding to the frame-shaped bank in a frame shape and having a first temperature being an atmospheric temperature or lower.

[0134] According to the configuration described above, after the ink material is applied, it is possible to suppress the ink material from flowing in the vicinity of the frame-shaped bank. With this, it is possible to suppress the ink from flowing over the frame-shaped bank, and to narrow a width of an edge portion being a portion with a different film thickness after the ink material is cured. Accordingly, a high quality film can be formed by the ink-jet method. Additionally, the organic EL display device having a frame region with a narrow width in the periphery of the pixel formation region can be formed.

[0135] In the substrate mounting stage according to a second aspect of the disclosure, in the first aspect, the temperature adjustment portion may include a high temperature portion disposed at a position corresponding to the pixel formation region in a region surrounded by the low temperature portion and having a second temperature higher than the atmospheric temperature.

[0136] According to the configuration described above, fluidity of the ink material covering the pixel formation region is promoted, and leveling of the ink material is promoted. With this, time in relation to a leveling process of the ink material can be improved.

[0137] In the substrate mounting stage according to a third aspect of the disclosure, in the second aspect, the substrate mounting stage may include temperature adjustment elements disposed in a matrix shape and having the first temperature, in which the low temperature portion may be configured of a plurality of the temperature adjustment elements.

[0138] According to the configuration described above, the low temperature portion can be set in accordance with a shape of the frame-shaped bank. Accordingly, the substrate mounting stage with high versatility can be obtained.

[0139] In the substrate mounting stage according to a fourth aspect of the disclosure, in the second aspect, the substrate mounting stage may include temperature adjustment elements disposed in a matrix shape and having the first temperature or the second temperature, in which each of the low temperature portion and the high temperature portion may be configured of a plurality of the temperature adjustment elements.

[0140] According to the configuration described above, the low temperature portion and the high temperature portion can be set in accordance with shapes of the frame-shaped bank and the pixel formation region. Accordingly, the substrate mounting stage with high versatility can be obtained.

[0141] In the substrate mounting stage according to a fifth aspect of the disclosure, in the third or fourth aspect, a heat insulating portion may be disposed between the low temperature portion and the high temperature portion. According to the configuration described above, it is possible to maintain the low temperature portion at the first temperature and maintain the high temperature portion at the second temperature with high precision.

[0142] In the substrate mounting stage according to a sixth aspect of the disclosure, in the fifth aspect, the heat insulating portion may be provided in the periphery of the temperature adjustment element in a grid shape and may include a circulation portion, fluid flowing in the circulation portion.

[0143] In the substrate mounting stage according to a seventh aspect of the present disclosure, in the fifth aspect, the heat insulating portion may be provided in the periphery of the temperature adjustment element in a grid shape and may have a groove shape recessed from a surface of the substrate mounting stage.

[0144] In the substrate mounting stage according to an eighth aspect of the disclosure, in the second and fourth to seventh aspects, the high temperature portion may be subjected to a temperature adjustment to have a temperature gradient from an application start position to an application end position of the ink material by the ink-jet method.

[0145] According to the configuration described above, the high temperature portion can be subjected to the temperature adjustment so as to have a temperature in accordance with a height of the ink material from the application start position to the application end position. With this, the time in relation to the leveling process of the ink material can be improved.

[0146] In the substrate mounting stage according to a ninth aspect of the disclosure, in the eighth aspect, the high temperature portion may have a higher temperature in the center of the pixel formation region than in the application start position.

[0147] In the substrate mounting stage according to a tenth aspect of the disclosure, in the eighth or ninth aspect, the high temperature portion may have a higher temperature in the center of the pixel formation region than in the application start position and the application end position.

[0148] In the substrate mounting stage according to an eleventh aspect of the disclosure, in the third or fourth aspect, the temperature adjustment element may be configured of a Peltier element.

[0149] An ink-jet applying device according to a twelfth aspect of the disclosure may include the substrate mounting stage in the first to eleventh aspects and the ink-jet applying device may apply the ink material.

[0150] A leveling applying device according to a thirteenth aspect of the disclosure may include the substrate mounting stage in the first to eleventh aspects and the leveling applying device may level the ink material.

[0151] A method for manufacturing an organic EL display device according to a fourteenth aspect of the disclosure is a method for manufacturing an organic EL display device to manufacture an organic EL display device from a substrate with organic EL display panel formation regions disposed in a matrix shape,

[0152] a pixel formation region with pixels disposed in a matrix shape, a frame-shaped bank surrounding the pixel formation region in a frame shape, and an ink material before being cured applied by an ink-jet method configured to cover the pixel formation region in the frame-shaped bank being disposed in the organic EL display panel formation region,

[0153] the method including temperature-adjusting a temperature of a position corresponding to the frame-shaped bank of the substrate to a first temperature being an atmospheric temperature or lower after the ink material is applied by the ink-jet method.

[0154] In the method for manufacturing an organic EL display device according to a fifteenth aspect of the disclosure, in the fourteenth aspect **14**, in the temperature-adjusting, a temperature of a position corresponding to the pixel formation region of the substrate is preferably further adjusted to the second temperature higher than the atmospheric temperature.

[0155] The disclosure is not limited to each of the embodiments stated above, and various modifications may be implemented within a range not departing from the scope of the claims. Embodiments obtained by appropriately combining technical approaches stated in each of the different embodiments also fall within the scope of the technology of the disclosure. Moreover, novel technical features may be formed by combining the technical approaches stated in each of the embodiments.

REFERENCE SIGNS LIST

[0156] **1** Substrate
[0157] **2** TFT substrate
[0158] **3** Pixel formation region
[0159] **4** Frame-shaped bank
[0160] **5** Sealing layer
[0161] **5***a* Edge portion
[0162] **6**, **8** Inorganic film
[0163] **7** Organic film
[0164] **7***a* Ink material
[0165] **7***ae* Application end position
[0166] **7***as* Application start position
[0167] **9** Organic EL display panel formation region
[0168] **10** Sealing system
[0169] **11** TFT step S
[0170] **12** Substrate transport robot
[0171] **12** Organic EL step S
[0172] **13** Ink-jet applying device
[0173] **14** Leveling device
[0174] **21**, **41** Substrate mounting stage
[0175] **22** UV light source
[0176] **30**, **30**A to **30**C Substrate mounting portion
[0177] **31** Temperature adjustment element
[0178] **32** Heat insulating portion
[0179] **33**, **33**A, **33**B High temperature portion
[0180] **34**, **34**B Low temperature portion
[0181] **37** Lift pin
[0182] **39**, **39**B Temperature adjustment portion
[0183] **42** Ink-jet head
[0184] **43** Head support portion

1. A substrate mounting stage mounted with organic EL display panel formation regions disposed in a matrix shape,

a pixel formation region with pixels disposed in a matrix shape, a frame-shaped bank surrounding the pixel formation region in a frame shape, and an ink material before being cured applied by an ink-jet method configured to cover the pixel formation region in the frame-shaped bank being disposed in the organic EL display panel formation region,

the substrate mounting stage comprising:

temperature adjustment portions subjected to a temperature adjustment and disposed in a matrix shape,

wherein the temperature adjustment portion includes a low temperature portion disposed at a position corresponding to the frame-shaped bank in a frame shape and having a first temperature being an atmospheric temperature or lower.

2. The substrate mounting stage according to claim **1**,

wherein the temperature adjustment portion includes a high temperature portion disposed at a position corresponding to the pixel formation region in a region surrounded by the low temperature portion and having a second temperature higher than the atmospheric temperature.

3. The substrate mounting stage according to claim **2**, further comprising

temperature adjustment elements disposed in a matrix shape and having the first temperature,

wherein the low temperature portion includes a plurality of the temperature adjustment elements.

4. The substrate mounting stage according to claim **2**, further comprising temperature adjustment elements disposed in a matrix shape and having the first temperature or the second temperature,

wherein each of the low temperature portion and the high temperature portion includes a plurality of the temperature adjustment elements.

5. The substrate mounting stage according to claim **3**,

wherein a heat insulating portion is disposed between the low temperature portion and the high temperature portion.

6. The substrate mounting stage according to claim **5**,

wherein the heat insulating portion is provided in a periphery of the temperature adjustment element in a grid shape and includes a circulation portion that flows fluid in the circulation portion.

7. The substrate mounting stage according to claim **5**,

wherein the heat insulating portion is provided in the periphery of the temperature adjustment element in a grid shape and has a groove shape recessed from a surface of the substrate mounting stage.

8. The substrate mounting stage according to claim **2**,

wherein the high temperature portion is subjected to a temperature adjustment to have a temperature gradient from an application start position to an application end position of the ink material by the ink-jet method.

9. The substrate mounting stage according to claim **8**,

wherein the high temperature portion has a higher temperature level in a center of the pixel formation region than a temperature of the application start position.

10. The substrate mounting stage according to claim **8**,

wherein the high temperature portion has a higher temperature level in the center of the pixel formation region than the temperature of the application start position and a temperature of the application end position.

11. The substrate mounting stage according to claim **3**,

wherein the temperature adjustment element includes a Peltier element.

12. An ink-jet applying device comprising:

the substrate mounting stage according to claim **1**, the ink-jet applying device applying the ink material.

13. A leveling device comprising:

the substrate mounting stage according to claim **1**, the leveling device leveling the ink material.

14. A method for manufacturing an organic EL display device to manufacture an organic EL display device from a substrate with organic EL display panel formation regions disposed in a matrix shape,

a pixel formation region with pixels disposed in a matrix shape, a frame-shaped bank surrounding the pixel formation region in a frame shape, and an ink material before being cured applied by an ink-jet method configured to cover the pixel formation region in the frame-shaped bank being disposed in the organic EL display panel formation region,

the method comprising:

temperature-adjusting a temperature of a position corresponding to the frame-shaped bank of the substrate to a first temperature being an atmospheric temperature or lower after the ink material is applied by the ink-jet method.

15. The method for manufacturing an organic EL display device according to claim **14**,

wherein in the temperature-adjusting, a temperature of a position corresponding to the pixel formation region of the substrate is further adjusted to the second temperature higher than the atmospheric temperature.

* * * * *

专利名称(译)	基板安装台，喷墨施加装置，整平装置以及有机el显示装置的制造方法		
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摘要(译)

基板安装部包括低温部，该低温部的温度在与围绕基板的像素形成区域的框形堤相对应的位置处被调节为大气温度或更低。通过该构造，密封层的边缘宽度变窄。