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(54) **DISPLAY DEVICE AND METHOD FOR PRODUCING SAME**

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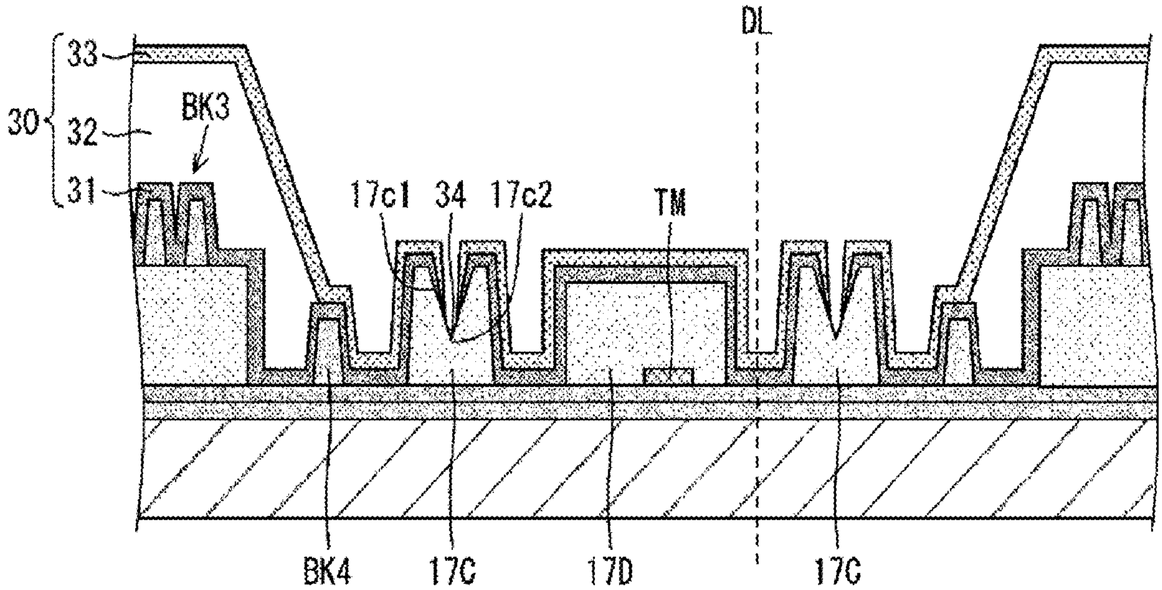
(57) **ABSTRACT**

The organic EL display device includes a third organic insulating film pattern portion, which includes a groove on an upper surface thereof, between a display region and at least part of an edge portion of a TFT substrate. A first inorganic layer and a second inorganic layer of a sealing film cover the third organic insulating film pattern portion and at least part of the edge portion in a plan view, and are split apart in the groove.



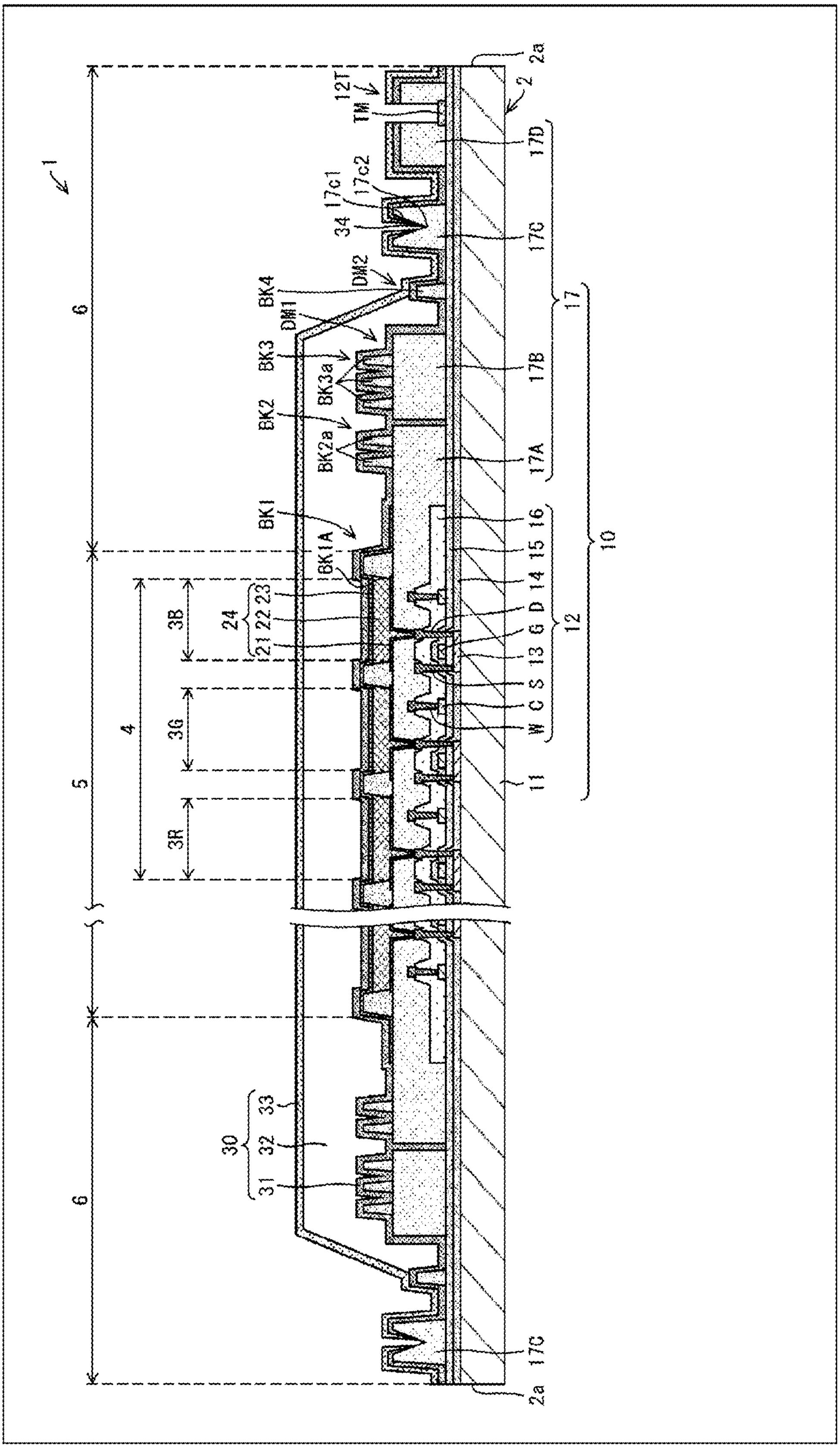

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FIG. 1

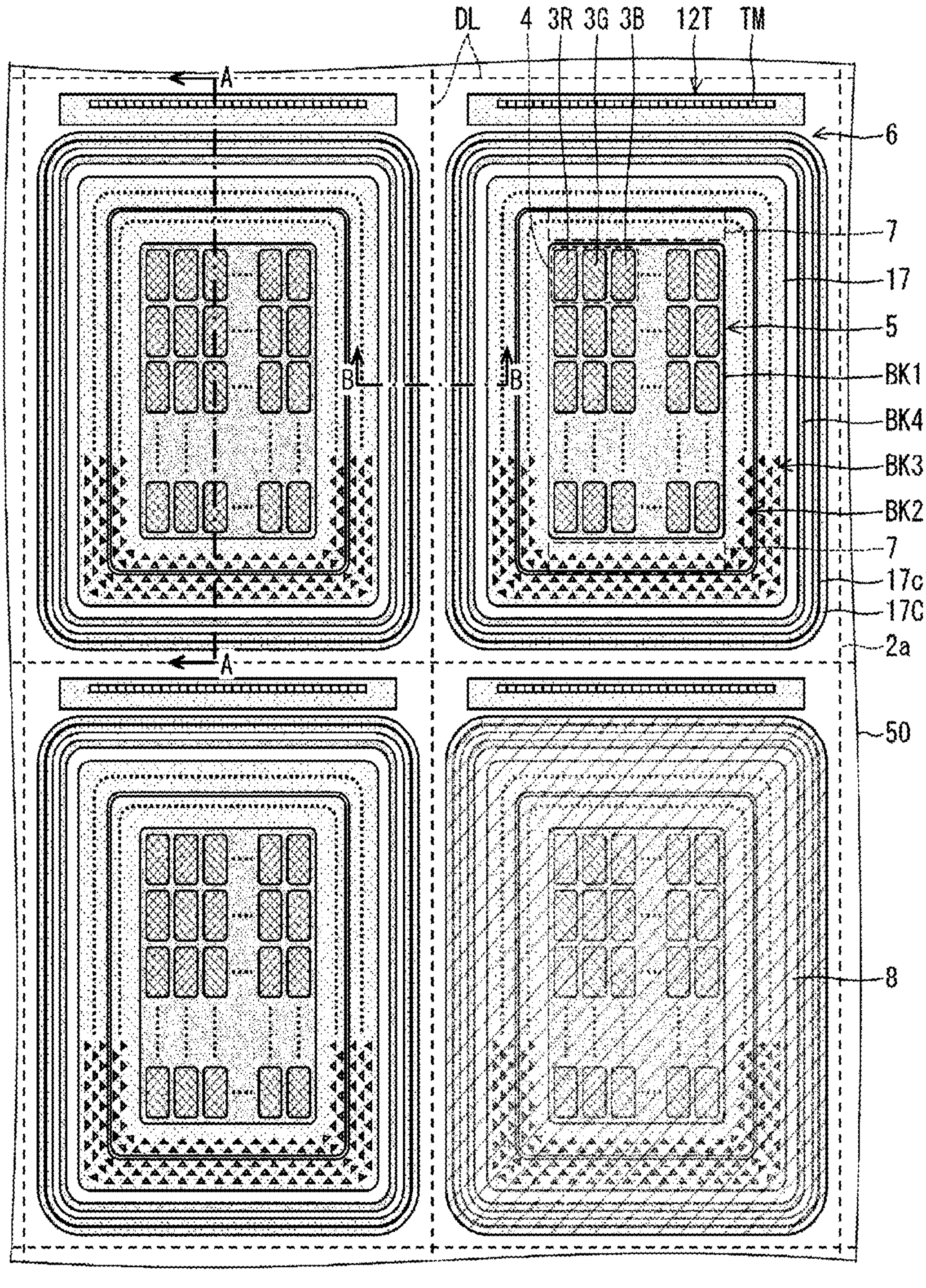


FIG. 2

FIG. 3A

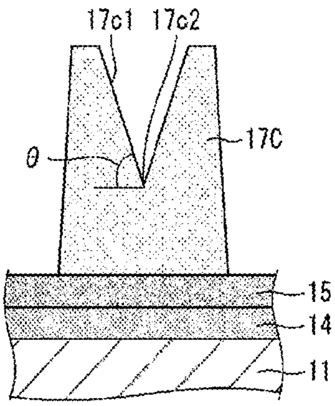


FIG. 3B

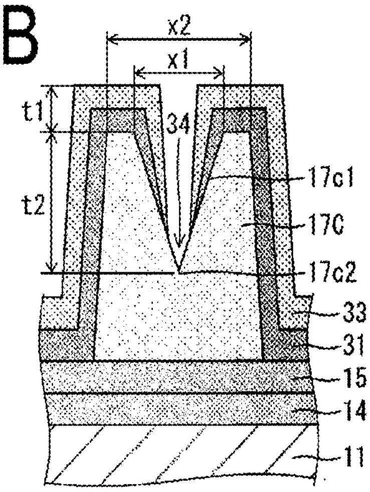


FIG. 4A

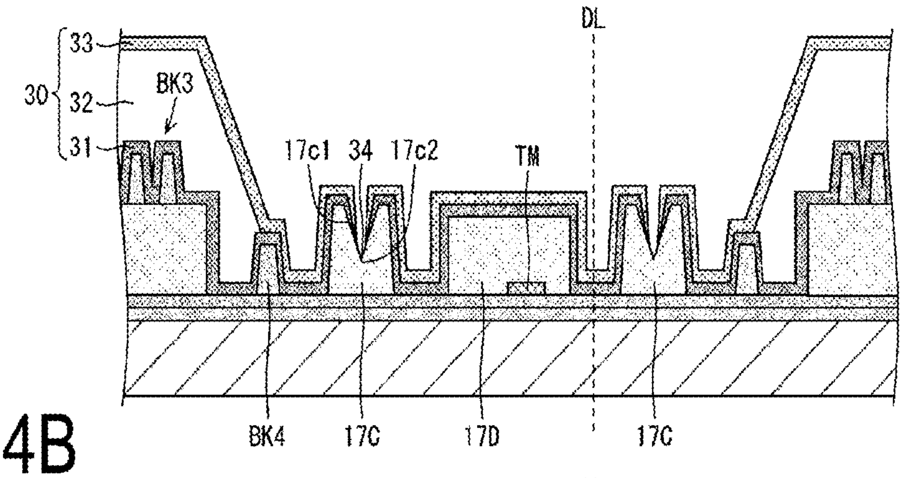


FIG. 4B

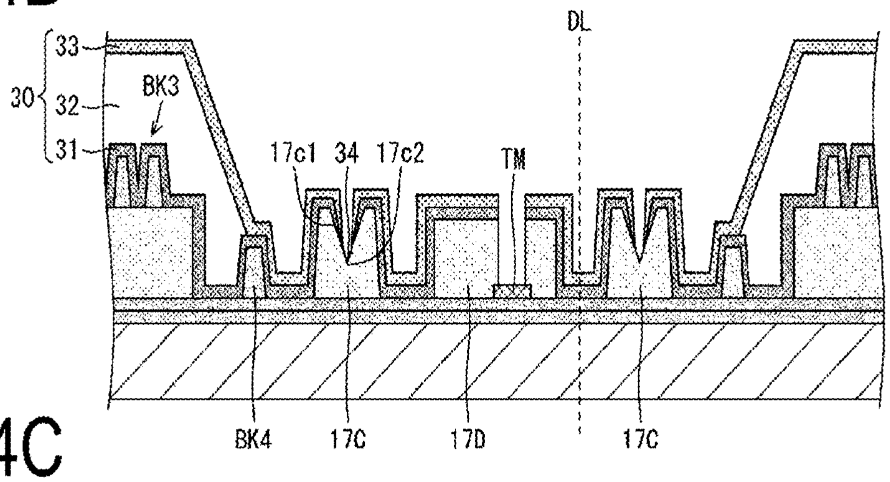


FIG. 4C

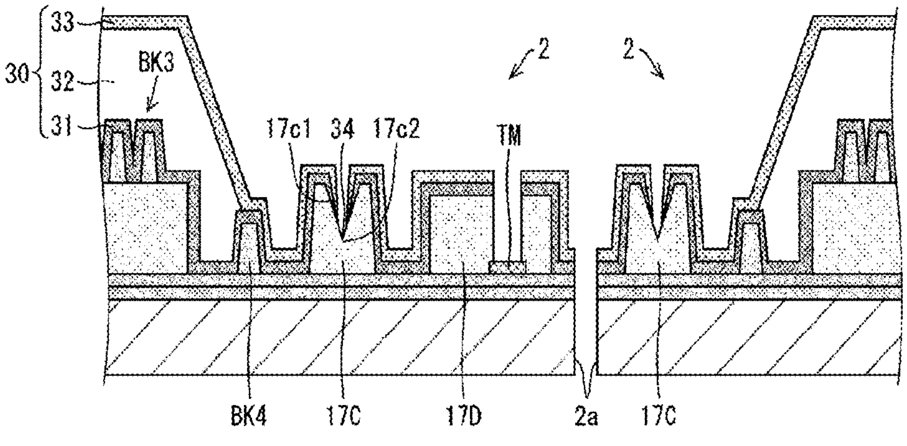


FIG. 5A

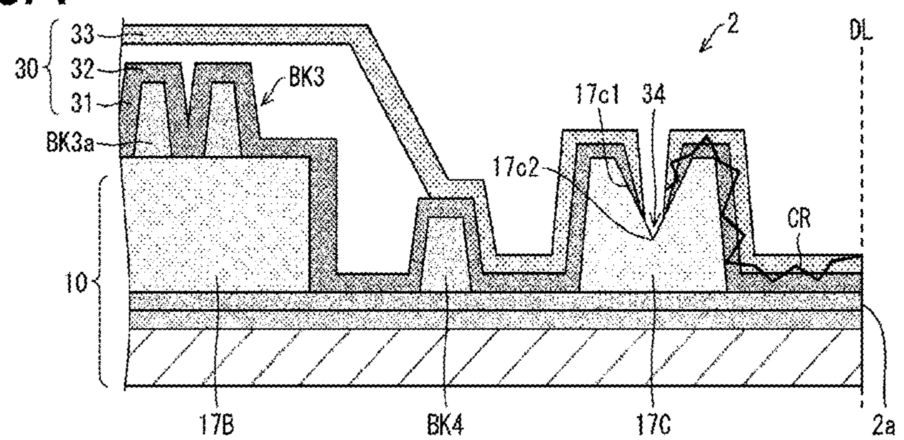


FIG. 5B

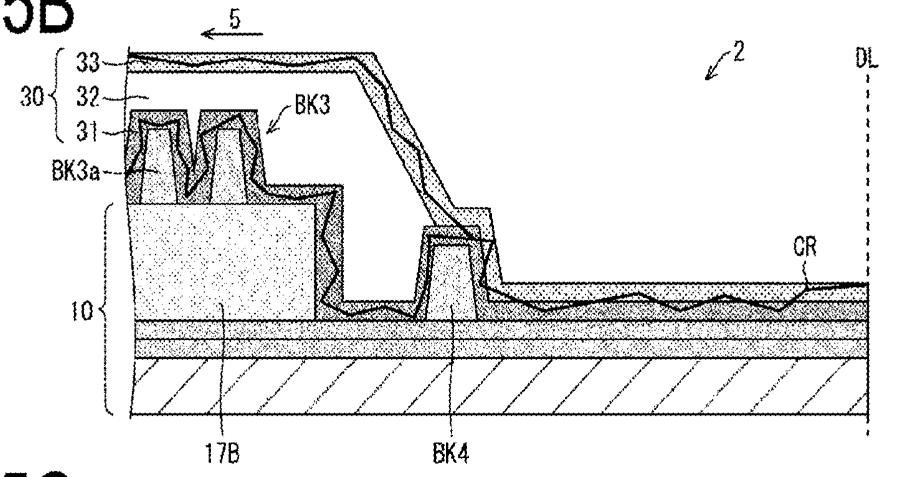


FIG. 5C

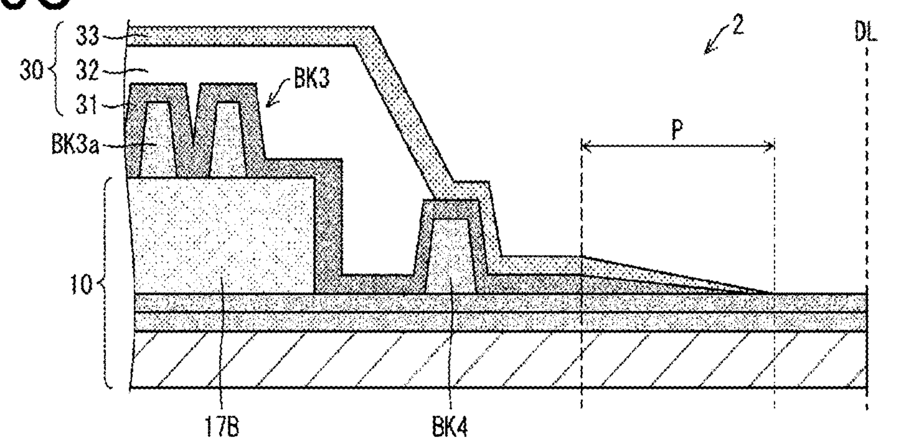


FIG. 6A

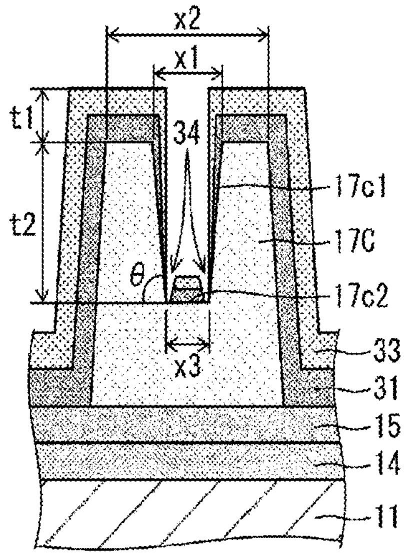


FIG. 6B

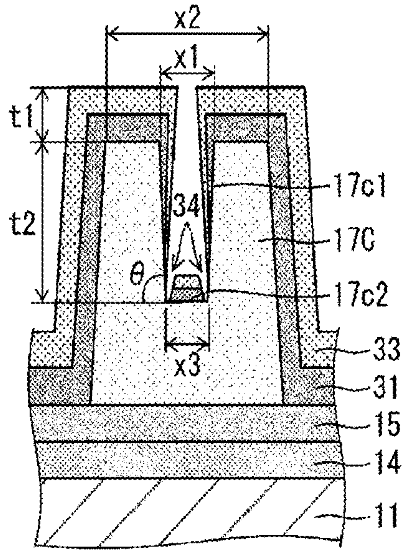
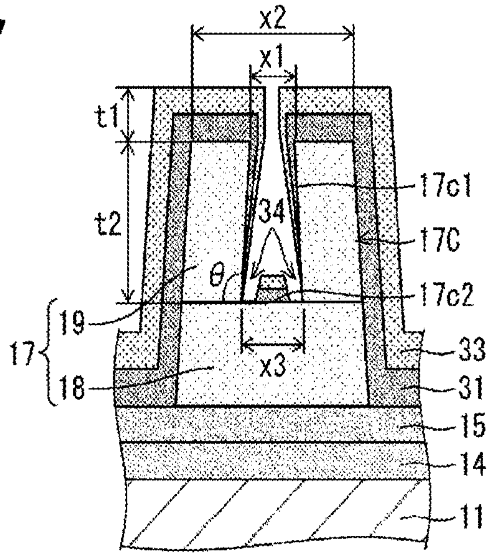
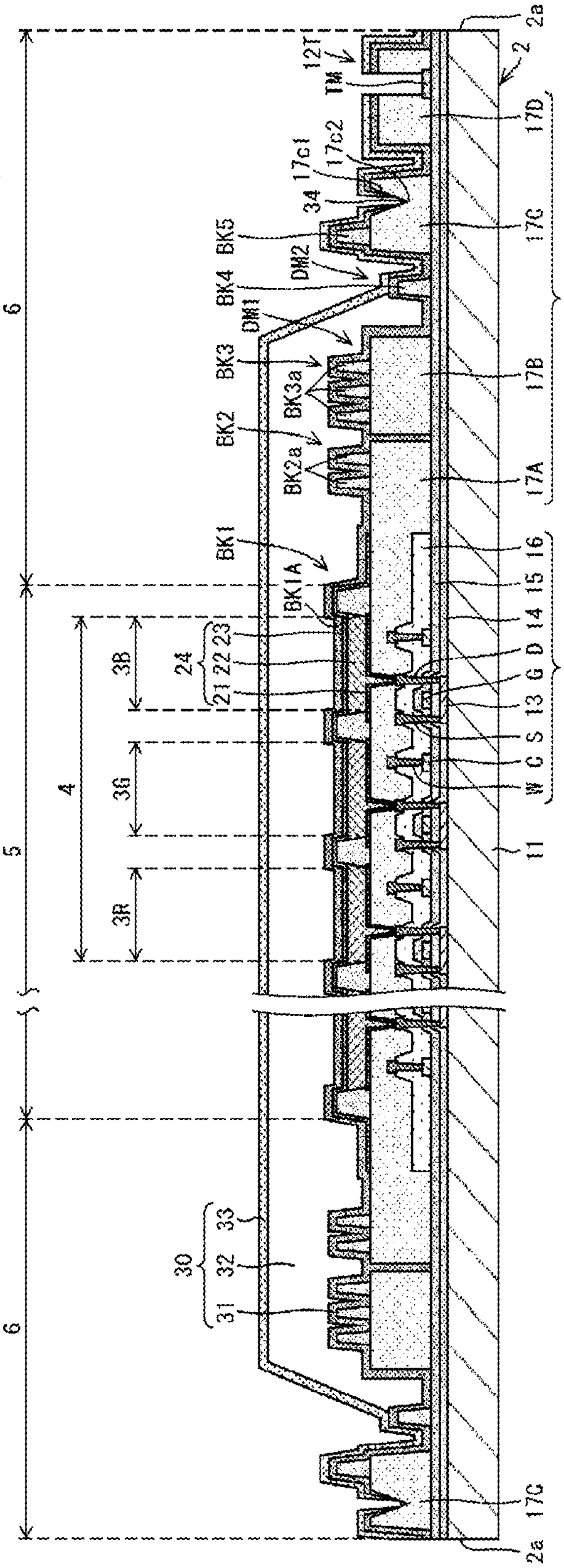


FIG. 6C

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17
BK2
BK2a
17A
BK1
BK1A
16
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14
D
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FIG. 7

FIG. 8A

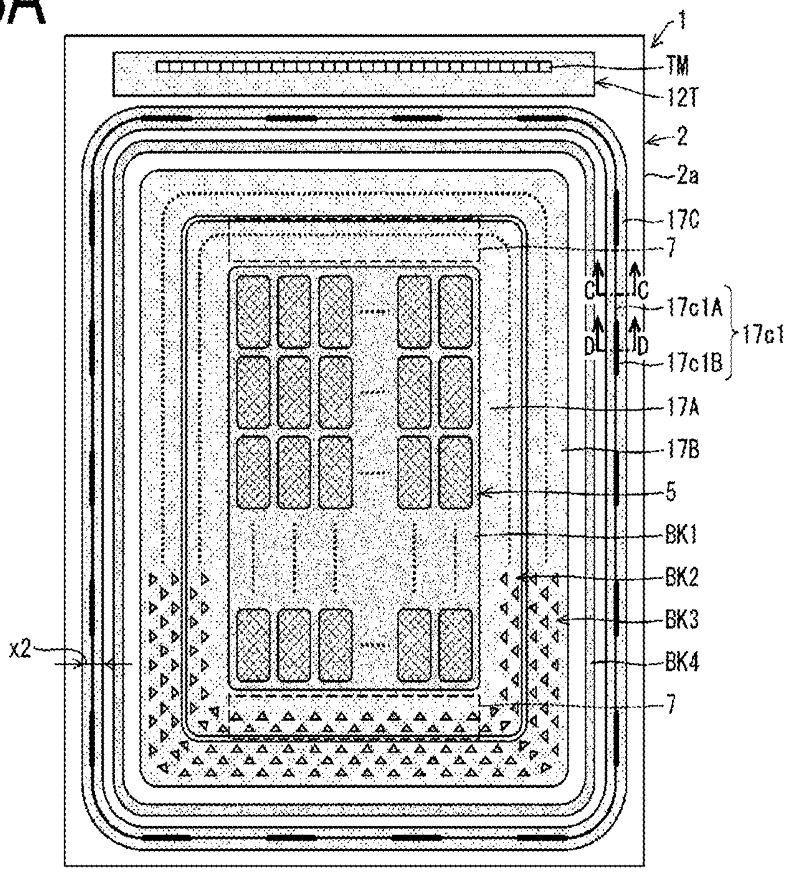


FIG. 8B

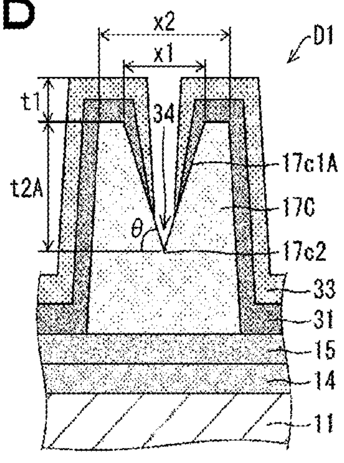
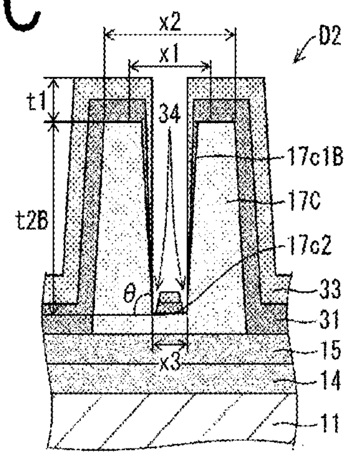


FIG. 8C



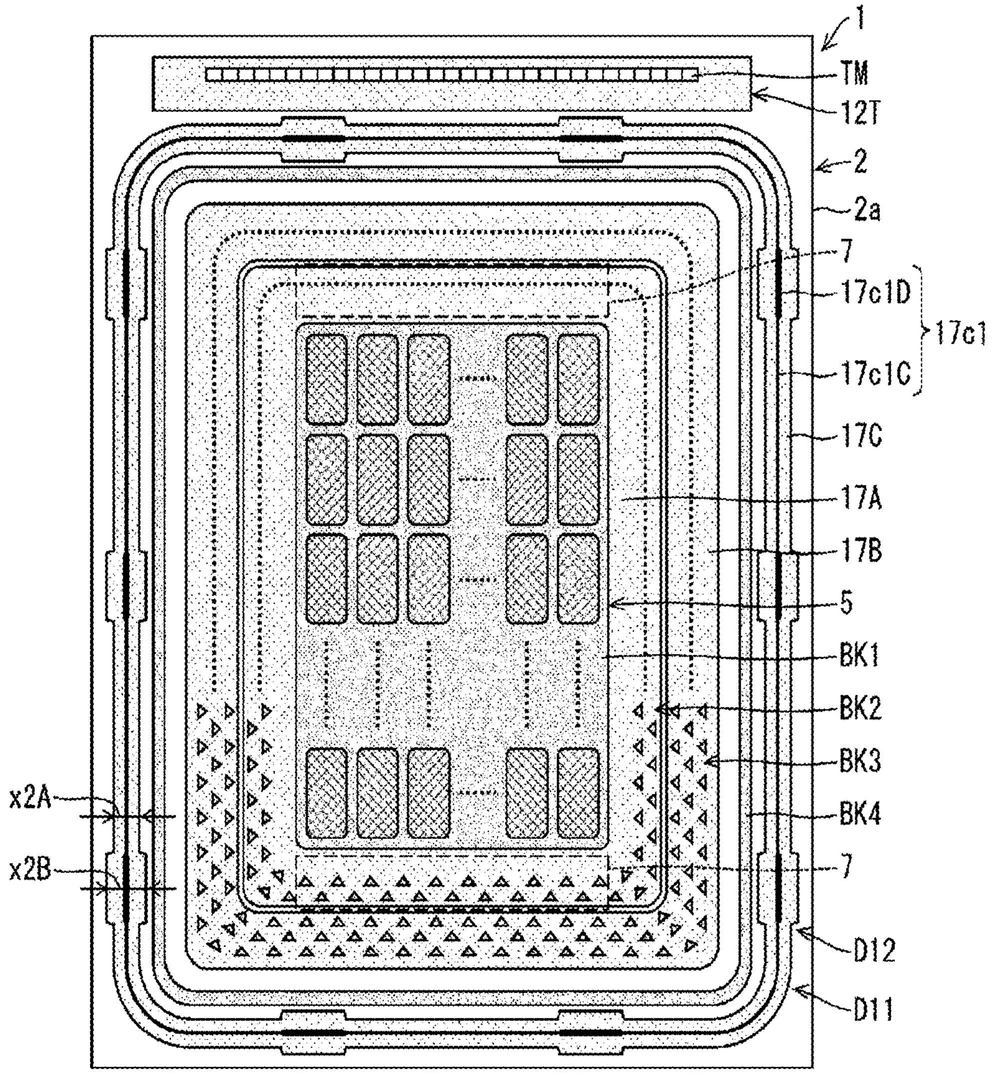

1
TM
12T
2
2a
7
17c1D
17c1
17c1C
17C
17A
17B
5
BK1
BK2
BK3
BK4
x2A
x2B
7
D12
D11

FIG. 9

DISPLAY DEVICE AND METHOD FOR PRODUCING SAME

TECHNICAL FIELD

[0001] The disclosure relates to a display device and to a method for manufacturing the display device.

BACKGROUND ART

[0002] EL display devices that use the Electro Luminescence (hereinafter referred to as "EL") of a luminescent material is gathering attention as a display device offering a faster response speed in comparison to liquid crystal display devices, and also having a wider viewing angle.

[0003] This type of display device has a configuration in which light emitting elements, such as OLED elements, connected to thin film transistors (TFTs) are provided on a TFT substrate having a configuration in which the TFTs are provided on a support body such as a glass substrate or the like.

[0004] However, in general, this type of light emitting element is susceptible to the influence of moisture, oxygen, and the like, and the characteristics thereof deteriorate due to a reaction to small amounts of moisture, oxygen, or the like, thus impairing the life of the display device.

[0005] Thus, to prevent moisture or oxygen from penetrating into the light emitting element, the light emitting element is sealed with a sealing film including an inorganic layer. The inorganic layer has a moisture-proof function to prevent the penetration of moisture and functions as a barrier layer.

[0006] In commercial production, after a plurality of display devices are formed on a large mother substrate, individual display devices are obtained from the plurality of display devices by dividing the substrate along boundaries between the display devices adjacent to each other.

[0007] However, in a case that the substrate is divided in this way, and the inorganic layer of the sealing film is present on a division line, a crack generated by cutting the inorganic layer at the time of dividing the mother substrate may spread through the inorganic layer due to impact, vibrations, or the like, and may spread to a display region of the divided display device, when or after dividing the mother substrate.

[0008] In a case that the crack generated by dividing the mother substrate reaches into the display region of the display device in this manner, moisture or oxygen penetrates into the light emitting element, and the light emitting element is damaged, for example, thus reducing the reliability of the display device. Therefore, in the related art, to prevent the crack generated by dividing of the mother substrate, regions to be divided and regions on which the inorganic layer is formed need to be separated (see PTLs 1 and 2, for example).

CITATION LIST

Patent Literature

[0009] PTL 1: JP 2010-141181 A (published on Jun. 24, 2010)

[0010] PTL 2: JP 2014-127436 A (published on Jul. 7, 2014)

SUMMARY

Technical Problem

[0011] However, in a case that each sealing film is formed independently so that adjacent sealing films are not in contact with each other, and the inorganic layer is formed using a CVD mask, there is a problem in that a shadow is generated on an edge portion of the inorganic layer and the film thickness becomes thinner. Therefore, the edge portion of the inorganic layer needs to be sufficiently separated from the display region by a distance including machining accuracy and alignment accuracy of the CVD mask such that the shadow does not reach the display region. As a result, there is a problem in that frame narrowing becomes difficult, for example.

[0012] In light of the foregoing, an object of the disclosure is to provide a highly reliable display device in which a sealing film is formed on an edge portion of the display device and which can prevent a crack generated in the sealing film as a result of division of a mother substrate from spreading into a display region, and a method for manufacturing the display device.

Solution to Problem

[0013] In order to solve the above-described problem, a display device according to an aspect of the disclosure is a display device including a support body, a plurality of light emitting elements provided in a display region on the support body, and a sealing film configured to seal the plurality of light emitting elements. The display device includes a resin layer including a groove on an upper surface thereof, the resin layer being provided between the display region and at least part of an edge portion of the support body in a plan view, and being separated from the at least part of the edge portion. The sealing film includes at least an inorganic layer. In a plan view, the inorganic layer covers the resin layer and the at least part of the edge portion, and is split apart in the groove.

[0014] In order to solve the above-described problem, a method for manufacturing a display device according to an aspect of the disclosure is a method for manufacturing a display device including a support body, a plurality of light emitting elements provided in a display region on the support body, and a sealing film configured to seal the plurality of light emitting elements. The method includes forming a resin layer including a groove in an upper surface thereof on a mother substrate configuring at least part of the support body, the resin layer being formed, in a plan view, between at least part of a scheduled division line, of a plurality of the scheduled division lines for dividing and singulating the mother substrate into the individual display devices, and the display region in a region surrounded by the plurality of scheduled division lines, the resin layer being separated from the at least part of the plurality of scheduled division lines, forming the sealing film, and dividing the mother substrate, on which the sealing film is formed, along the plurality of scheduled division lines surrounding around each of the display regions. The forming the sealing film includes forming an inorganic layer. In the forming the inorganic layer, the inorganic layer covers the resin layer, and, by forming the inorganic layer to also cover the at least part of the plurality of scheduled division lines, the inorganic layer is split apart in the groove.

Advantageous Effects of Disclosure

[0015] According to an aspect of the disclosure, a highly reliable display device in which a sealing film is formed on an edge portion of the display device and which can prevent a crack generated in the sealing film as a result of division of a mother substrate from spreading into a display region, and a method for manufacturing the display device can be provided.

BRIEF DESCRIPTION OF DRAWINGS

[0016] FIG. **1** is a cross-sectional view illustrating an example of a schematic configuration of an organic EL display device according to a first embodiment of the disclosure.

[0017] FIG. **2** is a plan view illustrating a schematic configuration of main portions of an organic EL substrate of an organic EL display device according to the first embodiment of the disclosure before performing singulation.

[0018] FIG. **3**A is a cross-sectional view illustrating a schematic configuration of a third organic insulating film pattern portion in which a groove is formed according to the first embodiment of the disclosure, and FIG. **3**B is a cross-sectional view illustrating a schematic configuration of the third organic insulating film pattern portion, when a first inorganic layer and a second inorganic layer are formed on the third organic insulating film pattern portion illustrated in FIG. **3**A.

[0019] FIGS. **4**A to **4**C are cross-sectional views illustrating manufacturing steps of main portions of the organic EL display device according to the first embodiment of the disclosure in order of the steps.

[0020] FIG. **5**A is a cross-sectional view illustrating a schematic configuration of the vicinity of a division line during singulation of the organic EL substrate according to the first embodiment of the disclosure, FIG. **5**B is a cross-sectional view illustrating a schematic configuration of the vicinity of the division line during the singulation of the organic EL substrate, when the first inorganic layer and the second inorganic layer of a sealing film are formed on the division line on the organic EL substrate on which the third organic insulating film pattern portion including the groove is not formed, and FIG. **5**C is a cross-sectional view illustrating a schematic configuration of the vicinity of the division line during the singulation of the organic EL substrate, when the sealing film is formed, using a CVD mask, being separated from the division line.

[0021] FIGS. **6**A to **6**C are each a cross-sectional view illustrating an example of a shape of the groove according to a first modified example of the first embodiment of the disclosure.

[0022] FIG. **7** is a cross-sectional view illustrating an example of a schematic configuration of the organic EL display device according to a second modified example of the first embodiment of the disclosure.

[0023] FIG. **8**A is a plan view illustrating an example of a schematic configuration of the organic EL display device according to a third modified example of the first embodiment of the disclosure, FIG. **8**B is a cross-sectional view taken along a line C-C illustrated in FIG. **8**A, and FIG. **8**C is a cross-sectional view taken along a line D-D illustrated in FIG. **8**A.

[0024] FIG. **9** is a plan view illustrating an example of a schematic configuration of the organic EL display device according to a fourth modified example of the first embodiment of the disclosure.

DESCRIPTION OF EMBODIMENTS

[0025] A detailed description follows regarding embodiments of the disclosure.

[0026] A description follows regarding an embodiment of the disclosure with reference to FIG. **1** to FIG. **9**.

[0027] Note that, in the following description, as an example of a display device according to the present embodiment, an example is given of an organic EL display device provided with an Organic Light Emitting Diode (OLED) layer including OLED elements, known as organic EL elements, as light emitting elements.

Schematic Configuration of Organic EL Display Device

[0028] FIG. **1** is a cross sectional view illustrating an example of a schematic configuration of an organic EL display device **1** according to the present embodiment. FIG. **2** is a plan view illustrating a schematic configuration of main portions of an organic EL substrate **2** of the organic EL display device **1** according to the present embodiment, before performing singulation. Note that FIG. **1** illustrates a cross section of the organic EL display device **1** after the singulation, and the cross section corresponds to a cross section of the organic EL display device **1** illustrated in FIG. **2** taken along a line A-A in the direction of the arrows.

[0029] Note that in FIG. **2**, for ease of illustration, apart from banks BK**1** to BK**4**, a third organic insulating film pattern portion **17**C, and a terminal portion **12**T on which are provided a plurality of terminals TM that are terminals of each of wiring lines, illustration of other portions is omitted. Furthermore, in FIG. **2**, for ease of illustration, a ratio of a frame region **6** with respect to a display region **5** is illustrated as being larger than in actuality.

[0030] As illustrated in FIG. **1**, the organic EL display device **1** is provided with the organic EL substrate **2** and a drive circuit (not illustrated).

[0031] The organic EL substrate **2** has a configuration in which an OLED layer **20** configuring an OLED element (an organic EL element), a sealing film **30**, and a cover body (not illustrated) are provided on a Thin Film Transistor (TFT) substrate **10**, in that order from the TFT substrate **10** side.

[0032] Note that the organic EL display device **1** may be a flexible display device that has flexibility and can be bent, or may be a non-bendable display device that has rigidity.

TFT Substrate 10

[0033] The TFT substrate **10** is provided with an electrically insulating support body **11** and a TFT layer **12** provided on the support body **11**.

Support Body 11

[0034] Examples of the support body **11** include a glass substrate, a plastic substrate, or a plastic film. Note that the support body **11** may be a flexible layered film in which a barrier layer (a moisture-proof layer) is provided on a plastic film (a resin layer). Furthermore, the layered film may have a configuration in which, on a face opposite to the face of the plastic film on which the barrier layer is provided, a lower face film that faces the outside is provided, with an adhesive layer interposed therebetween.

[0035] Examples of the resin used in the plastic film include a polyimide, polyethylene, a polyamide, or the like.

[0036] The barrier layer is a layer for preventing moisture or impurities from reaching the TFT layer **12** and the OLED layer **20** formed on the support body **11**, and can be formed, for example, by a silicon oxide (SiOx) film, a silicon nitride (SiNx) film, or a layered film of these, formed by CVD.

[0037] The barrier layer is provided over the whole surface of the plastic film, such that the surface of the plastic film is not exposed. In this way, even when a material with poor liquid chemical resistance, such as a polyimide, is used as the plastic film, elution of the plastic film by liquid chemicals and process contamination can be prevented.

[0038] In a case that the organic EL display device **1** is the flexible display device, the lower face film is bonded to the lower face of the plastic film (the resin layer), from which the glass substrate has been peeled, in order to manufacture the organic EL display device **1** having excellent flexibility. A plastic film formed from a flexible resin is used as the lower face film. Examples of the flexible resin include polyethylene terephthalate, polyethylene naphthalate, a cycloolefin polymer, a polyimide, a polycarbonate, polyethylene, and an aramid.

TFT Layer **12**

[0039] The TFT layer **12** includes a semiconductor layer **13** formed in a plurality of island shapes, a gate insulating film **14** formed on the support body **11** covering the semiconductor layer **13**, a plurality of gate electrodes G and a plurality of gate wiring lines (not illustrated) formed on the gate insulating film **14**, an inorganic insulating film **15** (a first passivation film) covering the above-described gate electrodes G and wiring lines formed on the gate insulating film **14**, a plurality of capacitance electrodes C formed on the inorganic insulating film **15**, an inorganic insulating film **16** (a second passivation film) formed on the inorganic insulating film **15** covering the capacitance electrodes C, a plurality of source electrodes S, a plurality of drain electrodes D, and a plurality of wiring lines W, a plurality of source wiring lines (not illustrated), and a plurality of power source lines (not illustrated) formed on the inorganic insulating film **16**, an organic insulating film **17** covering the above-described electrodes and wiring lines formed on the inorganic insulating film **16**, and the terminal portion **12**T on which the plurality of terminals TM (terminal electrodes) for connecting to the outside are provided.

[0040] The semiconductor layer **13** is formed of amorphous silicon, low-temperature polysilicon (LTPS), or an oxide semiconductor, for example. The gate insulating film **14** is formed of silicon oxide (SiOx) or silicon nitride (SiNx), or is configured by a layered film formed of these materials, for example.

[0041] The gate electrode G, the source electrode S, the drain electrode D, the capacitance electrode C, the wiring line W, a lead-out wiring line (not illustrated), and the terminal TM are formed of a single layer film or a layered film formed of a metal such as aluminum (Al), tungsten (W), molybdenum (Mo), tantalum (Ta), chromium (Cr), titanium (Ti), or copper (Cu), for example.

[0042] The inorganic insulating films **15** and **16** are formed of silicon oxide (SiOx) or silicon nitride (SiNx), for example. The organic insulating film **17** is formed of a photosensitive resin material such as a polyimide resin and an acrylic resin, for example.

[0043] The semiconductor layer **13**, the gate electrode G, the inorganic insulating films **15** and **16**, the source electrode S, and the drain electrode D configure the TFT **18**.

[0044] The source electrode S and the drain electrode D are connected to the semiconductor layer **13** with a contact hole provided in the gate insulating film **14** and the inorganic insulating films **15** and **16** interposed therebetween. The source electrode S is connected to the power source line (not illustrated), for example. The drain electrode D is connected to a first electrode **21** with a contact hole extending through the organic insulating film **17** interposed therebetween. The wiring line W is connected to the capacitance electrode C with a contact hole provided in the inorganic insulating film **16** interposed therebetween.

[0045] Furthermore, the gate wiring line is connected to the gate electrode G, and the source wiring line is connected to the source electrode S. The gate wiring line and the source wiring line are intersected orthogonal to each other in a plan view.

[0046] Regions surrounded in a lattice pattern by the gate wiring line and the source wiring line are subpixels **3**, and a single pixel **4** is formed by a set of the subpixels **3** of each of colors. In examples illustrated in FIG. **1** and FIG. **2**, a red subpixel **3**R, a green subpixel **3**G, and a blue subpixel **3**B are provided as the subpixels **3**, and the single pixel **4** is formed by the red subpixel **3**R, the green subpixel **3**G, and the blue subpixel **3**B. The TFT **18** is provided for each of the subpixels **3**.

[0047] Note that, in FIG. **1**, a case is illustrated, as an example, in which the TFT **18** has a top gate structure with the semiconductor layer **13** as a channel, but the TFT **18** may have a bottom gate structure.

[0048] As illustrated in FIG. **1** and FIG. **2**, the organic EL display device **1** includes the display region **5** in which the subpixels **3** are arranged in a matrix pattern and on which an image is displayed and the frame region **6** which is a peripheral region surrounding the periphery of the display region **5** and on which the subpixels **3** are not arranged.

[0049] As illustrated in FIG. **1**, the terminal TM is provided in the frame region **6**. The terminal TM is electrically connected to the gate wiring line, for example, with the lead-out wiring line (not illustrated) interposed therebetween. The source wiring line is connected to the terminal TM (not illustrated) with the lead-out wiring line (not illustrated) interposed therebetween.

[0050] The terminal portion **12**T, in which the terminals TM are provided, is provided between the display region **5** in which the organic EL elements **24** is provided and part of an edge portion **2***a* of the TFT substrate **10**. In the example illustrated in FIG. **1** and FIG. **2**, the terminal portion **12**T faces one side of the TFT substrate **10** and is provided between a sealing region **8** that is surrounded by the bank BK**4** (to be described later) and seals the organic EL elements **24** and an organic layer **32** (to be described later) of the sealing film **30** sealing the organic EL elements **24**, and the edge portion **2***a* of the one side of the TFT substrate **10**. However, the present embodiment is not limited to this example, and the terminal portion **12**T may be provided facing two sides of the TFT substrate **10**. Note that the sealing region **8** is provided in a region indicated by diagonal lines in FIG. **2**, and for convenience of illustration, the sealing region **8** is illustrated in FIG. **2** only in a section corresponding to the sealing region **8** of one organic EL display device **1**. However, it goes without saying that the sealing region **8** is also provided for the other organic EL display devices **1**.

[0051] As illustrated in FIG. **1**, the organic insulating film **17** flattens steps on the TFTs **18** and the wiring lines W in the display region **5**, and also covers edge portions of the terminals TM.

[0052] A portion of the terminal TM that is not covered by the organic insulating film **17** is electrically connected to a flexible film cable, a flexible printed circuit (FPC) substrate, an external circuit such as an integrated circuit (IC) with an anisotropic conductive film (ACF) or the like interposed therebetween.

[0053] Furthermore, as illustrated in FIG. **1**, the organic insulating film **17** covers an end face of the inorganic insulating film **16**.

[0054] The organic insulating film **17** is divided into a plurality of patterns that are separated from each other. The organic insulating film **17** is provided in the display region **5** as a flattening film, and is also provided in the frame region **6**. The organic insulating film **17** according to the present embodiment includes a first organic insulating film pattern portion **17**A, a second organic insulating film pattern portion **17**B, the third organic insulating film pattern portion **17**C, and a fourth organic insulating film pattern portion **17**D. The second organic insulating film pattern portion **17**B to the fourth organic insulating film pattern portion **17**D are formed of the same material as the first organic insulating film pattern portion **17**A, and are provided in the same layer as the first organic insulating film pattern portion **17**A, while being separated from the first organic insulating film pattern portion **17**A. Note that the first organic insulating film pattern portion **17**A to the fourth organic insulating film pattern portion **17**D will be described below.

OLED Layer **20**

[0055] The OLED layer **20** includes the first electrode **21** (a lower electrode) formed on the organic insulating film **17**, the banks BK (wall bodies, embankments), an organic EL layer **22** formed on the first electrode **21** and formed from an organic layer including at least a light emitting layer, and a second electrode **23** (an upper electrode) formed on the organic EL layer **22**.

[0056] The first electrode **21**, the organic EL layer **22**, and the second electrode **23** configure the organic EL element **24** (the OLED element). Note that, in the present embodiment, the layers between the first electrode **21** and the second electrode **23** are collectively referred to as the organic EL layer **22**.

[0057] Furthermore, an optical adjustment layer (not illustrated) that performs optical adjustment, and a protection layer that protects the second electrode **23** such that oxygen or moisture does not penetrate into the organic EL element **24** from outside may be formed on the second electrode **23**. In the present embodiment, the organic EL layer **22** formed on each of the subpixels **3**, the pair of electrode layers (the first electrode **21** and the second electrode **23**) that sandwich the organic EL layer **22**, and the optical adjustment layer and the protection layer (not illustrated) that are formed as necessary, are referred to together as the organic EL element **24**.

[0058] The first electrode **21** is formed on the organic insulating film **17** in the display region **5**. The first electrode **21** allows holes to be injected (supplied) into the organic EL layer **22**, and the second electrode **23** allows electrons to be injected into the organic EL layer **22**. The holes and the electrons injected into the organic EL layer **22** are recombined in the organic EL layer **22**, and thus form excitons. The formed excitons emit light as they become deactivated from an excited state to a ground state, and the emitted light is emitted to the outside from the organic EL element **24**.

[0059] The first electrode **21** is electrically connected to the TFT **18** with a contact hole formed in the organic insulating film **17** interposed therebetween.

[0060] The first electrode **21** is a pattern electrode formed in an island-shaped pattern for each of the subpixels **3**. Meanwhile, the second electrode **23** is a solid-like common electrode provided in common to each of the subpixels **3**.

[0061] As illustrated in FIG. **2**, second electrode connecting portions **7** in which second electrode connecting electrodes (not illustrated) each connected to the second electrode **23** are provided are provided along and outside one pair of sides facing each other of two pair of sides of the display region **5**.

[0062] The bank BK includes the bank BK**1** (a lattice-shaped bank) disposed in the display region **5** and the banks BK**2** to BK**4** (frame-shaped banks) disposed in the frame region **6**. Note that each of the banks BK**1** to BK**4** will be described below together with the first organic insulating film pattern portion **17**A to the fourth organic insulating film pattern portion **17**D.

[0063] A peripheral portion of the first electrode **21** is covered by the bank BK**1**. As illustrated in FIG. **1** and FIG. **2**, in the bank BK**1**, an opening BK**1**A is provided for each of the subpixels **3**. Exposed portions of the first electrode **21** exposed by the opening BK**1**A form a light emitting region of each of the subpixels **3**.

[0064] In a case that, for the organic EL layer **22** of the organic EL element **24**, separate patterning is performed such that a different color light is emitted for each of the subpixels **3**, as illustrated in FIG. **1**, the organic EL layer **22** is formed for each of the regions (the subpixel **3**) surrounded by the bank BK**1**. Thus, the organic EL display device **1** illustrated in FIG. **1** emits red color light from the red subpixel **3**R, emits green color light from the green subpixel **3**G, and emits blue color light from the blue subpixel **3**B. In this way, in a case that the organic EL display device **1** is provided with the organic EL element **24** formed using the RGB separate patterning method, full color image display can be performed using the red color light, the green color light, and the blue color light, without using a color filter.

[0065] For example, the organic EL layer **22** is configured by layering a hole injecting layer, a hole transport layer, a light emitting layer, an electron transport layer, and an electron injecting layer, in this order from the first electrode **21** side. Note that a single layer may have a plurality of functions. For example, in place of the hole injection layer and the hole transport layer, a hole injection-cum-transport layer having the functions of both these layers may be provided. In addition, in place of the electron injection layer and the electron transport layer, an electron injection-cum-transport layer having the functions of both these layers may be provided. In addition, a carrier blocking layer may be provided between the layers as appropriate.

[0066] Note that the above-described layering order is for a case in which the first electrode **21** is an anode electrode and the second electrode **23** is a cathode electrode, and when the first electrode **21** is the cathode electrode and the second electrode **23** is the anode electrode, the order of each of the layers configuring the organic EL layer **22** is inverted.

[0067] In a case that the organic EL display device **1** is a bottom-emitting type configured to emit light from the back surface side of the support body **11**, it is preferable that the second electrode **23** be formed by a reflective electrode material, and the first electrode **21** be formed by a transparent or semi-transparent light-transmissive electrode material.

[0068] A transparent conductive film such as indium tin oxide (ITO) and indium zinc oxide (IZO), or a thin film of a metal such as gold (Au), platinum (Pt), and nickel (Ni) can be used as the first electrode **21**, for example. To inject electrons into the light emitting layer, a metal with a small work function, such as lithium (Li), cerium (Ce), barium (Ba), and aluminum (Al), or an alloy containing these metals, such as a magnesium alloy (MgAg or the like) and an aluminum alloy (AlLi, AlCa, AlMg, or the like), is used as the second electrode **23**.

[0069] Meanwhile, in a case that the organic EL display device **1** is a top-emitting type configured to emit light from the sealing film **30** side, it is preferable that the first electrode **21** be formed by a reflective electrode material, and the second electrode **23** be formed by a transparent or semi-transparent light-transmissive electrode material.

[0070] The first electrode **21** and the second electrode **23** may each have a single layer structure or may each have a layered structure. For example, in a case that the organic EL element **24** is a top-emitting organic EL element, the first electrode **21** may have a layered structure configured by a reflective electrode and a transparent electrode.

Organic Insulating Film **17** and Banks BK

[0071] In the present embodiment, by forming the organic insulating film **17** on the TFT substrate **10** up to the outer side of the sealing region **8** surrounded by the bank BK**4**, as a resin layer provided with a crack stopper, the third organic insulating film pattern portion **17**C, in which a groove **17***c***1** is formed, is formed surrounding the sealing region **8**.

[0072] As described above, the organic insulating film **17** is divided into the first organic insulating film pattern portion **17**A to the fourth organic insulating film pattern portion **17**D.

[0073] As illustrated in FIG. **1**, the first organic insulating film pattern portion **17**A is formed continuously from the display region **5** to the frame region **6**. The second organic insulating film pattern portion **17**B to the fourth organic insulating film pattern portion **17**D are formed in the frame region **6**. Of the second organic insulating film pattern portion **17**B to the fourth organic insulating film pattern portion **17**D, the second organic insulating film pattern portion **17**B is formed in a frame shape being separated from the first organic insulating film pattern portion **17**A to surround the first organic insulating film pattern portion **17**A. The third organic insulating film pattern portion **17**C is formed in a frame shape being separated from the second organic insulating film pattern portion **17**B to surround the second organic insulating film pattern portion **17**B. The fourth organic insulating film pattern portion **17**D covers the edge portions of the terminals TM.

[0074] The first organic insulating film pattern portion **17**A is a flattening film, and as described above, flattens the steps on the TFTs **18** and the wiring lines W in the display region **5**. Note that the TFTs **18** and the organic EL elements **24** are provided on the first organic insulating film pattern portion **17**A, but the TFTs **18** and the organic EL elements **24** are not provided on the second organic insulating film pattern portion **17**B, the third organic insulating film pattern portion **17**C, and the fourth organic insulating film pattern portion **17**D.

[0075] As described above, on the first organic insulating film pattern portion **17**A formed continuously from the display region **5** to the frame region **6**, the bank BK**1** is formed in the display region **5**, while the bank BK**2** is formed in the frame region **6**.

[0076] The bank BK**1** functions as an edge cover that inhibits, at the peripheral portion of the first electrode **21**, a short circuit with the second electrode **23** due to electrode concentration or thinning of the organic EL layer **22**, and also functions as a subpixel isolation layer that isolates the subpixels **3** from each other such that electric current does not leak to the adjacent subpixel **3**.

[0077] The bank BK**1** is provided in a lattice pattern in a plan view, for example, covering each edge of the first electrodes **21** arranged in a matrix pattern in the display region **5**. The bank BK**2** is formed in a frame shape surrounding the display region **5**.

[0078] The bank BK**2** is formed by a plurality of dot-shaped banks BK**2***a* that are separated from each other, and each of the dot-shaped banks is arranged in a plurality of rows to form an intermittent frame shape. As illustrated in FIG. **2**, the bank BK**2** has a configuration in which the dot-shaped banks BK**2***a* of the adjacent rows are disposed regularly in a zig-zag shape with respect to each other in a plan view.

[0079] The second organic insulating film pattern portion **17**B is formed in a frame shape outside the first organic insulating film pattern portion **17**A (in other words, in a plan view, between the first organic insulating film pattern portion **17**A and the edge portion **2***a* of the organic EL substrate **2**) to surround the first organic insulating film pattern portion **17**A. The bank BK**3** is formed in a frame shape on the second organic insulating film pattern portion **17**B to surround the bank BK**2**.

[0080] The bank BK**3** is formed by a plurality of dot-shaped banks BK**3***a* that are separated from each other, and each of the dot-shaped banks is arranged in a plurality of rows to form an intermittent frame shape. As illustrated in FIG. **2**, the bank BK**3** has a configuration in which the dot-shaped banks BK**3***a* of the adjacent rows are disposed regularly in a zig-zag shape with respect to each other in a plan view.

[0081] The second organic insulating film pattern portion **17**B is separated from the first organic insulating film pattern portion **17**A, and thus the second organic insulating film pattern portion **17**B on which the bank BK**3** is provided is used as a first dam portion DM**1** configured to stop the penetration of moisture into the TFTs **18** and the organic EL elements **24** inside the first organic insulating film pattern portion **17**A.

[0082] The bank BK**4**, which is formed in a frame shape formed by a continuous line rather than in a dot-shape, is formed outside the first dam portion DM**1** (in other words, between the first dam portion DM**1** and the edge portion **2***a* of the organic EL substrate **2**) to surround the first dam portion DM**1**. The bank BK**4** is formed on the inorganic insulating film **15** in the frame region **6**. The bank BK**4** functions as an organic layer stopper that holds back an organic insulating material forming the organic layer **32** in the sealing film **30**, which will be described below.

[0083] Further, since the first organic insulating film pattern portion **17**A and the second organic insulating film pattern portion **17**B are separated from each other, the bank BK**4** is used as a second dam portion DM**2** configured to prevent the penetration of moisture into the TFTs **18** and the organic EL elements **24** inside the first organic insulating film pattern portion **17**A.

[0084] Note that, to improve coverage of a formation surface on which each of the banks BK is formed, a cross-section thereof is preferably a forwardly tapered shape.

[0085] The third organic insulating film pattern portion **17**C is formed in a frame shape outside the bank BK**4** (in other words, between the bank BK**4** and the edge portion **2***a* of the organic EL substrate **2**) to surround the bank BK**4**.

[0086] The groove **17***c***1**, which is formed in a fine continuous line-shape, is formed in a frame shape, in a plan view, on the upper surface of the third organic insulating film pattern portion **17**C to surround the bank BK**4**. Note that the groove **17***c***1** will be described in detail below.

[0087] As described above, the fourth organic insulating film pattern portion **17**D covers the edge portions of the terminals TM.

[0088] In the present embodiment, as illustrated in FIG. **2**, the display region **5** is formed in a quadrilateral shape. Thus, the outer shape of the first organic insulating film pattern portion **17**A is formed, corresponding to the quadrilateral-shaped display region **5**, in a quadrilateral shape having a substantially similar shape to the outer shape of the display region **5**. Furthermore, the outer shapes (the outer edge shapes of the frames) of the second organic insulating film pattern portion **17**B, the third organic insulating film pattern portion **17**C, and the bank BK**4** surrounding the first organic insulating film pattern portion **17**A are also formed in a quadrilateral shape having a substantially similar shape to the outer shape of the display region **5**.

[0089] Note that four corner portions of each of the first organic insulating film pattern portion **17**A, the second organic insulating film pattern portion **17**B, the third organic insulating film pattern portion **17**C, and the bank BK**4** may be curved lines as illustrated in FIG. **2**, or may be right angles.

[0090] The first organic insulating film pattern portion **17**A is formed such that a straight line distance from each edge portion of the display region **5** to each inner side face of the first organic insulating film pattern portion **17**A facing each edge portion is constant. Furthermore, the second organic insulating film pattern portion **17**B is formed such that a straight line distance from each outer side face of the first organic insulating film pattern portion **17**A to each inner side face of the second organic insulating film pattern portion **17**B facing each outer side face is constant. The bank BK**4** is formed such that a straight line distance from each outer side face of the second organic insulating film pattern portion **17**B to each inner side face of the bank BK**4** facing each outer side face is constant. The third organic insulating film pattern portion **17**C is formed such that a straight line distance from each outer side face of the bank BK**4** to each inner side face of the third organic insulating film pattern portion **17**C facing each of the outer side faces is constant.

[0091] As described above, outside the display region **5** on which the lattice-shaped bank BK**1** is provided, the frame-shaped bank BK**2**, the frame-shaped bank BK**3**, the first dam portion DM**1** formed by the second organic insulating film pattern portion **17**B, the second dam portion DM**2** formed by the frame-shaped bank BK**4**, and the third organic insulating film pattern portion **17**C provided with the groove **17***c***1** are provided in this order from the inside to the outside with the lattice-shaped bank BK**1** at the center.

[0092] The banks BK**1** to BK**4** are formed from an organic insulating material. The banks BK**1** to BK**4** are formed, for example, from a photosensitive resin, such as an acrylic resin, or a polyimide resin. The banks BK**1** to BK**4** can be formed in the same step, for example.

[0093] When forming the organic layer **32** of the sealing film **30**, which will be described below, the banks BK**2** to BK**4** define edges of the organic layer **32** by reducing the flow rate of a liquid organic insulating material (ink), which is a material of the organic layer **32**, in stages, thereby regulating wet-spreading of the organic insulating material.

[0094] In particular, after the liquid organic insulating material that forms the organic layer **32** is applied using the ink-jet method or the like, the dot-shaped banks BK**2***a* and BK**3***a* align edges of the wetly spreading liquid organic insulating material, block the flow of the wetly spreading organic insulating material, and align edge portions of the organic insulating material to be in a substantially straight line shape.

[0095] Furthermore, since the organic insulating material wetly spreads while passing through the banks BK**2** and BK**3**, the banks BK**2** and BK**3** function as resistance. As a result of passing through the banks BK**2** and BK**3**, the speed of the wet-spreading of the organic insulating material decreases. According to the present embodiment, by providing the banks BK**2** and BK**3** closer to the display region **5** than the bank BK**4** in this way, the flow of the organic insulating material can be blocked, and an overflow of the organic insulating material beyond the bank BK**4** to the outside (particularly, reaching onto the terminal portion **12**T) can be prevented.

[0096] The organic insulating material forming the organic layer **32** is held back by the bank BK**4**, while covering an edge portion of the bank BK**4** on the bank BK**3** side. As a result, the organic layer **32** comes in contact with the edge portions of the bank BK**4** closer to the bank BK**3**, with a first inorganic layer **31** interposed therebetween.

[0097] Furthermore, although not illustrated, in the present embodiment, the second electrode **23** is formed covering the bank BK**2** formed along a side of the first organic insulating film pattern portion **17**A on which the second electrode connecting portion **7** is provided.

[0098] Thus, since the bank BK**2** is formed by the plurality of dot-shaped banks BK**2***a*, the second electrode **23** is formed covering the steps of the dot-shaped banks BK**2***a*, and at the same time, is formed on planar portions located in gaps between the dot-shaped banks BK**2***a*. Since the bank BK**2** is formed by the plurality of dot-shaped banks BK**2***a* in this way, the second electrode **23** and the second electrode connecting portion **7** can be reliably made conductive.

Sealing Film 30

[0099] The sealing film **30** includes the first inorganic layer **31** (a lower layer inorganic sealing layer), the organic layer **32** (a first organic sealing layer), and a second inorganic layer **33** (an upper layer inorganic sealing layer), layered in this order from the TFT substrate **10** side.

[0100] The first inorganic layer **31** and the second inorganic layer **33** have a moisture-proof function to prevent the penetration of moisture, and function as barrier layers to inhibit deterioration of the organic EL element **24** caused by moisture or oxygen.

[0101] The organic layer **32** is used as a buffer layer (a stress relief layer), which relieves stress in the first inorganic layer **31** and the second inorganic layer **33** in which film stress is large, performs flattening and burying of pinholes by burying step portions and foreign material on the surface of the OLED layer **20** in the display region **5**, and further, prevents the occurrence of cracks in the second inorganic layer **33** when the second inorganic layer **33** is layered, by flattening a foundation of the second inorganic layer **33**.

[0102] The first inorganic layer **31** and the second inorganic layer **33** are each formed by CVD, for example, and each can be formed by a silicon oxide film, a silicon nitride film, or a silicon oxynitride film, or by a layered film of these films. Each of the thickness of the first inorganic layer **31** and the thickness of the second inorganic layer **33** is 500 to 1500 nm, for example.

[0103] The organic layer **32** is a light-transmissive organic insulating film that is thicker than the first inorganic layer **31** and the second inorganic layer **33**, and may be formed of a photosensitive resin such as an acrylic resin, an epoxy resin, and a silicone resin. The organic layer **32** can be formed, for example, by performing ink-jet application of an ink including this type of photosensitive resin, as the organic insulating material, onto the first inorganic layer **31**, and then performing ultraviolet (UV) curing. The thickness of the organic layer **32** is 4 to 12 μm, for example.

[0104] The first inorganic layer **31** is formed on the support body **11** over the whole surface of the display region **5** and the frame region **6**, apart from a surface on the terminals TM, the first inorganic layer **31** covering, in a plan view, the second electrode **23**, the organic insulating film **17** apart from a part of the terminal portion **12**T (in the present embodiment, the first organic insulating film pattern portion **17**A to the third organic insulating film pattern portion **17**C, and an edge portion of the fourth portion organic insulating film pattern portion **17**D on the third organic insulating film pattern portion **17**C side), the organic EL elements **24**, the inorganic insulating film **15**, and the banks BK that are not covered by the second electrode **23** (in the present embodiment, a part of the bank BK**2**, and the banks BK**3** and BK**4**).

[0105] However, the first inorganic layer **31** is split apart (pattern cut) in the groove **17***c***1** provided in the third organic insulating film pattern portion **17**C.

[0106] In addition to covering the first organic insulating film pattern portion **17**A and the second organic insulating film pattern portion **17**B, the organic EL elements **24**, and the banks BK**1** to BK**3**, the organic layer **32** preferably covers the edge portion of the bank BK**4** on the bank BK**3** side and a part of an upper portion of the bank BK**4** with the first inorganic layer **31** interposed therebetween, the bank BK**4** functioning as the organic layer stopper. The organic layer **32** is provided in the sealing region **8** (see FIG. **2**) that is surrounded by the bank BK**4** serving as the organic layer stopper and is configured to seal the organic EL elements **24**.

[0107] The second inorganic layer **33** is formed superimposing on the first inorganic layer **31**. In a case that a cross section of the organic layer **32** is exposed, moisture or the like penetrates from this cross section. Thus, to prevent the cross section of the organic layer **32** from being exposed, the second inorganic layer **33** covers the first inorganic layer **31** so as to seal the organic layer **32** between the first inorganic layer **31** and the second inorganic layer **33**.

[0108] The second inorganic layer **33** is formed on the first inorganic layer **31** over the whole surface of the display region **5** and the frame region **6**, apart from the surface on the terminals TM, the second inorganic layer **33** covering, in a plan view, the second electrode **23**, the organic insulating film **17** apart from the part of the terminal portion **12**T (in the present embodiment, the first organic insulating film pattern portion **17**A to the third organic insulating film pattern portion **17**C, and the edge portion of the fourth organic insulating film pattern portion **17**D on the third organic insulating film pattern portion **17**C side), the organic EL elements **24**, the inorganic insulating film **15**, and the banks BK that are not covered by the second electrode **23** (the part of the bank BK**2**, and the banks BK**3** and BK**4**), with at least the first inorganic layer **31**, of the first inorganic layer **31** and the organic layer **32**, interposed therebetween.

[0109] However, similarly to the first inorganic layer **31**, the second inorganic layer **33** is split apart (pattern cut) in the groove **17***c***1** provided in the third organic insulating film pattern portion **17**C.

[0110] Note that, as described above, an inorganic layer or an organic layer (not illustrated), such as the optical adjustment layer or the electrode protection layer, may be formed between the second electrode **23** and the sealing film **30**.

Groove 17*c*1

[0111] Next, the groove **17***c***1** will be described below with reference to FIG. **1** to FIGS. **3**A and **3**B.

[0112] FIG. **3**A is a cross-sectional view illustrating a schematic configuration of the third organic insulating film pattern portion **17**C in which the groove **17***c***1** is formed, according to the present embodiment, and FIG. **3**B is a cross-sectional view illustrating a schematic configuration of the third organic insulating film pattern portion **17**C when the first inorganic layer **31** and the second inorganic layer **33** are formed on the third organic insulating film pattern portion **17**C illustrated in FIG. **3**A.

[0113] As described above, the groove **17***c***1** is formed in the upper surface of the third organic insulating film pattern portion **17**C formed outside the sealing region **8** surrounded by the bank BK**4**, as illustrated in FIG. **1** to FIGS. **3**A and **3**B.

[0114] The groove **17***c***1** functions as a crack stopper that prevents cracks, which are generated in the sealing film **30** on the edge portion **2***a* of the organic EL substrate **2** as a result of the division of the mother substrate **50** (see FIG. **2**), from spreading into the display region **5**.

[0115] In the CVD used for forming an inorganic sealing film, a low temperature that is 80° C. or lower is generally used, for example, in order to prevent thermal damage to a function layer (specifically, an EL layer such as the organic EL layer **22**) of the light emitting element, and the substrate temperature has a similar temperature. Thus, even with plasma CVD, film growth on the substrate is unlikely to occur, and there is little seeping of an inorganic sealing film material into the groove **17***c***1**, in particular, seeping of an inorganic sealing film material into a shadow section.

[0116] Thus, as described above, when the groove **17***c***1** is formed in the upper surface of the third organic insulating film pattern portion **17**C, and the first inorganic layer **31** and the second inorganic layer **33** are formed on the third organic insulating film pattern portion **17**C, the first inorganic layer **31** and the second inorganic layer **33** cannot extend as far as the groove **17***c***1**, and the first inorganic layer **31** and the second inorganic layer **33** are naturally split apart (pattern cut) at a bottom portion **17***c***2** of the groove **17***c***1** when forming the first inorganic layer **31** and the second inorganic layer **33**.

[0117] When the first inorganic layer **31** and the second inorganic layer **33** are formed on the third organic insulating film pattern portion **17**C in which, for example, a V-shaped groove is formed as the groove **17***c***1**, the first inorganic layer **31** and the second inorganic layer **33** cannot extend as far as the groove **17***c***1**, and, with the bottom portion **17***c***2** of the groove **17***c***1** acting as a base point, the first inorganic layer **31** and the second inorganic layer **33** are naturally split apart (pattern cut) when forming the first inorganic layer **31** and the second inorganic layer **33**. As a result, a split portion **34** in which the first inorganic layer **31** and the second inorganic layer **33** are split apart is formed in the bottom portion **17***c***2** of the groove **17***c***1**.

[0118] In the present embodiment, the width (groove width) and the depth of the groove **17***c***1** may be appropriately set to a width and a depth by which the first inorganic layer **31** and the second inorganic layer **33** layered on the third organic insulating film pattern portion **17**C are split apart in the groove **17***c***1**, in accordance with the shape, width, and depth of the groove **17***c***1**, as well as the thickness and the like of the first inorganic layer **31** and the second inorganic layer **33**, and the width and the depth of the groove **17***c***1** are not particularly limited.

[0119] However, as illustrated in FIG. **3**B, when the width of the groove **17***c***1** (namely, the groove width or the width of the upper end of the groove **17***c***1**) in a plan view is **x1**, the width, in the same direction as the width **x1**, at the outermost surface of the third organic insulating film pattern portion **17**C (resin layer) including the groove **17***c***1** is **x2**, and the total layer thickness of the first inorganic layer **31** and the second inorganic layer **33** is **t1**, the width **x1** preferably satisfies $t1<x1<x2$.

[0120] Note that here, the width (groove width) of the groove **17***c***1** in a plan view refers to the length in the short direction of the upper end of the groove **17***c***1**, namely, the length in the short direction of the groove **17***c***1** on the same plane as the outermost surface of the third organic insulating film pattern portion **17**C. In addition, the length in the short direction of the groove **17***c***1** refers to the length of the groove **17***c***1** in the direction orthogonal to the direction (in other words, in a direction traversing the edge portion **2***a*) in which the groove **17***c***1** extends (in other words, in the direction along the edge portion **2***a* of the organic EL substrate **2**).

[0121] Furthermore, the first inorganic layer **31** and the second inorganic layer **33** having the same film thickness as the first inorganic layer **31** and the second inorganic layer **33** in the display region **5** are formed on the third organic insulating film pattern portion **17**C (more specifically, on the top surface of the third organic insulating film pattern portion **17**C).

[0122] As an example, the width **x1** is preferably within a range of 2 μm to 5 μm, for example. By setting the width **x1** to be the above-described width, the splitting of the first inorganic layer **31** and the second inorganic layer **33** easily occurs. Furthermore, the width **x2** is preferably within a range of 7 μm to 25 μm, for example, from a perspective of pattern forming. As described above, both the thickness of the first inorganic layer **31** and the thickness of the second inorganic layer **33** are 500 to 1500 nm, for example, and the layer thickness **t1** is 1 μm to 3 μm, for example.

[0123] Furthermore, when the depth of the groove **17***c***1** (the length in the normal direction) is **t2**, the depth **t2** of the groove **17***c***1** is preferably within a range of 0.5 μm to 2 μm, for example. By setting the depth **t2** to be the above-described depth, the splitting of the first inorganic layer **31** and the second inorganic layer **33** easily occurs.

[0124] The organic insulating film **17** is formed to have a thickness that allows the groove **17***c***1** to be formed. In the present embodiment, the third organic insulating film pattern portion **17**C, which is the resin layer including the groove **17***c***1**, is formed by the organic insulating film **17**, and the first organic insulating film pattern portion **17**A of the organic insulating film **17** is the flattening film that compensates for the steps caused by the TFTs **18**. Thus, the organic insulating film **17** is formed to have a thickness that allows the steps caused by the TFTs **18** to be compensated for and the groove **17***c***1** to be formed. The thickness of the organic insulating film **17** is 1 to 3 μm, for example.

[0125] Furthermore, as illustrated in FIG. **3**A, an angle formed by an inner wall of the groove **17***c***1** and a surface parallel to the surface of the TFT substrate **10** (in other words, an angle formed by the inner wall of the groove **17***c***1** and a horizontal surface: hereinafter, referred to as a "taper angle θ") is preferably within a range of 70° to 120°, for example. By setting the taper angle θ to the above-described angle, the splitting of the first inorganic layer **31** and the second inorganic layer **33** easily occurs.

Cover Body

[0126] As described above, a cover body (not illustrated) is provided on the sealing film **30**. The cover body is a function layer having at least one of a protection function, an optical compensation function, and a touch sensor function, and, in a case that the organic EL display device **1** is the flexible display device, for example, the cover body may be a protection film that functions as a support body when the glass substrate is peeled off. Furthermore, in a case that the organic EL display device **1** is a non-bendable and rigid display device, the cover body may be a counter substrate such as the glass substrate, and a filling layer formed from a filling material (not illustrated) may further be provided between the counter substrate and the organic EL substrate **2**.

[0127] In addition, the cover body may be provided with a function film, such as a polarizing film and a touch sensor film, or may be provided with a polarizer, a touch panel, and the like.

Method for Manufacturing Organic EL Display Device **1**

[0128] Next, a method for manufacturing the organic EL display device **1** will be described below with reference to FIG. **1** to FIGS. **4**A to **4**C.

[0129] FIGS. **4**A to **4**C are cross-sectional views illustrating manufacturing steps of main portions of the organic EL display device **1** according to the present embodiment, in order of the steps. FIGS. **4**A to **4**C each illustrate a cross section of the organic EL display device **1** illustrated in FIG. **2** taken along a line B-B in the direction of arrows.

[0130] First, as illustrated in FIG. **1**, on the mother substrate **50** (see FIG. **2**) configuring the support body **11** and formed by a large glass substrate or the like, the semiconductor layer **13**, the gate insulating film **14** formed on the mother substrate **50** covering the semiconductor layer **13**, the plurality of gate electrodes G and the plurality of gate wiring lines (not illustrated) formed on the gate insulating film **14**, the inorganic insulating film **15** covering the gate electrodes G and the gate wiring lines formed on the gate insulating film **14**, the plurality of capacitance electrodes C formed on the inorganic insulating film **15**, the inorganic insulating film **16** formed on the inorganic insulating film **15** covering the capacitance electrodes C, the plurality of source electrodes S, the plurality of drain electrodes D, the plurality of wiring lines W, the plurality of source wiring lines (not illustrated), and the plurality of power source lines (not illustrated) that are formed on the inorganic insulating film **16**, and the terminal portion **12**T including the plurality of terminals TM are formed by a known method.

[0131] Note that in a case that the organic EL display device **1** is a flexible display device, as the mother substrate **50**, a substrate is used that is obtained by forming a resin layer (a plastic film), such as a polyimide layer, and a moisture-proof layer, which configure the support body **11**, on a large carrier substrate such as a glass substrate.

[0132] Next, a photosensitive resin, such as an acrylic resin or a polyimide resin, is applied to the mother substrate **50** on which the above-described wiring lines and the like are formed, and patterning is performed by photolithography or the like, thus the organic insulating film **17** including the first organic insulating film pattern portion **17**A to the fourth organic insulating film pattern portion **17**D are formed.

[0133] Note that, at this time, the fourth organic insulating film pattern portion **17**D is formed covering the terminals TM in the terminal portion **12**T.

[0134] In addition, at this time, the groove **17***c***1** can be formed at the same time as the formation of the first organic insulating film pattern portion **17**A to the fourth organic insulating film pattern portion **17**D by using a halftone mask having partially different light transmittance, for example.

[0135] However, the present embodiment is not limited to this example, and, for example, after forming the first organic insulating film pattern portion **17**A to the fourth organic insulating film pattern portion **17**D, by performing the photolithography or the like once again, or by performing laser irradiation or the like on a position in which the groove **17***c***1** is formed in the third organic insulating film pattern portion **17**C, the first organic insulating film pattern portion **17**A to the fourth organic insulating film pattern portion **17**D, and the groove **17***c***1** may be formed in separate steps.

[0136] As a result, as illustrated in FIG. **1**, FIG. **2**, and FIG. **3**A, when the mother substrate **50** is divided along each of division lines DL, in a region, surrounded by the division lines DL, which forms the organic EL substrate **2** of each of the organic EL display devices **1**, the groove **17***c***1** is formed along each of the division lines DL that forms the edge portion **2***a* of the organic EL substrate **2** on each side of the organic EL substrate **2** other than the side facing the terminal portion **12**T, and the groove **17***c***1** is also formed between the display region **5** and the terminal portion **12**T such that the groove **17***c***1** passes between the display region **5** and the terminal portion **12**T and surrounds the display region **5**.

[0137] Note that here, the division line DL refers to a scheduled division line along which the mother substrate **50** is divided and singulated into the organic EL substrates **2** corresponding to the individual organic EL display devices **1**.

[0138] By the above-described step, the mother substrate **50**, on which the TFT layer **12** is formed, is formed as the TFT substrate **10**.

[0139] Next, the first electrode **21** is pattern formed in the matrix pattern by a sputtering method or the like. At this time, the first electrode **21** is electrically connected to the drain electrode D with the contact hole formed in the organic insulating film **17** interposed therebetween.

[0140] Next, an organic film (not illustrated) that is formed, for example, of a photosensitive resin such as an acrylic resin or a polyimide resin, is formed to cover the first electrode **21**, the organic insulating film **17**, and the inorganic insulating films **15** and **16**. Then, as illustrated in FIGS. **1** and **2**, the banks BK (BK**1** to BK**4**) formed by the organic film are pattern formed by photolithography or the like. Note that each of the banks BK**1** to BK**4** can be pattern formed using the same material in the same step. However, the banks BK**1** to BK**4** may also be formed in separate steps using mutually different masks.

[0141] After that, as illustrated in FIG. **1**, the organic EL layer **22** is formed by separately patterning vapor deposition, corresponding to each of the subpixels **3**R, **3**G, and **3**B, such that light emitting layers of each color cover the region surrounded by the bank BK**1** (namely, the opening BK**1**A). Note that in the film formation of the organic EL layer **22**, a method other than the vapor deposition method may be used, such as a paint-on method, the ink-jet method, or a printing method.

[0142] To perform the full color display, as an example, the light emitting layers can be pattern formed by the separately patterning vapor deposition, that is, for each of the light emission colors, as described above. However, the present embodiment is not limited to this example, and, to perform the full color display, a configuration may be used in which the white color light emitting organic EL element **24** that uses a white color (W) light emitting layer configured to emit white light, is used in combination with a color filter (CF) layer (not illustrated), and the light emission color for each of the subpixels **3** is selected. Furthermore, while using the light emitting layer whose light emission color is the color W, the full color image display may be realized by introducing a microcavity structure for each of the subpixels **3**. Note that, when changing the light emission color of each of the subpixels **3** using the method using the CF layer, the microcavity structure, or the like, it is not necessary for the light emitting layers to be separately patterned for each of the subpixels **3**.

[0143] Next, the second electrode **23** is pattern formed by vapor deposition using a vapor deposition mask, for example, over the whole surface of the display region **5** on the TFT substrate **10** covering the organic EL layer **22** and the bank BK**1**, so as to be electrically connected to the second electrode connecting electrode of the second electrode connecting portion **7** and to expose regions other than these regions.

[0144] In this way, the organic EL element **24** formed by the first electrode **21**, the organic EL layer **22**, and the second electrode **23** can be formed on the TFT substrate **10**.

[0145] Next, on the TFT substrate **10** on which the organic EL elements **24** are formed, the first inorganic layer **31** is formed in a maskless manner over the whole surface of the mother substrate **50** by a CVD method or the like, without using a CVD mask. As a result, the first inorganic layer **31** covering each of the division lines DL of the mother substrate **50** is formed, as illustrated in FIG. **3**A.

[0146] Next, the liquid organic insulating material (the ink) including the photosensitive resin is applied over the whole surface of the display region **5** using the ink-jet method or the like.

[0147] Next, the liquid organic insulating material that is wetly spread inside the region surrounded by the bank BK**4** is cured. As a result, the organic layer **32** whose edge portion along the bank BK**4** has a uniform film thickness is formed.

[0148] After that, on the first inorganic layer **31**, the second inorganic layer **33** is formed in a maskless manner in the same manner as the first inorganic layer **31**, such that the organic layer **32** is sealed by the first inorganic layer **31** and the second inorganic layer **33**.

[0149] As a result, the sealing film **30** formed by the first inorganic layer **31**, the organic layer **32**, and the second inorganic layer **33** is formed.

[0150] For example, as described above, plasma CVD is used for forming the first inorganic layer **31** and second inorganic layer **33**. The organic layer **32** is held back by the bank BK**4** to be contained inside the region surrounded by the bank BK**4**. Thus, the sealing film **30** on the third organic insulating film pattern portion **17**C and around the third organic insulating film pattern portion **17**C does not include the organic layer **32**, and only the first inorganic layer **31** and the second inorganic layer **33** are layered therein.

[0151] According to the present embodiment, as described above, by forming the groove **17***c***1** on the upper surface of the third organic insulating film pattern portion **17**C, when forming the first inorganic layer **31** and the second inorganic layer **33**, the first inorganic layer **31** and the second inorganic layer **33** are naturally split apart (pattern cut) at the bottom portion **17***c***2** of the groove **17***c***1**. As a result, the split portion **34** in which the first inorganic layer **31** and the second inorganic layer **33** are split apart is formed in the bottom portion **17***c***2** of the groove **17***c***1**.

[0152] Note that the split portion **34** is a split naturally formed during the film formation of each of the films (specifically, during the film formation of the first inorganic layer **31**, and during the film formation of the second inorganic layer **33**). Therefore, unlike a case in which the inorganic sealing film is physically cut after the formation of the inorganic sealing film (after the film formation of the first inorganic layer **31** and the second inorganic layer **33**, for example), when the first inorganic layer **31** is split apart and when the second inorganic layer **33** is split apart, a subsequent crack does not occur in the first inorganic layer **31** and the second inorganic layer **33**.

[0153] Note that, as described above, the first inorganic layer **31** and the second inorganic layer **33** having the same film thickness as the first inorganic layer **31** and the second inorganic layer **33** in the display region **5** are formed on the third organic insulating film pattern portion **17**C (more specifically, on the top surface of the third organic insulating film pattern portion **17**C).

[0154] After that, as illustrated in FIG. **4**B, by irradiating the terminal portion **12**T with a laser, a terminal exposing step is performed to expose the terminals TM of the terminal portion **12**T.

[0155] Next, after a protective film or the like (not illustrated) is bonded onto the sealing film **30**, the mother substrate **50** on which the TFT layer **12**, the OLED layer **20**, and the sealing film **30** are formed is divided (diced) along the division lines DL such that each of the display regions **5** on the mother substrate **50** is surrounded by the division lines DL. As a result, the mother substrate **50**, on which the TFT layer **12**, the OLED layer **20**, and the sealing film **30** are formed, is singulated into the individual organic EL substrates **2**, as illustrated in FIG. **4**C. Note that, for the dividing, a laser, a metal blade, or the like can be used.

[0156] In the obtained organic EL substrate **2**, the first inorganic layer **31** and the second inorganic layer **33** cover the edge portion **2***a* (edge) of the organic EL substrate **2** in a plan view, and peripheral edge portions (namely, all edges) of the first inorganic layer **31** and the second inorganic layer **33** overlap with peripheral edge portions (namely, all edges (the edge portions **2***a*)) of the organic EL substrate **2**.

[0157] Note that, in a case that the organic EL display device **1** is the flexible display device, after the protection film or the like is bonded onto the sealing film **30**, using laser irradiation, the carrier substrate is then peeled by ablation at an interface between the carrier substrate and the resin layer (the plastic film) of the mother substrate **50**. Then, after the lower face film is bonded to the peeling surface, the singulation of the organic EL substrate **2** is performed.

[0158] After that, as necessary, a function film, such as a polarizing film and a touch sensor film, or a polarizer, a touch panel or the like, is bonded to the organic EL substrate **2**.

Advantageous Effects

[0159] FIG. **5**A is a cross-sectional view illustrating a schematic configuration of the vicinity of the division line DL during the singulation of the organic EL substrate **2** according to the present embodiment, FIG. **5**B is a cross-sectional view illustrating a schematic configuration of the vicinity of the division line DL during the singulation of the organic EL substrate **2** when the first inorganic layer **31** and the second inorganic layer **33** of the sealing film **30** are formed on the division line DL of the organic EL substrate **2** on which the third organic insulating film pattern portion **17**C including the groove **17***c***1** is not formed, and FIG. **5**C is a cross-sectional view illustrating a schematic configuration of the vicinity of the division line DL during the singulation of the organic EL substrate **2** when the sealing film **30** is formed using the CVD mask to be separated from the division line DL.

[0160] As illustrated in FIGS. **5**A and **5**B, in a case that the inorganic sealing film such as the first inorganic layer **31** and the second inorganic layer **33** is present on the division line

DL, a crack CR may be generated in the inorganic sealing film on the division line DL as a result of the inorganic sealing film being cut.

[0161] At this time, as illustrated in FIG. **5**B, if a resin layer provided with a crack stopper, such as the third organic insulating film pattern portion **17**C including the groove **17***c***1**, is not formed, a crack generated in the inorganic sealing film may spread through the inorganic sealing film, and may spread into the display region **5** of the divided organic EL substrate **2**.

[0162] However, according to the present embodiment, as described above, since the third organic insulating film pattern portion **17**C including the groove **17***c***1** is provided outside the display region **5** (outside the sealing region **8**, for example) to surround the display region **5**, when forming the inorganic sealing film, the inorganic sealing film is naturally split apart at the bottom portion **17***c***2** of the groove **17***c***1**.

[0163] Thus, according to the present embodiment, as illustrated in FIG. **5**A, as a result of the first inorganic layer **31** and the second inorganic layer **33** being split apart, the split portion **34** is provided at the bottom portion **17***c***2** of the groove **17***c***1**.

[0164] Thus, according to the present embodiment, as illustrated in FIG. **5**A, even when the crack CR is generated in the sealing film **30** on the division line DL as a result of the sealing film **30** being cut, spreading of the crack CR is stopped by the split portion **34**. Thus, according to the present embodiment, the crack CR generated in the inorganic sealing film does not spread into the display region **5**, and moisture or oxygen does not penetrate into the display region **5**. Thus, the highly reliable organic EL display device **1** can be formed.

[0165] Note that when the sealing film **30** in each of the organic EL substrates **2** is formed independently using a CVD mask such that the sealing films **30** of the adjacent organic EL substrates **2** on the mother substrate **50** do not contact each other, the inorganic sealing film is not present on the division line DL, as illustrated in FIG. **5**C, so the crack CR generated in the inorganic sealing film does not spread into the display region **5**.

[0166] However, when the inorganic sealing layer is formed using the CVD mask, a shadow is generated on an edge portion of the inorganic sealing layer, as illustrated in FIG. **5**C.

[0167] At this time, a region on which the shadow is generated (a shadow region P) is approximately from 300 to 400 μm. Since the film thickness of the inorganic sealing film decreases in the shadow region P, barrier properties are reduced therein. For this reason, the edge portion of the inorganic layer needs to be sufficiently separated from the display region **5** such that the shadow region P is not present in the display region **5**, while also taking into account the machining accuracy and alignment accuracy of the CVD mask. Thus, when the division line DL and the formation region of the sealing film **30** are separated using the CVD mask, frame narrowing becomes impossible.

[0168] In contrast, according to the present embodiment, the shadow region P can be eliminated, so there is no such limitation. According to the present embodiment, since the inorganic sealing film can be provided on the division line DL, a margin for the forming accuracy of the inorganic sealing film can be secured. According to the present embodiment, since there is no need to separately dispose the edge portion of the inorganic sealing film and the divided region, the frame narrowing can be performed.

[0169] Note that in FIGS. **5**A to **5**C, although the position of the division line DL is aligned, the frame narrowing can be easily performed as long as the groove **17***c***1** (more specifically, the third organic insulating film pattern portion **17**C provided with the groove **17***c***1**) is disposed in a position close to the display region **5**. The groove **17***c***1** can be formed very slightly inside the division line DL (in other words, very slightly inside the edge portion **2***a* of the organic EL substrate **2**).

[0170] Furthermore, although not illustrated, in a case that a groove is formed on the division line DL by removing the inorganic sealing film on the division line DL after forming the sealing film **30**, photolithography using a photoresist, etching, and peeling steps are required after forming the sealing film **30**, and these steps need to be performed in a low temperature process so as not to damage the organic EL element **24**. Therefore, in a case that the groove is formed on the division line DL as described above, not only is an extra burden added in terms of equipment costs and running costs, but also yield decreases due to the increased number of steps.

[0171] In contrast, according to the present embodiment, since only the photolithography step for forming the eaves body **41** is required to be added, the burden of adding the number of steps is relatively low. In addition, by forming the eaves body **41** before the film forming step of the sealing film **30**, particularly before the film forming step of the organic EL **22**, material loss in a case that a pattern failure of the eaves body **41** occurs can be significantly reduced.

First Modified Example

[0172] FIGS. **6**A to **6**C are each a cross-sectional view illustrating an example of the shape of the groove **17***c***1** according to the present modified example.

[0173] In FIG. **1** and FIGS. **3**A and **3**B to FIG. **5**A, a case is illustrated, as an example, in which the groove **17***c***1** is a V-shaped groove having a V-shape in a cross-sectional view.

[0174] However, the present embodiment is not limited to this example. As illustrated in FIG. **6**A, the groove **17***c***1** may be a reversely tapered recessed groove having the taper angle θ of less than 90° and, for example, having reversely tapered inner wall surfaces in a cross-sectional view.

[0175] In this case, since the bottom portion **17***c***2** (lower end) of the groove **17***c***1** includes a flat portion, the first inorganic layer **31** and the second inorganic layer **33** are layered on (attached to) inner walls of the groove **17***c***1** and the flat portion of the bottom portion **17***c***2**. However, since the first inorganic layer **31** and the second inorganic layer **33** do not extend as far as edge portions of the bottom portion **17***c***2**, the first inorganic layer **31** and the second inorganic layer **33** are split apart in the edge portions, and the split portions **34** are formed in the edge portions.

[0176] In addition, although a case is illustrated, as an example, in which the taper angle θ is less than 90° in FIG. **1**, FIG. **6**A, and the like, as described above, the taper angle θ may be set to be 90° or more.

[0177] Thus, as illustrated in FIG. **6**B, the groove **17***c***1** may have the taper angle θ of 90° and may be a recessed groove having perpendicular inner wall surfaces.

[0178] Furthermore, as illustrated in FIG. **6**C, the groove **17***c***1** may be a forwardly tapered recessed groove having the taper angle θ greater than 90° and, for example, having forwardly tapered inner wall surfaces in a cross-sectional view.

[0179] In the above description, although a case is described, as an example, in which the groove **17***c***1** is formed by photolithography using a positive-working photosensitive resin for the organic insulating film **17**, the present embodiment is not limited to this example, and the groove **17***c***1** may be formed by laser machining, cutting, or the like, for example.

[0180] For example, the groove **17***c***1** illustrated in FIG. **6**C can be formed by irradiating the third organic insulating film pattern portion **17**C with a laser light after forming the third organic insulating film pattern portion **17**C in which the groove **17***c***1** is not formed.

[0181] Furthermore, as illustrated in FIG. **6**C, the organic insulating film **17** may be formed by a plurality of resin layers. In this case, the whole organic insulating film **17** may be formed by the plurality of resin layers, and for example, only the third organic insulating film pattern portion **17**C, or a portion of the organic insulating film pattern portion including the third organic insulating film pattern portion **17**C may be formed by the plurality of resin layers.

[0182] In FIG. **6**C, a case is illustrated, as an example, in which the third organic insulating film pattern portion **17**C has a layered structure in which a second resin layer **19** is layered on a first resin layer **18**. However, the present embodiment is not limited to this example.

[0183] Note that, when the third organic insulating film pattern portion **17**C has the layered structure in which the plurality of resin layers are layered, each of the resin layers may be formed of resins having different light transmittance and absorption rates, or may be formed using a combination of a positive-working photosensitive resin and a negative-working photosensitive resin.

[0184] In this way, the groove **17***c***1** can be machined into a desired shape by a known method, for example, by selecting a material, selecting a machining method, adjusting energy output conditions such as the amount of light exposure or the laser output, or the like.

[0185] When the bottom **17***c***2** of the groove **17***c***1** includes the flat portion as described above, as illustrated in FIGS. **6**A to **6**C, when the width (groove width) of the flat portion of the bottom portion **17***c***2** of the groove **17***c***1** is x**3**, and the total layer thickness of the first inorganic layer **31** and the second inorganic layer **33** is t**1**, the width x**3** preferably satisfies $0<x3<t1$.

[0186] Note that here, the width (groove width) of the flat portion of the bottom portion **17***c***2** of the groove **17***c***1** refers to the length in the short direction of the flat portion of the bottom portion **17***c***2** of the groove **17***c***1** (similarly to the width x**1**, the direction orthogonal to the direction in which the groove **17***c***1** extends).

[0187] Furthermore, in this case as well, as described above, when the width of the upper end of the groove **17***c***1** is x**1**, the width, in the same direction as the width x**1**, at the outermost surface of the third organic insulating film pattern portion **17**C including the groove **17***c***1** is x**2**, and the total layer thickness of the first inorganic layer **31** and the second inorganic layer **33** is t**1**, the width x**1** preferably satisfies $t1<x1<x2$.

[0188] The width x**3** is not particularly limited as long as $0<x3<t1$ is satisfied, but the width x**3** is preferably within a range of 0.5 μm to 2 μm, for example. The widths x**1** and x**2**, the layer thickness t**1**, and the depth t**2** are set as described above.

Second Modified Example

[0189] FIG. **7** is a cross-sectional view illustrating an example of a schematic configuration of the organic EL display device **1** according to the present modified example.

[0190] The organic EL display device **1** according to the present modified example differs from the organic EL display device **1** illustrated in FIG. **1** to FIG. **5**A in that the third organic insulating film pattern portion **17**C is provided with a frame-shaped bank BK**5** formed by a continuous line to surround the bank BK**4**, and the groove **17***c***1** is provided in the third organic insulating film pattern portion **17**C outside the bank BK**5** to surround the bank BK**5**.

[0191] In the present modified example, the frame-shaped bank BK**2**, the frame-shaped bank BK**3**, the frame-shaped bank BK**4**, and the frame-shaped bank BK**5** are formed outside the lattice-shaped bank BK**1** as the banks BK, and are provided in this order from the inside to the outside with the lattice-shaped bank BK**1** at the center.

[0192] The bank BK**5** can be formed of the same material as the banks BK**1** to BK**4**, for example, using an acrylic resin, a polyimide resin, or the like, and the banks BK**1** to BK**5** can be formed in the same step, for example.

[0193] The bank BK**5** holds back the organic insulating material, which forms the organic layer **32**, when the bank BK**4** fails to hold back the organic layer **32**. Also, since the third organic insulating film pattern portion **17**C is separated from the first organic insulating film pattern portion **17**A, the bank BK**4**, and the second organic insulating film pattern portion **17**B, the bank BK**5** is used as a third dam portion configured to prevent the penetration of moisture into the TFTs **18** and the organic EL elements **24** inside the first organic insulating film pattern portion **17**A.

[0194] In the present modified example, by extending the third organic insulating film pattern portion **17**C, which is used as the third dam portion, toward the edge portion **2***a* closer to the organic EL substrate **2**, in other words, closer to the division line DL, and by forming the groove **17***c***1** in the third organic insulating film pattern portion **17**C in this way, the third organic insulating film pattern portion **17**C can deploy a plurality of functions, namely, it can be used both as the third dam portion and as a body forming the crack stopper.

[0195] Note that, although not illustrated, organic insulating film pattern portions may be formed for the third dam portion and the groove **17***c***1**, respectively. For example, an organic insulating film pattern portion (not illustrated), which is provided with the bank BK**5** and surrounds the bank BK**4**, may be further formed as the third dam portion between the third organic insulating film pattern portion **17**C in which the groove **17***c***1** is formed, and the bank BK**4**, and a configuration may be adopted in which the third organic insulating film pattern portion **17**C in which the groove **17***c***1** is formed is formed surrounding the third dam portion.

[0196] In addition, in FIG. **1** and FIG. **4**B, a case is illustrated, as an example, in which, by exposing the terminals by irradiating the terminal portion **12**T with the laser, an opening, which has the same shape as and exposes the terminal TM, is formed in the fourth organic insulating film pattern portion **17**D and the first inorganic layer **31** and the second inorganic layer **33** covering the fourth organic insulating film pattern portion **17**D.

[0197] However, the present embodiment is not limited to this example. Regardless of the presence of the bank BK**5**, the shape (the size in a plan view) of the opening that is formed in the fourth organic insulating film pattern portion **17**D and exposes the terminal, and the shape (the size in a plan view) of the opening that is formed in the first inorganic layer **31** and the second inorganic layer **33** covering the fourth organic insulating film pattern portion **17**D may be the same as each other, as illustrated in FIG. **1** and FIG. **4**B, or may be different from each other, as illustrated in FIG. **7**.

[0198] Note that the difference in the shape of the opening may occur, for example, due to a difference in the absorption rate of the laser used for exposing the terminal. Furthermore, by changing the laser intensity for the first inorganic layer **31** and the second inorganic layer **33** from the laser intensity for the fourth organic insulating film pattern portion **17**D, the shape of the opening formed in each of the first inorganic layer **31**. the second inorganic layer **33**, and the fourth organic insulating film pattern portion **17**D may be changed.

[0199] Furthermore, as described above, since the third organic insulating film pattern portion **17**C in which the groove **17***c***1** is formed is provided, the organic EL display device **1** can form the first inorganic layer **31** and the second inorganic layer **33** in a maskless manner. However, the fourth organic insulating film pattern portion **17**D in which the opening is provided in advance to expose the terminal TM may be formed, and the first inorganic layer **31** and the second inorganic layer **33** may be formed using a CVD mask. The CVD mask includes a plurality of mask openings, and is formed such that lines passing over each of the terminals TM of the adjacent plurality of terminal portions **12**T on either side of the division line DL are covered, and such that, of four sides of the region surrounded by the division lines DL, at least the division line DL on the side on which the terminal portion **12**T is not provided is positioned inside the mask opening, and such that a region surrounding the division line DL on the side on which the terminal portion **12**T is not provided is open. In this case as well, since the third organic insulating film pattern portion **17**C in which the groove **17***c***1** is formed is provided, the first inorganic layer **31** and the second inorganic layer **33** can be split apart, and the spreading of cracks into the display region **5** can be prevented. Furthermore, the frame narrowing of the side on which the terminal portion **12**T is not provided can be achieved.

Third Modified Example

[0200] FIG. **8**A is a plan view illustrating an example of a schematic configuration of the organic EL display device **1** according to the present modified example, FIG. **8**B is a cross-sectional view taken along a line C-C illustrated in FIG. **8**A, and FIG. **8**C is a cross-sectional view taken along a line D-D illustrated in FIG. **8**A.

[0201] In the organic EL display device **1** according to the present modified example, as illustrated in FIGS. **8**A to **8**C, a groove **17***c***1**A and a groove **17***c***1**B, which is deeper than the groove **17***c***1**A, may be provided in the third organic insulating film pattern portion **17**C as the groove **17***c***1**. The grooves **17***c***1**A and **17***c***1**B may be periodically formed, for example, and a shallow groove portion D**1** provided with the relatively shallow groove **17***c***1**A and a deep groove portion D**2** provided with the relatively deep groove **17***c***1**B may be alternately provided at a uniform period in the third organic insulating film pattern portion **17**C.

[0202] Furthermore, in the organic EL display device **1** according to the present modified example, the shape of the groove **17***c***1** may be partially different. As illustrated in FIGS. **8**A to **8**C, the organic EL display device **1** according to the present modified example may have a configuration in which the grooves **17***c***1**A and **17***c***1**B have different shapes from each other and the grooves **17***c***1**A and **17***c***1**B having the different shapes are periodically formed, for example. For example, the shallow groove portion D**1** and the deep groove portion D**2** may be respectively provided with the grooves **17***c***1**A and **17***c***1**B having the different shapes.

[0203] Note that in FIGS. **8**A to **8**C, a case is illustrated, as an example, in which a V-shaped groove is provided in the shallow groove portion D**1** as the groove **17***c***1**A, and a recessed groove is provided in the deep groove portion D**2** as the groove **17***c***1**B, but the present modified example is not limited to this example. For example, the recessed groove may be provided in the shallow groove portion D**1** as the groove portion **17***c***1**A, and the V-shaped groove may be provided in the deep groove portion D**2** as the groove **17***c***1**B.

[0204] Furthermore, the groove **17***c***1**A and the groove **17***c***1**B may have different taper angles due to differences in the groove shapes, for example, and may have different taper angles due to differences in the depths. For example, a relatively shallow V-shaped groove may be provided in the shallow groove portion D**1** as the groove **17***c***1**A, a relatively deep V-shaped groove may be provided in the deep groove portion D**2** as the groove **17***c***1**B, and the groove **17***c***1**A and the groove **17***c***1**B may have the different taper angles θ due to differences in the depths thereof.

[0205] Note that in FIGS. **8**A to **8**C, a case is illustrated, as an example, in which the shallow groove portions D**1** are provided in corner portions of the organic EL substrate **2**, but the deep groove portions D**2** may be provided in the corner portions of the organic EL substrate **2**. For example, in FIG. **8**A, the shallow groove portions D**1** and the deep groove portions D**2** may be reversed in position.

[0206] Furthermore, in FIGS. **8**A to **8**C, a case is illustrated, as an example, in which the third organic insulating film pattern portion **17**C provided with the grooves **17***c***1**A and **17***c***1**B is formed in a single frame shape, but the present modified example is not limited to this example. For example, the third organic insulating film pattern portion **17**C provided with the shallow groove portions D**1** and the deep groove portions D**2** may be formed in a multiple frame shape, such as a double frame shape, a triple frame shape, or the like, and the shallow groove portions D**1** and the deep groove portions D**2** may be disposed to respectively form zig-zag patterns in adjacent frames.

[0207] Note that the taper angle θ of the groove **17***c***1** (the grooves **17***c* lA and **17***c***1**B) is preferably within the range of 70° to 120°, for example, as described above.

[0208] Furthermore, regardless of whether the groove **17***c***1** (the grooves **17***c***1**A and **17***c***1**B) is the groove **17***c***1**A or the groove **17***c***1**B, the width x**1** of the groove **17***c***1** preferably satisfies $t1<x1<x2$, as described above. In addition, regardless of whether the groove **17***c***1** is the groove **17***c***1**A or the groove **17***c***1**B, when the bottom portion **17***c***2** of the groove **17***c***1** includes a flat portion, the groove **17***c***1** preferably satisfies $0<x3<t1$.

[0209] Furthermore, when the depth of the groove **17***c***1**A of the shallow groove portion D**1** is t**2**A, and the depth of the groove **17***c***1**B of the deep groove portion D**2** is t**2**B, t**2**A<t**2**B is preferably satisfied, and the depths t**2**A and t**2**B of these grooves **17***c***1**A and **17***c***1**B (namely, the depth t**2** of the groove **17***c***1**) are preferably within the range of 0.5 μm to 2 μm, for example, as described above.

Fourth Modified Example

[0210] FIG. **9** is a plan view illustrating an example of a schematic configuration of the organic EL display device **1** according to the present modified example.

[0211] As illustrated in FIG. **9**, in the organic EL display device **1** according to the present modified example, the width of the third organic insulating film pattern portion **17**C in a plan view may be partially different, and in a plan view, as a groove **17***c***1**, a groove **17***c***1**C and a groove **17***c***1**D, which has a groove width wider than that of the groove **17***c***1**C, may be periodically provided.

[0212] For example, the groove **17***c***1**C having the relatively narrow groove width may be provided, as a narrow groove, in a narrow width portion D**11** in which the width of the third organic insulating film pattern portion **17**C is relatively narrow, and the groove **17***c***1**D having the relatively wide groove width may be provided, as a wide groove, in a wide width portion D**12** in which the width of the third organic insulating film pattern portion **17**C is relatively wide. Note that in FIG. **9**, a case is illustrated, as an example, in which the narrow width portion D**11** and the wide width portion D**12** are alternately provided at a uniform period, but the present modified example is not limited to this example.

[0213] Furthermore, the grooves **17***c***1**C and **17***c***1**D having different depths may be provided respectively in the narrow width portion D**11** and the wide width portion D**12**, and the grooves **17***c***1**C and **17***c***1**D having different shapes may be provided respectively in the narrow width portion D**11** and the wide width portion D**12**.

[0214] In addition, in FIG. **9**, an example is illustrated in which the narrow width sections D**11** are provided in the corner portions of the organic EL substrate **2**, but the wide width portions D**12** may be provided in the corner portions of the organic EL substrate **2**. For example, in FIG. **9**, the narrow width portions D**11** and the wide width portions D**12** may be reversed in position.

[0215] Furthermore, in FIG. **9**, a case is illustrated, as an example, in which the third organic insulating film pattern portion **17**C provided with the narrow width portions D**11** and the wide width portions D**12** is formed in a single frame shape, but the present modified example is not limited to this example. For example, the third organic insulating film pattern portion **17**C provided with the narrow width portions D**11** and the wide width portions D**12** may be formed in a multiple frame shape, such as a double-frame shape, a triple frame shape, or the like, and the narrow width portions D**11** and the wide width portions D**12** may be disposed to respectively form zig-zag patterns in adjacent frames.

[0216] As illustrated in FIG. **9**, when the width x**2**, in the same direction as the width x**1**, at the outermost surface of the third organic insulating film pattern portion **17**C in the narrow width portion **11** is x**2**A, and the width x**2**, in the same direction as the width x**1**, at the outermost surface of the third organic insulating film pattern portion **17**C in the wide width portion D**12** is x**2**B, x**2**A<x**2**B is satisfied.

[0217] The width x**2**A is preferably within a range of 7 μm to 15 μm, for example, for the reason of frame narrowing. The width x**2**B is preferably within a range of 9 μm to 25 μm, for example, for the reason of frame narrowing.

[0218] Furthermore, regardless of whether the groove **17***c***1** (the grooves **17***c***1**C and **17***c***1**D) is the groove **17***c***1**C or the groove **17***c***1**D, the width x**1** of the groove **17***c***1** preferably satisfies t**1**<x**1** <x**2**, as described above. In addition, regardless of whether the groove **17***c***1** is the groove **17***c***1**C or the groove **17***c***1**D, when the bottom portion **17***c***2** of the groove **17***c***1** includes a flat portion, the groove **17***c***1** preferably satisfies 0<x3 <t**1**. The width x**2** can be replaced as appropriate with the width x**2**A or the width x**2**B depending on whether the groove **17***c***1** is a groove provided in the narrow width portion D**11** or a groove provided in the wide width portion D**12**. Note that the widths x**1** and x**3**, the layer thickness t**1**, and the depth t**2** are set as described above.

[0219] Furthermore, in the present embodiment as well, the taper angle θ of the groove **17***c***1** (the grooves **17***c***1**C and **17***c***1**D) is preferably within the range of 70° to 120°, for example, as described above.

Fifth Modified Example

[0220] Furthermore, in FIG. **1**, a case is illustrated, as an example, in which the organic insulating film **17** includes the first organic insulating film pattern portion **17**A to the fourth organic insulating film pattern portion **17**D. However, the present embodiment is not limited to this example.

[0221] For example, the third organic insulating film pattern portion **17**C and the fourth organic insulating film pattern portion **17**D need not necessarily be provided separately, and the third organic insulating film pattern portion **17**C may cover the terminal portion **12**T to expose the terminals TM.

Sixth Modified Example

[0222] Furthermore, in FIG. **2**, a case is illustrated, as an example, in which the third organic insulating film pattern portion **17**C in which the groove **17***c***1** is formed is formed in the frame shape to surround the bank BK**4**. However, the present embodiment is not limited to this example.

[0223] For example, when the first inorganic layer **31** and the second inorganic layer **33** are formed in regions other than the terminals TM using a CVD mask such that the first inorganic layer **31** and the second inorganic layer **33** are not formed on the terminals TM, the groove **17***c***1** or the third organic insulating film pattern portion **17**C in which the groove **17***c***1** is formed need not necessarily be formed between the display region **5** and the terminal portion **12**T.

Seventh Modified Example

[0224] In the present embodiment, a case is described, as an example, in which the sealing film **30** includes the first inorganic layer **31** and the second inorganic layer **33**, and the first inorganic layer **31** and the second inorganic layer **33** are layered on the edge portion **2***a* of the organic EL substrate **2** (in other words, on the division line DL) and on the top surface of the third organic insulating film pattern portion **17**C.

[0225] However, the present embodiment is not limited to this example, and may have a configuration in which only one of the inorganic layers of the first inorganic layer **31** and the second inorganic layer **33** is formed on the edge portion

2*a* of the organic EL substrate **2** and on the top surface of the third organic insulating film pattern portion **17**C.

Eighth Modified Example

[0226] An object of the disclosure is to prevent the crack generated in the sealing film **30** from spreading into the display region **5**, as described above, and in FIG. **1**, a case is illustrated, as an example, in which the inorganic films, such as the gate insulating film **14** and the inorganic insulating film **15** (the passivation film) that are formed in the TFT step are formed on the edge portion **2***a* of the organic EL substrate **2** (in other words, on the division line DL). Since these inorganic films are typically formed by plasma CVD using a higher temperature than that for the inorganic sealing film, these inorganic films have strong crack resistance properties.

[0227] However, the present embodiment is not limited to this example. To prevent cracks from occurring in these inorganic films formed at the TFT step, these inorganic films on the division line DL may be removed by photolithography, etching, or the like at a step for forming the inorganic films.

Ninth Modified Example

[0228] As described above, in the present embodiment, as an example of the display device according to the present embodiment, the organic EL display device **1** including the organic EL elements **24** (the OLED elements) as the light emitting elements is described as an example. However, the present embodiment is not limited to this example, and the light emitting elements may be inorganic EL elements or Quantum-dot Light Emitting Diode (QLED) elements.

Supplement

[0229] A display device (the organic EL display device **1**) according to a first aspect of the disclosure includes a support body (the TFT substrate **10**), a plurality of light emitting elements (the organic EL elements **24**) provided in the display region **5** on the support body, and the sealing film **30** configured to seal the plurality of light emitting elements. The display device includes a resin layer (the third organic insulating film pattern portion **17**C) including a groove (the groove **17***c***1**) on an upper surface thereof, the resin layer being provided between the display region **5** and at least part of an edge portion of the support body (the edge portion **2***a* of the organic EL substrate **2** provided with the TFT substrate **10**) in a plan view, and being separated from the at least part of the edge portion. The sealing film **30** includes at least an inorganic layer (the first inorganic layer **31** and the second inorganic layer **33**), and, in a plan view, the inorganic layer covers the resin layer and the at least part of the edge portion, and is split apart in the groove.

[0230] According to a second aspect of the disclosure, in the display device according to the first aspect, the resin layer may be provided facing the at least part of the edge portion on which the inorganic layer is provided.

[0231] According to a third aspect of the disclosure, in the display device according to the first or second aspect, the display region **5** may include the plurality of subpixels **3**, the plurality of light emitting elements may each include the first electrode **21**, a function layer (the organic EL layer **22**) including a light emitting layer, and the second electrode **23**, the first electrode **21**, the function layer, and the second electrode **23** being layered in this order. At least the first electrode **21** may be provided for each of the plurality of subpixels **3**. The second electrode connecting portion **7** electrically connected to the second electrode **23** may be provided outside the display region **5**. The resin layer may be provided outside the second electrode connecting portion **7**.

[0232] According to an fourth aspect of the disclosure, in the display device according to any one of the first to third aspects, the sealing film **30** may include the first inorganic layer **31**, the second inorganic layer **33**, and the organic layer **32** sealed between the first inorganic layer **31** and the second inorganic layer **33** and covering the display region **5**, and the resin layer may be provided outside an edge portion of the organic layer **32** (namely, outside the sealing region **8**).

[0233] According to a fifth aspect of the disclosure, in the display device according to any one of the first to fourth aspects, the support body may have a quadrilateral shape in a plan view, the terminal portion **12**T may be provided between at least one side of four sides of the support body and the display region **5**, along the at least one side, and the resin layer may be provided facing at least an edge portion, of the support body, of a side on which the terminal portion **12**T is not provided.

[0234] According to a sixth aspect of the disclosure, in the display device according to the fifth aspect, the resin layer may be further provided between the display region **5** and the terminal portion **12**T.

[0235] According to a seventh aspect of the disclosure, in the display device according to any one of the first to sixth aspects, in a plan view, the resin layer may be formed in a frame shape surrounding the display region **5**.

[0236] According to an eighth aspect of the disclosure, in the display device according to any one of the first to seventh aspects, in a plan view, a peripheral edge portion of the inorganic layer overlaps with a peripheral edge portion (the whole edge portion **2***a*) of the support body.

[0237] According to a ninth aspect of the disclosure, in the display device according to any one of the first to eighth aspects, the resin layer may include the shallow groove portion D**1** having a relatively shallow depth of the groove, and the deep groove portion D**2** having a relatively deep depth of the groove.

[0238] According to a tenth aspect of the disclosure, in the display device according to the ninth aspect, the deep groove portions D**1** may be periodically provided.

[0239] According to an eleventh aspect of the disclosure, in the display device according to the ninth or tenth aspect, the groove in the shallow groove portion D**1** and the groove in the deep groove portion D**2** may have different shapes.

[0240] According to a twelfth aspect of the disclosure, in the display device according to any one of the first to eleventh aspects, the resin layer may include a narrow width portion having a width of the resin layer being relatively narrow and a wide width portion having the width of the resin layer being relatively wide.

[0241] According to a twelfth aspect of the disclosure, in the display device according to the twelfth aspect, a narrow groove having the width being relatively narrow may be provided as the groove in the narrow width portion D**11**, and a wide groove having the width being relatively wide may be provided as the groove in the wide width portion D**12**.

[0242] According to a fourteenth aspect of the disclosure, in the display device according to any one of the first to eleventh aspects, the resin layer may include the narrow width portion D11 having a width of the groove being relatively narrow, and the wide width portion D12 having the width of the groove being relatively wide.

[0243] According to a fifteenth aspect of the disclosure, in the display device according to any one of the twelfth to fourteenth aspects, the wide width portions D12 may be periodically provided.

[0244] According to a sixteenth aspect of the disclosure, in the display device according to any one of the first to fifteenth aspects, the plurality of light emitting elements may each be provided on a flattening film (the first organic insulating film pattern portion 17A) provided in the display region 5, and the resin layer may be formed of the same material as the flattening film and provided in the same layer as the flattening film being while being separated from the flattening film.

[0245] According to a seventeenth aspect of the disclosure, in the display device according to any one of the first to sixteenth aspects, the resin layer may further include a frame-shaped wall body (the bank BK5) surrounding the display region 5, and the groove may be provided surrounding the frame-shaped wall body.

[0246] According to an eighteenth aspect of the disclosure, in the display device according to any one of the first to seventeenth aspects, an angle formed by an inner wall of the groove and a plane parallel to a surface of the support body may be within a range of 70° to 120°.

[0247] According to a nineteenth aspect of the disclosure, in the display device according to any one of the first to eighteenth aspects, a depth of the groove may be within a range of 0.5 μm to 2 μm.

[0248] According to a twentieth aspect of the disclosure, in the display device according to any one of the first to nineteenth aspects, when a width of an upper end of the groove in a direction orthogonal to a direction along an edge portion of the support body in a plan view is x1, a width, in the same direction as the width of the upper end of the groove, at an outermost surface of the resin layer is x2, and a layer thickness of the inorganic layer on the resin layer is t1, $t1<x1<x2$ may be satisfied.

[0249] According to a twenty first aspect of the disclosure, in the display device according to any one of the first to twentieth aspects, the groove may include a flat portion in a bottom portion (the bottom portion 17*c*2) thereof, and when a width of the flat portion in the bottom portion of the groove in a direction orthogonal to a direction along the edge portion of the support body in a plan view is x3 and the layer thickness of the inorganic layer on the resin layer is t1, $0<x3<t1$ may be satisfied.

[0250] According to a twenty second aspect of the disclosure, in the display device according to any one of the first to twenty first aspects, the width of the groove may be within a range of 2 μm to 5 μm.

[0251] According to a twenty third aspect of the disclosure, in the display device according to any one of the first to twenty second aspects, the display device may be a flexible display device.

[0252] In a method for manufacturing the display device according to a twenty fourth aspect of the disclosure, the display device (the organic EL display device 1) includes a support body (the TFT substrate 10), a plurality of light emitting elements (the organic EL elements 24) provided in a display region 5 on the support body, and the sealing film 30 configured to seal the plurality of light emitting elements. The method includes forming a resin layer (the third organic insulating film pattern portion 17C) including a groove (the groove 17*c*1) in an upper surface thereof on the mother substrate 50 configuring at least part of the support body, the resin layer being formed, in a plan view, between at least part of a scheduled division line (the division line DL), of a plurality of the scheduled division lines for dividing and singulating the mother substrate 50 into the individual display devices, and the display region 5 in a region surrounded by the plurality of scheduled division lines, the resin layer being separated from the at least part of the plurality of scheduled division lines, forming the sealing film 30, and dividing the mother substrate 50, on which the sealing film 30 is formed, along the plurality of scheduled division lines surrounding around each of the display regions 5. The forming the sealing film includes forming an inorganic layer (the first inorganic layer 31 and the second inorganic layer 33), and in the forming the inorganic layer, the inorganic layer covers the resin layer, and by forming the inorganic layer to also cover the at least part of the plurality of scheduled division lines, the inorganic layer is split apart in the groove.

[0253] According to a twenty fifth aspect of the disclosure, in the method for manufacturing the display device according to the twenty fourth aspect, in the forming the resin layer, the resin layer may be formed facing the at least part of the plurality of scheduled division lines.

[0254] According to a twenty sixth aspect of the disclosure, in the method for manufacturing the display device according to the twenty fourth or twenty fifth aspect, in the forming the resin layer, the resin layer may be formed, in a plan view, in a frame shape surrounding the display region 5, inside the region surrounded by the plurality of scheduled division lines.

[0255] According to a twenty seventh aspect of the disclosure, in the method for manufacturing the display device according to the twenty fourth or twenty fifth aspect, the dividing the mother substrate 50 may further include dividing the mother substrate 50 into quadrilateral shapes in a plan view along the plurality of scheduled division lines, and forming the terminal portion 12T along part of the plurality of scheduled division lines, of the plurality of scheduled division lines corresponding to four sides of a region of the quadrilateral shape, between the part of the plurality of scheduled division lines and the display region 5 in the region having the quadrilateral shape surrounded by the plurality of scheduled division lines. In the forming the resin layer, the resin layer may be formed facing at least the scheduled division line on the side on which the terminal portion 12T is not provided, of the four sides of the region of the quadrilateral shape.

[0256] According to a twenty eighth aspect of the disclosure, the method for manufacturing the display device according to the twenty seventh aspect may further include covering, with a resin, the terminal portion 12T formed in the forming the terminal portion. In the forming the resin layer, the resin layer may be formed in a frame shape surrounding the display region 5 and passing between the display region 5 in the region of the quadrilateral shape and the terminal portion 12T, and in the forming the inorganic layer, the inorganic layer may be formed in a maskless manner over a whole surface of the mother substrate 50 such that the resin layer and each of the plurality of scheduled division lines are covered by the inorganic layer. After the forming the inorganic layer, the method may further include exposing the terminal TM of the terminal portion **12**T.

[0257] According to a twenty ninth aspect of the disclosure, in the method for manufacturing the display device according to the twenty eighth aspect, the exposing the terminal is performed by irradiating the terminal portion **12**T with a laser.

[0258] The disclosure is not limited to each of the embodiments described above, and various modifications may be made within the scope of the claims. Embodiments obtained by appropriately combining technical approaches disclosed in each of the different embodiments also fall within the technical scope of the disclosure. Moreover, novel technical features can be formed by combining the technical approaches disclosed in the embodiments.

REFERENCE SIGNS LIST

[0259] **1** Organic EL display device
[0260] **2** Organic EL substrate
[0261] **2***a* Edge portion
[0262] **3**, **3**R, **3**G, **3**B Subpixel
[0263] **4** Pixel
[0264] **5** Display region
[0265] **6** Frame region
[0266] **7** Second electrode connecting portion
[0267] **8** Sealing region
[0268] **10** TFT substrate (support body)
[0269] **12**T Terminal portion
[0270] **14** Gate insulating film
[0271] **15**, **16** Inorganic insulating film
[0272] **17** Organic insulating film
[0273] **17**A First organic insulating film pattern portion (flattening film)
[0274] **17**B Second organic insulating film pattern portion
[0275] **17**C Third organic insulating film pattern portion (resin layer)
[0276] **17**D Fourth organic insulating film pattern portion
[0277] **17***c***1**, **17***c***1**A, **17***c***1**B, **17***c***1**C, **17***c***1**D Groove
[0278] **17***c***2** Bottom portion
[0279] **18** First resin layer
[0280] **19** Second resin layer
[0281] **21** First electrode
[0282] **22** Organic EL layer (function layer)
[0283] **23** Second electrode
[0284] **24** Organic EL element (light emitting element)
[0285] **30** Sealing film
[0286] **31** First inorganic layer
[0287] **32** Organic layer
[0288] **33** Second inorganic layer
[0289] **34** Split portion
[0290] **50** Mother substrate
[0291] BK, BK**1**, BK**2**, BK**3**, BK**4**, BK**5** Bank
[0292] DL Division line (scheduled division line)
[0293] D**1** Shallow groove portion
[0294] D**2** Deep groove portion
[0295] D**11** Narrow width portion
[0296] D**12** Wide width portion

1. A display device comprising:
a support body;
a plurality of light emitting elements provided in a display region on the support body; and
a sealing film configured to seal the plurality of light emitting elements,
wherein the display device further includes a resin layer including a groove on an upper surface thereof, the resin layer being provided between the display region and at least part of an edge portion of the support body in a plan view, and being separated from the at least part of the edge portion,
the sealing film includes at least an inorganic layer, and
in a plan view, the inorganic layer covers the resin layer and the at least part of the edge portion, and is split apart in the groove.

2. The display device according to claim **1**,
wherein the resin layer is provided facing the at least part of the edge portion on which the inorganic layer is provided.

3. The display device according to claim **1** or **2**,
wherein the display region includes a plurality of subpixels,
the plurality of light emitting elements each includes a first electrode, a function layer including a light emitting layer, and a second electrode, the first electrode, the function layer, and the second electrode being layered in this order,
at least the first electrode is provided for each of the plurality of subpixels,
a second electrode connecting portion electrically connected to the second electrode is provided outside the display region, and
the resin layer is provided outside the second electrode connecting portion.

4. The display device according to claim **1**,
wherein the sealing film includes a first inorganic layer, a second inorganic layer, and an organic layer sealed between the first inorganic layer and the second inorganic layer and covering the display region, and
the resin layer is provided outside an edge portion of the organic layer.

5. The display device according to claim **1**,
wherein the support body has a quadrilateral shape in a plan view,
a terminal portion is provided between at least one side of four sides of the support body and the display region, along the at least one side, and
the resin layer is provided facing at least an edge portion, of the support body, of a side on which the terminal portion is not provided.

6. The display device according to claim **5**,
wherein the resin layer is further provided between the display region and the terminal portion.

7. The display device according to claim **1**,
wherein, in a plan view, the resin layer is formed in a frame shape surrounding the display region.

8. The display device according to claim **1**,
wherein, in a plan view, a peripheral edge portion of the inorganic layer overlaps with a peripheral edge portion of the support body.

9. The display device according to claim **1**,
wherein the resin layer includes a shallow groove portion having a relatively shallow depth of the groove, and a deep groove portion having a relatively deep depth of the groove.

10. The display device according to claim **9**,
wherein the deep groove portions are periodically provided.

11. The display device according to claim **9**,

wherein the groove in the shallow groove portion and the groove in the deep groove portion have different shapes.

12. The display device according to claim **1**,

wherein the resin layer includes a narrow width portion having a width of the resin layer being relatively narrow and a wide width portion having the width of the resin layer being relatively wide.

13. The display device according to claim **12**,

wherein a narrow groove having the width being relatively narrow is provided as the groove in the narrow width portion, and a wide groove having the width being relatively wide is provided as the groove in the wide width portion.

14. The display device according to claim **1**,

wherein the resin layer includes the narrow width portion having a width of the groove being relatively narrow, and the wide width portion having the width of the groove being relatively wide.

15. The display device according to claim **12**,

wherein the wide width portions are periodically provided.

16. The display device according to claim **1**,

wherein the plurality of light emitting elements is each provided on a flattening film provided in the display region, and

the resin layer is formed of the same material as the flattening film and provided in the same layer as the flattening film while being separated from the flattening film.

17. The display device according to claim **1**,

wherein the resin layer further includes a frame-shaped wall body surrounding the display region, and

the groove is provided surrounding the frame-shaped wall body.

18. The display device according to claim **1**,

wherein an angle formed by an inner wall of the groove and a plane parallel to a surface of the support body is within a range of 70° to 120°.

19. (canceled).

20. The display device according to claim **1**,

wherein when a width of an upper end of the groove in a direction orthogonal to a direction along an edge portion of the support body in a plan view is x**1**, a width, in the same direction as the width of the upper end of the groove, at an outermost surface of the resin layer is x**2**, and a layer thickness of the inorganic layer on the resin layer is t**1**, $t1<x1<x2$ is satisfied.

21. The display device according to claim **1**,

wherein the groove includes a flat portion in a bottom portion thereof, and

when a width of the flat portion in the bottom portion of the groove in a direction orthogonal to a direction along the edge portion of the support body in a plan view is x**3** and the layer thickness of the inorganic layer on the resin layer is t**1**, $0<x3<t1$ is satisfied.

22-29. (canceled)

* * * * *

patsnap

专利名称(译)	显示装置及其制造方法		
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申请(专利权)人(译)	夏普株式会社		
当前申请(专利权)人(译)	夏普株式会社		
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外部链接	Espacenet USPTO		

摘要(译)

有机EL显示装置包括第三有机绝缘膜图案部分，该第三有机绝缘膜图案部分在其上表面上在显示区域和TFT基板的边缘部分的至少一部分之间包括凹槽。 密封膜的第一无机层和第二无机层在平面图中覆盖第三有机绝缘膜图案部分和边缘部分的至少一部分，并且在凹槽中分开。