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(54) **ORGANIC EL DISPLAY DEVICE**

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(57) **ABSTRACT**

A bank layer includes projecting portions swollen toward in a thickness direction of a first substrate in an adhesion area. A multi-barrier includes a portion, in which a organic barrier is not disposed, on an upper side of the projecting portions. Therefore, it is possible to obtain, in the adhesion area, a portion in which a first inorganic barrier layer and a second inorganic barrier layer directly come in contact with each other. In an organic EL display device including the multi-barrier formed of an organic material and an inorganic material, it is possible to prevent two facing substrates from being separated from each other.

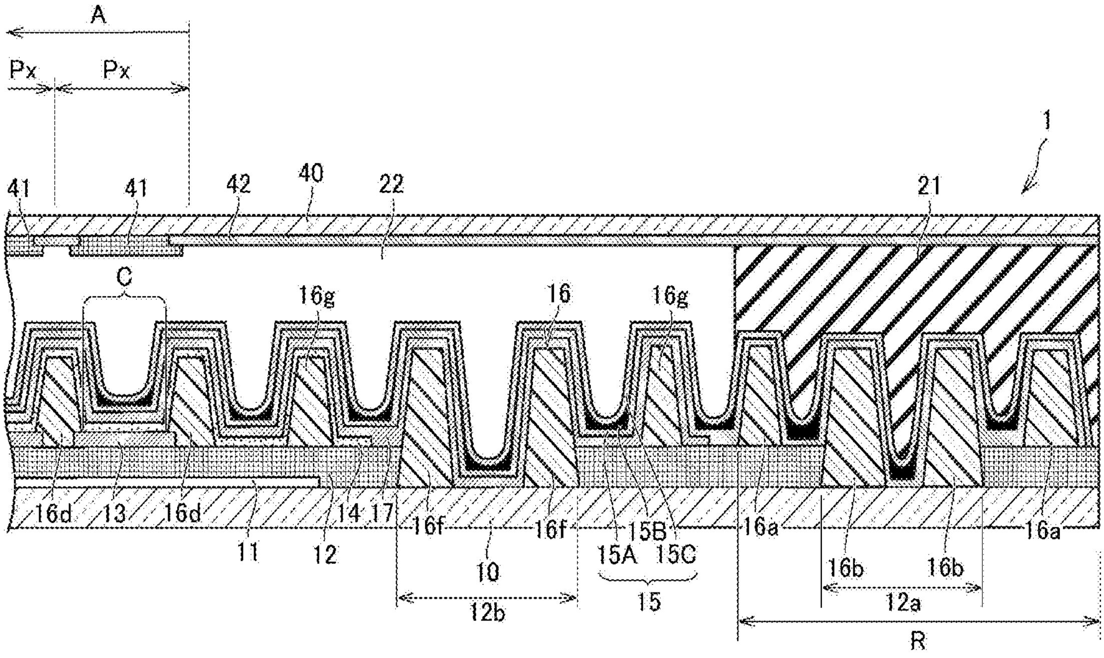


FIG.1

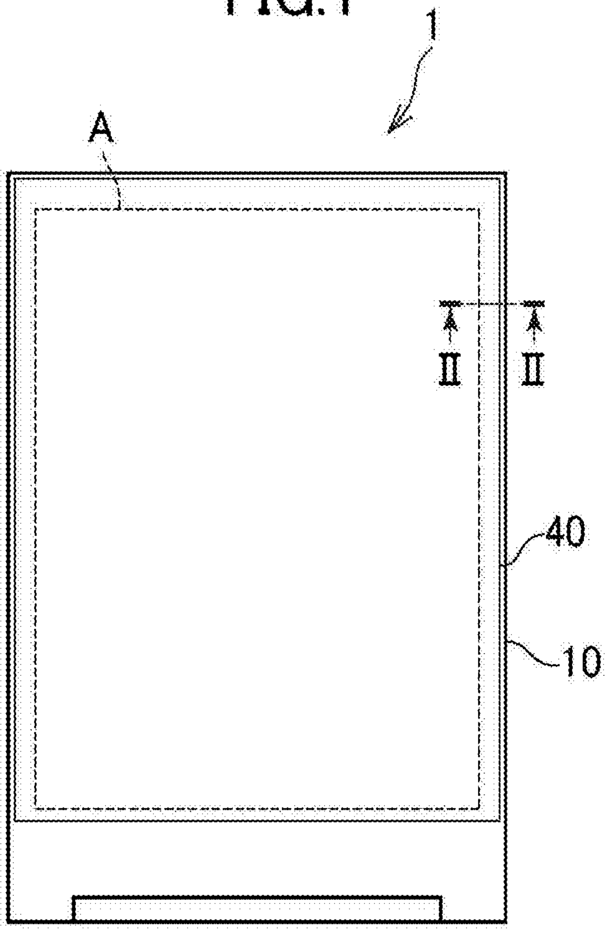


FIG.2

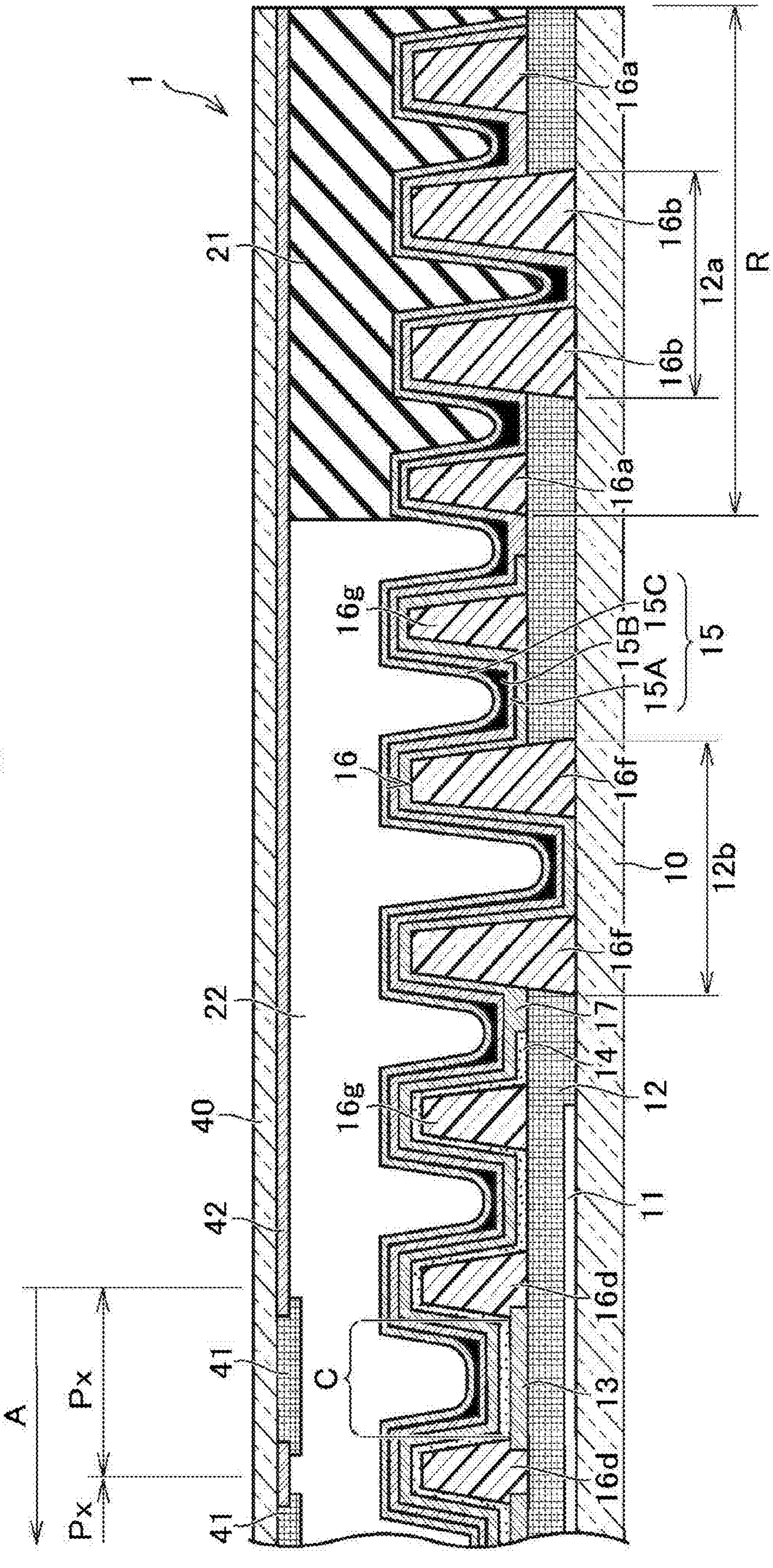

1
21
16a
16b
12a
R
16b
16a
16g
15C
15B
15A
15
16
16f
10
12b
16f
22
17
14
12
40
16g
11
42
16d
A
Px
41
C
13
16d
Px
41

FIG.3

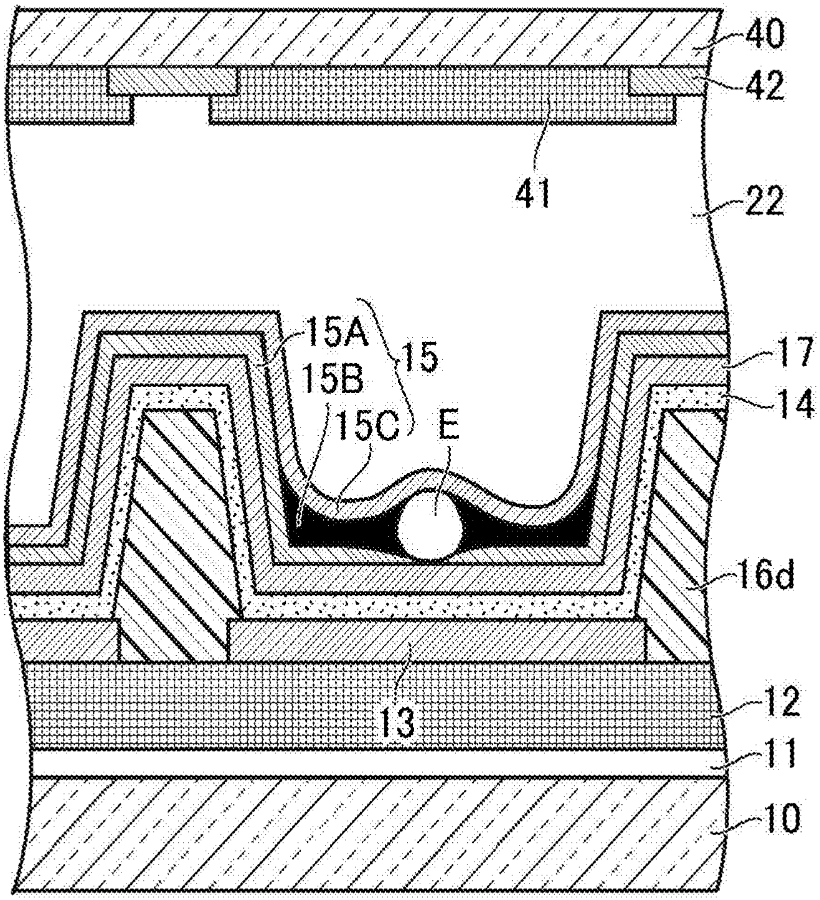


FIG.4A

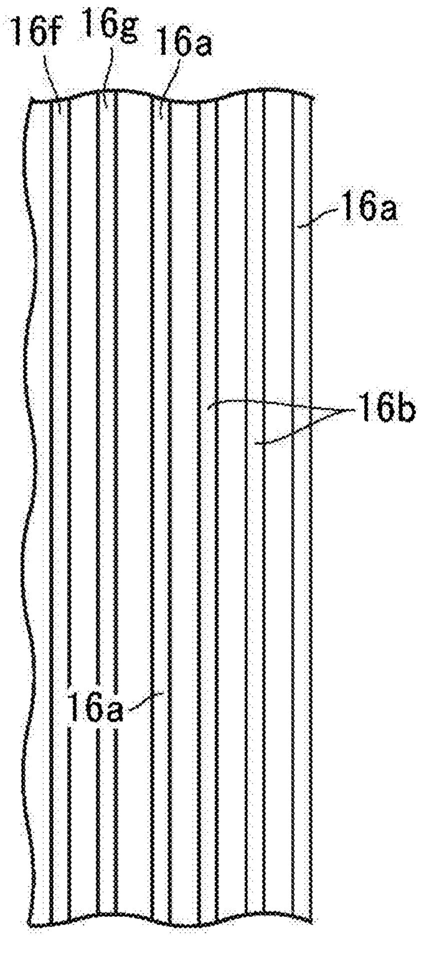
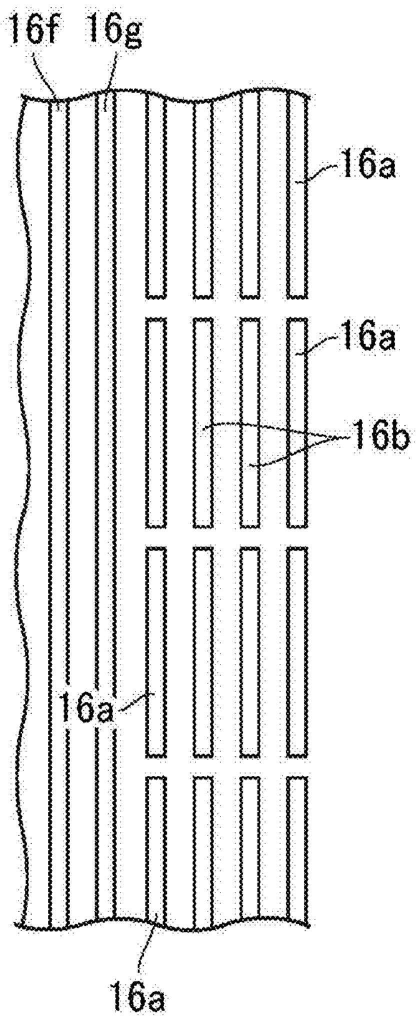


FIG.4B



ORGANIC EL DISPLAY DEVICE

CROSS-REFERENCE TO RELATED APPLICATION

[0001] The present application claims priority from Japanese application JP2014-163679 filed on Aug. 11, 2014, the content of which is hereby incorporated by reference into this application.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to an organic EL display device.

[0004] 2. Description of the Related Art

[0005] Organic EL display devices include a first substrate on which an organic layer including a light emitting layer is formed, and a second substrate facing the first substrate. A sealing material is disposed along an outer periphery of the second substrate. The outer periphery of the second substrate is bonded to the first substrate by using the sealing material. For example, JP2006-004909A, JP2002-311853A, and JP2007-200838A disclose the sealing material. When moisture infiltrates into the organic layer, the organic layer is deteriorated, and thereby the quality of an image is deteriorated. Therefore, a number of the organic EL display devices includes a barrier which covers the organic layer and prevents moisture from infiltrating into the organic layer. JP2005-504652A discloses a barrier formed of a plurality of layers.

SUMMARY OF THE INVENTION

[0006] In a process of forming the first substrate, a pin hole may be caused in a barrier due to a foreign particle such as dust in some cases. When the pin hole is caused, moisture infiltrates into the pin hole and thereby an organic layer is deteriorated. The inventors of the present application have examined a multi-barrier structure formed of a plurality of barrier layers which are formed of inorganic materials, and an organic barrier which is formed of organic materials. The first barrier layer covers the organic layer. The organic barrier is disposed on a first inorganic barrier layer. When foreign particle exists on the first inorganic barrier layer, the organic barrier is formed so as to surround the foreign particle. A second inorganic barrier layer covers the first inorganic barrier layer and the organic barrier. According to the multi-barrier, the organic barrier is formed around the foreign particle, and an uneven surface (that is, a difference in level) around the foreign particle is decreased by the organic barrier. Therefore, even when the thickness of the second inorganic barrier layer is made small, the second inorganic barrier layer can completely cover the foreign particle. As a result, it is possible to efficiently prevent moisture from infiltrating into the organic layer. The organic barrier is, for example, formed as follows. A solvent including the organic material is made into a sprayed state and then sprayed onto the first inorganic barrier layer. The organic material on the first inorganic barrier layer is moved on the first inorganic barrier layer due to surface tension thereof, thereby forming a liquid droplet. When the foreign particle exists, the organic material coheres around the foreign particle due to the surface tension.

[0007] Incidentally, adhesive properties between the organic material and the inorganic material are not satisfactory, and thus the organic barrier and the inorganic barrier layer are likely to be separated. Since the multi-barrier is formed on the entire surface of the first substrate, the sealing material is bonded to the first substrate via the multi-barrier. When the multi-barrier is formed of the organic barrier and the inorganic barrier layer, the outer periphery of the second substrate is likely to be separated from the first substrate due to low adhesive properties between the organic barrier and the inorganic barrier layer.

[0008] An object of the invention is to provide an organic EL display device which includes a multi-barrier formed of an organic material and an inorganic material so as to prevent two facing substrates from being separated from each other.

[0009] (1) According to an aspect of the invention, there is provided an organic EL display device including: a first substrate; a second substrate facing the first substrate; a sealing material disposed between the first substrate and the second substrate; an adhesion area overlapping a position of the sealing material in planar view of the first substrate and the second substrate; an organic layer formed on the first substrate, and including a light emitting layer; a multi-barrier formed on the first substrate to cover the organic layer, and including a first inorganic barrier layer formed of an inorganic material, an organic barrier formed of an organic material and disposed on an upper side of the first inorganic barrier layer, a second inorganic barrier layer formed of in inorganic material and covering the organic barrier and the first inorganic barrier layer, and a portion formed in the adhesion area; and a projecting portion formed on the first substrate and projected toward the second substrate. At least a portion of the projecting portion is disposed in the adhesion area, and is covered with the multi-barrier. The multi-barrier includes a portion in which the organic barrier is not disposed on the upper side of the at least a portion of the projecting portion.

[0010] According to the organic EL display device, the first inorganic barrier layer and the second inorganic barrier layer directly come in contact with each other in the portion in which the organic barrier is not disposed. As a result, it is possible to prevent the first substrate and the second substrate from being separated from each other because of low adhesive properties between the inorganic barrier layer and the organic barrier.

[0011] (2) In the above described (1), the first substrate may include a pixel electrode which is provided in each of a plurality of pixels, and the projecting portion may be formed in a bank layer including a partition wall disposed between two adjacent pixel electrodes.

[0012] (3) In the above described (1) or (2), a plurality of projecting portions arranged in a direction parallel to the first substrate and the second substrate may be formed as the projecting portion. According to this, it is possible to efficiently prevent the first substrate and the second substrate from being separated from each other.

[0013] (4) In the above described (3), the plurality of projecting portions may include a first projecting portion and a second projecting portion, the organic barrier may include a portion positioned between the first projecting portion and the second projecting portion, and a thickness of the portion of the organic barrier may be smaller than a height of the first projecting portion and the second projecting portion. It is possible to efficiently prevent the organic barrier from being formed on the upper side of the projecting portion.

[0014] (5) In any one of the above described (1) to (4), the projecting portion may surround a display area. According to this, it is possible to efficiently prevent the first substrate and the second substrate from being separated from each other.

[0015] (6) In the above described (5), the projecting portion may be formed into a wall shape which extends along the sealing material.

[0016] (7) In any one of the above described (1) to (6), the first substrate may be provided with a planarization film, the planarization film may include an opening extending along the sealing material in the adhesion area, the projecting portion may be formed on the planarization film, and include a portion which is formed in the opening of the planarization film. According to this, it is possible to prevent the moisture which infiltrates from an edge of the planarization film from infiltrating into the planarization film to the display area.

[0017] (8) In the above described (7), the projecting portion may be formed in the opening of the planarization film. According to this, the projecting portion is not required to avoid the opening of the planarization film, and thus the width of the opening of the planarization film can be made greater.

[0018] (9) In the above described (8), a plurality of projecting portions arranged in a direction parallel to the first substrate and the second substrate are formed as the projecting portion formed in the opening of the planarization film. It is easy to secure an area in which the first inorganic barrier layer and the second inorganic barrier layer directly come in contact to each other.

[0019] (10) In any one of the above described (1) to (9), the first inorganic barrier layer and the second inorganic barrier layer may come in contact with each other in an area overlapping the projecting portion on the multi-barrier.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] FIG. **1** is a plan view of an organic EL display according to the invention.

[0021] FIG. **2** is a sectional view taken along line II-II shown in FIG. **1**.

[0022] FIG. **3** is a sectional view illustrating a function of an organic barrier, and illustrating the organic barrier which is formed around a foreign particle.

[0023] FIGS. **4**A and **4**B are plan views illustrating an example of a projecting portion in a bank layer.

DETAILED DESCRIPTION OF THE INVENTION

[0024] Hereinafter, an embodiment of the invention will be described. FIG. **1** is a plan view of an organic EL display **1** according to the invention. FIG. **2** is a sectional view taken along line II-II shown in FIG. **1**. In the present specification, an "upper direction" indicates a direction toward a second substrate **40** from a first substrate **10**, a "lower direction" indicates a direction toward the first substrate **10** from the second substrate **40**.

[0025] Disclosure of the present specification is merely only an example. Thus, embodiments which maintain the spirit of the invention and are easily modified by those skilled in the art is surely contained in the scope of the invention. In addition, a width, a thickness, and a shape of each portion shown in the drawings may be schematically represented. Therefore, the description of the width, and the thickness of each portion in the drawings is merely an example, and does not limit the interpretation of the invention.

[0026] As illustrated in FIG. **2**, the organic EL display device **1** includes a first substrate **10** and a second substrate **40** facing the first substrate **10**. The substrates **10** and **40** are, for example, transparent substrates formed of glass or a resin. The circuit layer **11** is formed on the first substrate **10**. The circuit layer **11** includes an electronic line such as a scanning line, a data signal line, and a power supply line. In addition, the circuit layer **11** includes a thin film transistor (TFT) for controlling power supply to the organic layer **14**. The circuit layer **11** is covered with a planarization film **12**. A plurality of pixel electrodes **13** are disposed on the upper side of the planarization film **12**. The organic EL display device **1** includes the display area A (refer to FIG. **1**) which is defined by a plurality of pixels Px. The pixel electrode **13** is provided in each of the plurality of pixels Px. The pixel electrode **13** is connected to the TFT of the circuit layer **11** through a contact hole (not shown) formed on the planarization film **12**.

[0027] The bank layer **16** including a partition wall **16***d* is formed on the first substrate **10**. The partition wall **16***d* is disposed on the planarization film **12**, and is positioned between two adjacent pixel electrodes **13**. The partition wall **16***d* may overlap the outer periphery of each of the pixel electrodes **13**. A bank opening C positioned in each of the pixels Px is formed in the bank layer **16** (the bank opening C is an area which is surrounded by the partition wall **16***d*). The pixel electrode **13** is exposed in the bank opening C. The bank layer **16** is formed of, for example, a photosensitive resin material. The bank layer **16** may be formed of the inorganic material such as SiN. In addition to the partition wall **16***d*, the projecting portions **16***a*, **16***b*, **16***f*, and **16***g* are formed on the bank layer **16**. The projecting portions **16***a*, **16***b*, **16***f*, and **16***g* will be described below.

[0028] The organic layer **14** including a light emitting layer is formed on the first substrate **10**. The organic layer **14** is formed on the pixel electrode **13** and the bank layer **16**, and is in contact with the pixel electrode **13** inside the bank opening C. The organic layer **14** may include a charge injection layer, a charge transfer layer, or the like (here, a charge includes both a positive hole and an electron). A common electrode **17** overlapping the plurality of pixels Px is formed on the organic layer **14**. The common electrode **17** is in contact with the organic layer **14**. The partition wall **16***d* of the bank layer **16** prevents a short-circuit from occurring between the outer periphery of the pixel electrode **13** and the common electrode **17**.

[0029] For example, the common organic layer **14** is formed in the entire display area A. In this case, the organic layer **14** includes a plurality of light emitting layers which have different emitting colors from each other (the color filter system) so as to emit white light. In another example, each of the plurality of pixels has the light emitting layer formed therein in response to the pixel color (a separate coloring system). For example, a light emitting layer which emits red light is formed in a red pixel, and a light emitting layer which emits blue light is formed in a blue pixel. In addition, the organic layer **14** includes a light emitting layer which emits a specific color such as the blue light, and the organic layer **14** may be formed in the entire display area (a color conversion system). As an example, a color filter organic EL display device **1** is illustrated in FIG. **2**.

[0030] A multi-barrier **15** covering the organic layer **14** and the common electrode **17** is formed on the first substrate **10**. The multi-barrier **15** is formed on the upper side of the organic layer **14** and the common electrode **17**, and includes a portion which is formed on the outside further than the outer periphery of the organic layer **14** and the common electrode **17**. In the example of FIG. **2**, the common electrode **17** spreads toward the outside further than the outer periphery of the organic layer **14**. The multi-barrier **15** spreads toward the outside further than the outer periphery of the common electrode **17**. For example, the multi-barrier **15** is formed on the entire first substrate **10**.

[0031] The multi-barrier **15** includes a first inorganic barrier layer **15**A, an organic barrier **15**B disposed on the first inorganic barrier layer **15**A, and a second inorganic barrier layer **15**C covering the first inorganic barrier layer **15**A and the organic barrier **15**B. The first inorganic barrier layer **15**A and the second inorganic barrier layer **15**C are formed of inorganic materials. A material of the inorganic barrier layers **15**A and **15**C is an inorganic material capable of preventing the moisture from infiltrating into the organic layer **14**. The inorganic material is, for example, SiN, but is not limited to thereto. Each of the first inorganic barrier layer **15**A and the second inorganic barrier layer **15**C may be formed of not only one layer but also formed of a plurality of layers. For example, the first inorganic barrier layer **15**A may include an SiN layer and an SiO layer. The organic barrier **15**B is formed of the organic material. Examples of materials of the organic barrier **15**B include an acrylic resin, a polyimide resin, epoxy resin, and the like.

[0032] The organic layer **14**, the common electrode **17**, and the first inorganic barrier layer **15**A are formed on the upper side of the bank layer **16**, and have undulations in response to the convexo-concave of the bank layer **16**. The organic barrier **15**B is dispersedly disposed on the first inorganic barrier layer **15**A. Specifically, the organic barrier **15**B is stored in a corner in the bank opening C or a portion between two adjacent projecting portions **16***a*, **16***b*, **16***f*, and **16***g*. The organic barrier **15**B is not formed on the upper side of the partition wall **16***d* of the bank layer **16**, or on the upper side of the projecting portions **16***a*, **16***b*, **16***f*, and **16***g*. In addition, in a case where the foreign particle exists below the multi-barrier **15**, the organic barrier **15**B is formed so as to surround the foreign particle.

[0033] The organic barrier **15**B is, for example, formed as follows. The first inorganic barrier layer **15**A is formed on the common electrode **17** by using, for example, a CVD method. Thereafter, a solvent which is obtained by mixing the organic material and a polymerization initiator is made into a spray state and then sprayed onto the first inorganic barrier layer **15**A in a vacuum state. In that process, the supplying conditions of the solvent (a supplying time, the temperature of a substrate, the atmosphere for forming a film, or the like) are adjusted so that the organic material does not form a film on the first inorganic barrier layer **15**A. The organic materials attached on the first inorganic barrier layer **15**A exhibit behavior as a liquid. For this reason, the organic material is stored in the recessed portion which is made in the bank layer **16** and the first inorganic barrier layer **15**A or the corner thereof. The organic material stored in the recessed portion or the corner thereof becomes the organic barrier **15**B. Thus, the organic barrier **15**B is formed in the recessed portion at the corner on the inner side of the bank opening C and between two adjacent projecting portions **16***a*, **16***b*, **16***f*, and **16***g*. In a case where the foreign particle exists, the organic material coheres around the foreign particle due to the surface tension. Accordingly, the organic barrier **15**B is formed around the foreign particle. The second inorganic barrier layer **15**C is formed on the upper side of the organic barrier **15**B.

[0034] FIG. **3** is a sectional view illustrating a function of the organic barrier **15**B, and illustrates the organic barrier **15**B formed around a foreign particle E. As illustrated in FIG. **3**, the foreign particle E is greater than the thickness of the first inorganic barrier layer **15**A, and thus the foreign particle E may not be covered with the first inorganic barrier layer **15**C in some cases. In this case, in the process of forming the organic barrier **15**B, the liquid organic material coheres around the foreign particle E due to the surface tension. As a result, a gentle slope is formed around the foreign particle E by the organic barrier **15**B. The slope in which the organic barrier **15**B is formed prevents the second inorganic barrier layer **15**C from being disconnected around the foreign particle E. As a result, it is possible to prevent the pin hole which is caused by the foreign particle E from being formed in the multi-barrier **15**.

[0035] As illustrated in FIG. **2**, a sealing material **21** is disposed between the first substrate **10** and the second substrate **40**. The first substrate **10** and the second substrate **40** are bonded to each other by the sealing material **21**. The sealing material **21** is formed so as to surround the entire periphery of the display area A. The sealing material **21** is disposed along the outer periphery of the second substrate **40**, the outer periphery of the second substrate **40** is attached to the first substrate **10**. The sealing material **21** may be disposed inwardly from the outer periphery of the second substrate **40**. In addition, the sealing material **21** may be disposed inwardly from the outer periphery of the first substrate **10**. The organic EL display device **1** includes the adhesion area R overlapping the sealing material **21** in planar view of the first substrate **10** and the second substrate **40**. The adhesion area R is defined as an area positioned below the sealing material **21** and including the width corresponding to the sealing material **21**. The multi-barrier **15** and the bank layer **16** include portions formed in the adhesion area R, and the sealing material **21** is bonded to the first substrate **10** through the portion of the multi-barrier **15** and the bank layer **16**. In the example illustrated in FIG. **2**, the sealing material **21** directly comes in contact with the multi-barrier **15**. However, the sealing material **21** may not directly come in contact with the multi-barrier **15**. A filler **22** is filled between the first substrate **10** and the second substrate **40** and inside the sealing material **21**.

[0036] The second substrate **40** in the example illustrated in FIG. **2** includes a color filter **41** in each of the pixels Px. In a case where the organic EL display device **1** employs the above described separate coloring system, the color filter **41** may not be provided on the second substrate **40**. A black matrix **42** is formed on the second substrate **40** so as to partition off the adjacent pixels Px.

[0037] As illustrated in FIG. **2**, the bank layer **16** includes the projecting portions **16***a* and **16***b* which are swollen toward the second substrate **40** in the adhesion area R. The multi-barrier **15** covers the projecting portions **16***a* and **16***b*. The multi-barrier **15** includes, on the upper side and the side surface of the projecting portions **16***a* and **16***b*, a portion in which the organic barrier **15**B is not disposed. In the portion in which the organic barrier **15**B is not disposed, the first inorganic barrier layer **15**A and the second inorganic barrier layer **15**C directly is in contact with each other. As a result, it is possible to prevent the first substrate **10** and the second substrate **40** from being separated from each other because of low adhesive properties between the inorganic barrier layers **15**A and **15**C, and the organic barrier **15**B. As described above, the material of the organic barrier **15**B represents the behavior as the liquid in the process of forming the organic barrier **15**B. Therefore, in the process of forming the organic barrier **15**B, the material of the organic barrier **15**B is moved an area around the projecting portions **16***a* and **16***b* (an area between the two adjacent projecting portions) from the upper side of the projecting portions **16***a* and **16***b*. Due to this movement, a portion in which the organic barrier **15**B does not exist is formed on the upper side of the projecting portions **16***a* and **16***b*.

[0038] The thickness of the first inorganic barrier layer **15**A is set such that the first inorganic barrier layer **15**A has the undulation caused by the projecting portions **16***a* and **16***b* in the bank layer **16**. Due to this undulation, the material of the organic barrier **15**B is moved to an area around the projecting portions **16***a* and **16***b* from the upper side of the projecting portions **16***a* and **16***b* in the process of forming the organic barrier **15**B. For example, the thickness of the second inorganic barrier layer **15**C is also set such that the material of the second inorganic barrier layer **15**C has an undulation in response to the projecting portions **16***a* and **16***b* in the bank layer **16**. In the example illustrated in FIG. **2**, all of the multi-barriers **15** include the undulation in response to the projecting portions **16***a* and **16***b* in the bank layer **16**. For example, the thickness of the multi-barrier **15** (a distance between the lower surface of the first inorganic barrier layer **15**A and the upper surface of the second inorganic barrier layer **15**C) is smaller than the height of the projecting portions **16***a* and **16***b*.

[0039] The bank layer **16** may include, as illustrated in FIG. **2**, a plurality of the projecting portions **16***a* and **16***b* which are arranged in the direction (the horizontal direction) parallel to the first substrate **10** and the second substrate **40**, in the adhesion area R. With such a configuration, the width of one projecting portion becomes smaller, and thus it is possible to reduce an area in which the material of the organic barrier **15**B is stored from being made on the upper side of the projecting portion. As a result, it is possible to efficiently prevent the substrates **10** and **40** from being separated from each other. In the example illustrated in FIG. **2**, the bank layer **16** includes two first projecting portions **16***a* and two second projecting portions **16***b* which are arranged in the horizontal direction. The plurality of projecting portions **16***a* and **16***b* are separately disposed from each other. That is, the bank layer **16** is disconnected between two adjacent projecting portions **16***a* and **16***b*. Due to this, the recessed portion between the two adjacent projecting portions becomes deeper, and thus the organic barrier **15**B is likely to be stored in the recessed portion. The number of the projecting portion which is formed in the adhesion area R is not limited to that of the above projecting portions **16***a* and **16***b*. Alternatively, when viewing a cut section (for example, a cut section in FIG. **2**) which is perpendicular to the extending direction of the sealing material **21**, the bank layer **16** may include only one projecting portion in the adhesion area R.

[0040] As illustrated in FIG. **2**, a portion of the organic barrier **15**B is stored between two adjacent projecting portions **16***a* and **16***b*. The thickness of this portion in the organic barrier **15**B is smaller than the height of the projecting portions **16***a* and **16***b*. In the example, the height of the second projecting portion **16***b* is higher than that of the first projecting portion **16***a*. The thickness of the organic barrier **15**B between two adjacent projecting portions **16***a* and **16***b* is smaller than the height of the first projecting portion **16***a* which is lower than that of the second projecting portion **16***b*. It is possible to efficiently prevent the organic barrier **15**B from being formed on the upper side of the projecting portions **16***a* and **16***b* by setting the thickness of the organic barrier **15**B as described above.

[0041] The projecting portions **16***a* and **16***b* are formed along the sealing material **21**. The projecting portions **16***a* and **16***b* are preferably formed so as to surround the entire periphery of the display area A. That is, the projecting portions **16***a* and **16***b* are preferably formed along four edges (a right edge, a left edge, a leading edge, and a trailing edge) in the display area A. The positions for the projecting portions **16***a* and **16***b* are not limited thereto. For example, the projecting portions **16***a* and **16***b* may be provided along two edges (for example, the right edge and the left edge in the display area A) which are positioned on the side opposite to each other. In addition, the projecting portions **16***a* and **16***b* may be provided at only one edge in the display area A.

[0042] FIGS. **4**A and **4**B are plan views illustrating an example of the projecting portions **16***a* and **16***b*. As illustrated in FIG. **4**A, the projecting portions **16***a* and **16***b* are formed into a wall shape which extends to, for example, the sealing material **21**. The projecting portions **16***a* and **16***b* in FIG. **4**A are continuously provided on the entire periphery thereof. In a case where the projecting portions **16***a* and **16***b* surround the entire periphery of the display area A, the projecting portions **16***a* and **16***b* are continuously provided on the entire periphery thereof, for example. As another example, as illustrated in FIG. **4**B, the plurality of projecting portions **16***a* and **16***b* extending along the sealing material **21** may be arranged at certain intervals. In a case where the projecting portions **16***a* and **16***b* surround the entire periphery of the display area A, the plurality portions **16***a* and **16***b* extending along the sealing material **21** may be arranged at certain intervals, and surround the display area A as a whole. Further, as another example, the projecting portions **16***a* and **16***b* may be formed into a column shape projecting toward to the second substrate **40**. In this case, the plurality of portions **16***a* and **16***b* are arranged along the sealing material **21**.

[0043] As described above, the planarization film **12** is formed on the first substrate **10**. As illustrated in FIG. **2**, the opening **12***a* may be formed on the planarization film **12**. The opening **12***a* is formed in the adhesion area R, and extends along the sealing material **21**. The bank layer **16** includes a portion which is formed in the opening **12***a*. With such a structure, it is possible to prevent the moisture which infiltrates from the edge of the planarization film **12** from infiltrating into the planarization film **12** to the display area A. That is, the moisture infiltration path is shielded by the opening **12***a*. The sealing material **21** is disposed along the outer periphery edge of the second substrate **40**. The opening **12***a* in the adhesion area R shields the moisture at the position spaced from the display area A.

[0044] As illustrated in FIG. **2**, the second projecting portion **16***b* of the bank layer **16** may be formed in the opening **12***a*. In this way, the second projecting portion **16***b* is not required to avoid the opening **12***a*, and thus the width of the opening **12***a* of the planarization film **12** can be made greater. As a result, it is possible to efficiently shield moisture infiltration through the planarization film **12**. For example, a plurality of the second projecting portions (two projecting portions **16** in the example in FIG. **2**) **16***b* arranged in the horizontal direction may be formed in the opening **12***a*. A structure of the bank layer **16** is not limited as above. For example, when viewing the cut section (for example, the cut section in FIG. **2**) perpendicular to the extending direction of the sealing material **21**, only one second projecting portion **16***b* may be provided in the opening **12***a*. In addition, more than two second projecting portions **16***b* arranged in the horizontal direction are formed in the opening **12***a*.

[0045] It is preferable that the opening **12***a* passes through the planarization film **12** in the thickness direction thereof. With this, it is possible to efficiently suppress the moisture infiltration. In addition, it is preferable that the opening **12***a* surrounds the entire periphery of display area A. Thus, it is possible to more efficiently suppress the moisture infiltration. In this case, similar to the opening **12***a*, the second projecting portion **16***b* may surround the entire periphery of the display area A. Alternatively, a plurality of second projecting portions **16***b* maybe intermittently disposed along the sealing material **21**, and formed in the opening **12***a*.

[0046] The bank layer **16** includes the first projecting portion **16***a*. The first projecting portion **16***a* is formed on the planarization film **12** unlike the second projecting portion **16***b*. In the example illustrated in FIG. **2**, the first projecting portion **16***a* is disposed inwardly from the second projecting portion **16***b* (on the display area A side). In addition, the first projecting portion **16***a* is also disposed outwardly from the second projecting portion **16***b* (located toward the outside of the outer periphery side of the organic EL display device **1**). The projecting portion formed on the bank layer **16** is not limited to the above description. For example, the first projecting portion **16***a* may not be necessarily formed. Alternatively, the first projecting portion **16***a* may be disposed inwardly or outwardly from the second projecting portion **16***b*.

[0047] As illustrated in FIG. **2**, the planarization film **12** may include an opening **12***b* formed on the inner side of the opening **12***a* (the display area A side of the opening **12***a*). The opening **12***b* is positioned on the outer side of the display area A. The opening **12***b* extends along the outer edge of the display area A. The bank layer **16** includes a portion which is formed in the opening **12***b*. With such a structure, it is possible to further efficiently prevent the moisture which infiltrates from the edge of the planarization film **12** from infiltrating into the planarization film **12** to the display area A. It is preferable that the opening **12***b* passes through the planarization film **12** in the thickness direction thereof. With this, it is possible to efficiently suppress the moisture infiltration. In addition, it is preferable that the opening **12***b* surrounds the entire periphery of display area A. Thus, it is possible to more efficiently suppress the moisture infiltration.

[0048] As illustrated in FIG. **2**, a third projecting portion **16***f* may be formed in the opening **12***b*. According to this structure, the multi-barrier **15** includes a portion in which the organic barrier **15**B is not formed on the upper side of the third projecting portion **16***f*. In this portion, the first inorganic barrier layer **15**A and the second inorganic barrier layer **15**C directly come in contact with each other, and thus it is possible to prevent the first inorganic barrier layer **15**A and the second inorganic barrier layer **15**C from being separated from each other. A plurality of third projecting portions **16***f* (two projecting portions **16***f* in FIG. **2**) arranged in the horizontal direction are formed in the opening **12***b*. The third projecting portion **16***f* may surround the entire periphery of the display area A similar to the opening **12***b*. The plurality of third projecting portions **16***f* may be intermittently formed along the edge of the display area A.

[0049] As illustrated in FIG. **2**, the bank layer **16** may include a fourth projecting portion **16***g* in an area which is located outside the display area A and is located inside the sealing material **21**. The fourth projecting portion **16***g* is formed on the planarization film **12** unlike the third projecting portion **16***f*. According to this structure, the multi-barrier **15** includes a portion in which the organic barrier **15**B is not formed on the upper side of the fourth projecting portion **16***g*. In this portion, the first inorganic barrier layer **15**A and the second inorganic barrier layer **15**C directly come in contact with each other, and thus it is possible to prevent the first inorganic barrier layer **15**A and the second inorganic barrier layer **15**C from being separated from each other. The fourth projecting portion **16***g* may surround the entire periphery of display area A, and a plurality of fourth projecting portions **16***g* may be intermittently formed along the edge of the display area A.

[0050] As described above, the bank layer **16** includes the projecting portions **16***a* and **16***b* which are swollen in the thickness direction of the first substrate **10** in the adhesion area R. The multi-barrier **15** includes a portion in which the organic barrier **15**B is not disposed on the upper side of the projecting portions **16***a* and **16***b*. Therefore, it is possible to obtain, in the adhesion area R, a portion in which the first inorganic barrier layer **15**A and the second inorganic barrier layer **15**C directly come in contact with each other. As a result, it is possible to prevent the first substrate **10** and the second substrate **40** from being separated from each other because of low adhesive properties between the inorganic barrier layers **15**A and **15**C, and the organic barrier **15**B.

[0051] The invention is not limited to the above-described organic EL display device **1**, but may be variously modified.

[0052] For example, as described above, when viewing a cut section (for example, a cut section in FIG. **2**) which is perpendicular to the extending direction of the sealing material **21**, the bank layer **16** may include only one projecting portion in the adhesion area R. In this case, a portion of the projecting portion may not exist in the adhesion area R. For example, a portion of the projecting portion toward the display area A may be located out of the adhesion area R toward the display area A.

[0053] In addition, the bank layer **16** may include the recessed portion having the width smaller than the adhesion area R in the adhesion area R. In this case, a swollen portion which is adjacent to the recessed portion functions as the projecting portion in claims.

[0054] In addition, the layer on which the projecting portions **16***a* and **16***b* are formed is not necessarily to be the bank layer **16**. For example, a layer different from the bank layer **16** may be newly provided with the projecting portions **16***a* and **16***b* which are positioned below the sealing material **21**.

What is claimed is:

1. An organic EL display device comprising:

a first substrate;

a second substrate facing the first substrate;

a sealing material disposed between the first substrate and the second substrate;

an adhesion area overlapping a position of the sealing material in planar view of the first substrate and the second substrate;

an organic layer formed on the first substrate, and including a light emitting layer;

a multi-barrier formed on the first substrate to cover the organic layer, and includes

a first inorganic barrier layer formed of an inorganic material, an organic barrier formed of an organic material and disposed on an upper side of the first inorganic barrier layer,

a second inorganic barrier layer formed of an inorganic material and covering the organic barrier and the first inorganic barrier layer, and

a portion formed in the adhesion area; and

a projecting portion formed on the first substrate, and projected toward the second substrate,

wherein at least a portion of the projecting portion is located in the adhesion area, and is covered with the multi-barrier, and

wherein the multi-barrier includes a portion in which the organic barrier is not disposed on the upper side of the at least a portion of the projecting portion.

2. The organic EL display device according to claim **1**,

wherein the first substrate includes a pixel electrode which is provided in each of a plurality of pixels, and

wherein the projecting portion is formed in a bank layer including a partition wall that is disposed between two adjacent pixel electrodes.

3. The organic EL display device according to claim **1**,

wherein a plurality of projecting portions arranged in a direction parallel to the first substrate and the second substrate are formed as the projecting portion.

4. The organic EL display device according to claim **3**,

wherein the plurality of projecting portions includes a first projecting portion and a second projecting portion,

wherein the organic barrier includes a portion positioned between the first projecting portion and the second projecting portion, and

wherein a thickness of the portion of the organic barrier is smaller than a height of the first projecting portion and the second projecting portion.

5. The organic EL display device according to claim **1**,

wherein the projecting portion surrounds a display area.

6. The organic EL display device according to claim **5**,

wherein the projecting portion is formed into a wall shape which extends along the sealing material.

7. The organic EL display device according to claim **1**,

wherein the first substrate is provided with a planarization film,

wherein the planarization film includes an opening extending along the sealing material in the adhesion area, and

wherein the projecting portion is formed on the planarization film, and includes a portion which is formed in the opening of the planarization film.

8. The organic EL display device according to claim **7**,

wherein the projecting portion is formed in the opening of the planarization film.

9. The organic EL display device according to claim **8**,

wherein a plurality of projecting portions arranged in a direction parallel to the first substrate and the second substrate are formed as the projecting portion formed in the opening of the planarization film.

10. The organic EL display device according to claim **1**,

wherein the first inorganic barrier layer and the second inorganic barrier layer come in contact with each other in an area overlapping the projecting portion on the multi-barrier.

* * * * *

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申请(专利权)人(译)	日本展示INC.		
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摘要(译)

堤层包括在粘合区域中朝向第一基板的厚度方向膨胀的突出部分。多屏障包括在突出部分的上侧上没有设置有机屏障的部分。因此，可以在粘合区域中获得第一无机阻挡层和第二无机阻挡层直接接触彼此接触的部分。在包括由有机材料和无机材料形成的多屏障的有机EL显示装置中，可以防止两个面对的基板彼此分离。