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(54) **METHOD FOR MANUFACTURING ORGANIC ELECTROLUMINESCENT DISPLAY DEVICE**

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(57) **ABSTRACT**

A circuit substrate is prepared. The circuit substrate has an anode, a cathode, an organic electroluminescent film sandwiched between the anode and the cathode, and a sealing film sealing the organic electroluminescent film. A color filter substrate is prepared. The circuit substrate and the color filter substrate are bonded together with an adhesive layer. In the step of preparing the color filter substrate, a plurality of color layers, each colored one of a plurality of colors, are disposed on a substrate, and an adhesive is then printed on the substrate so that the adhesive layer covering the plurality of color layers is formed.

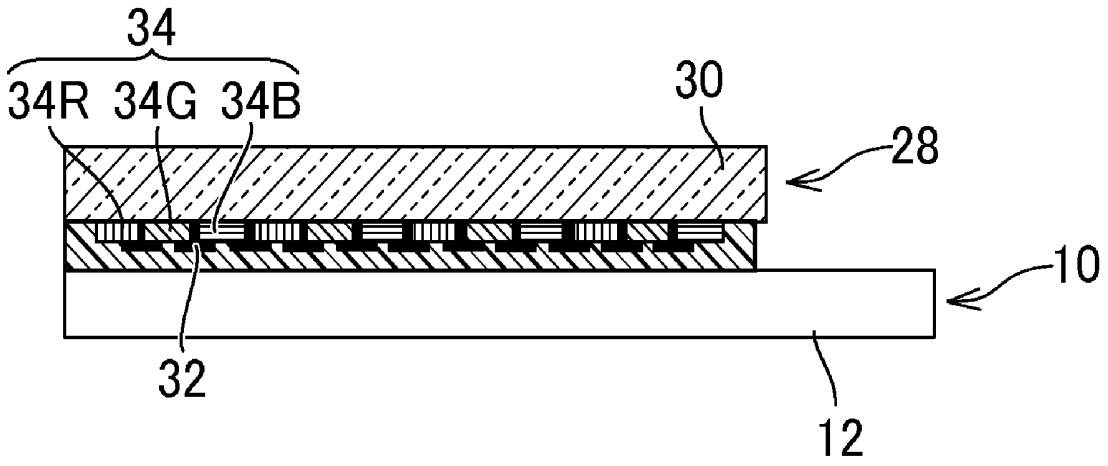


FIG.1

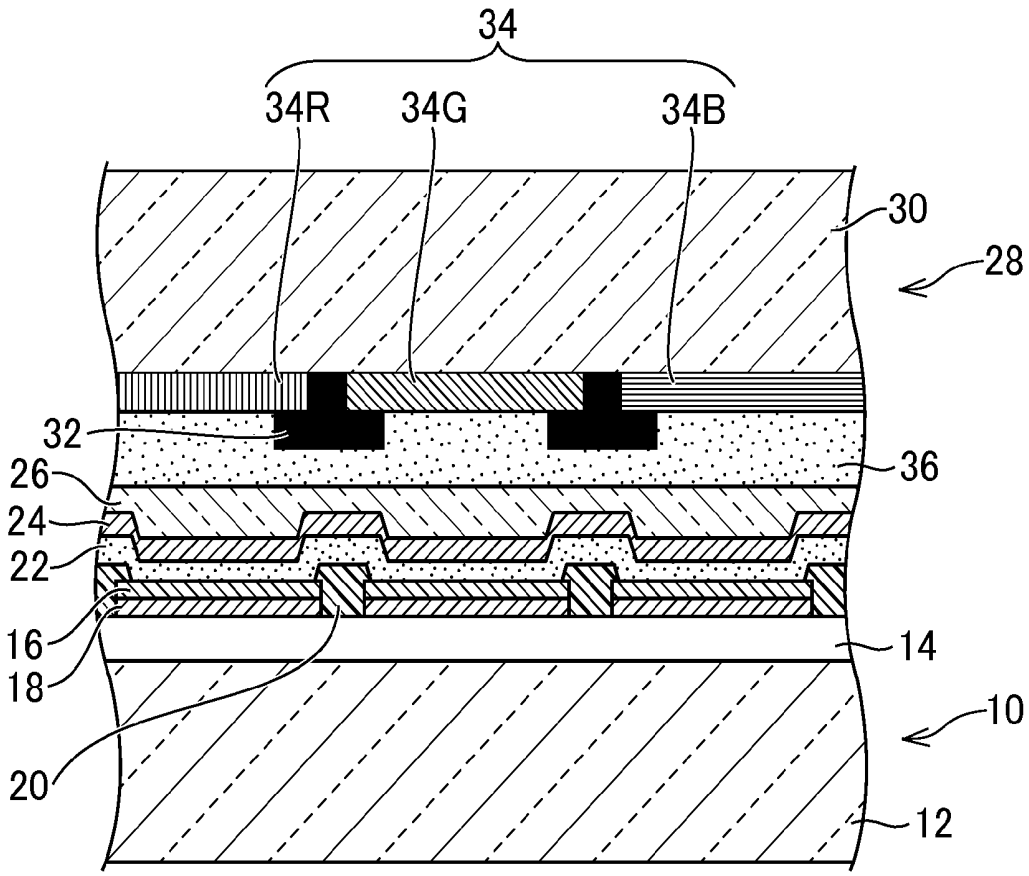


FIG.2

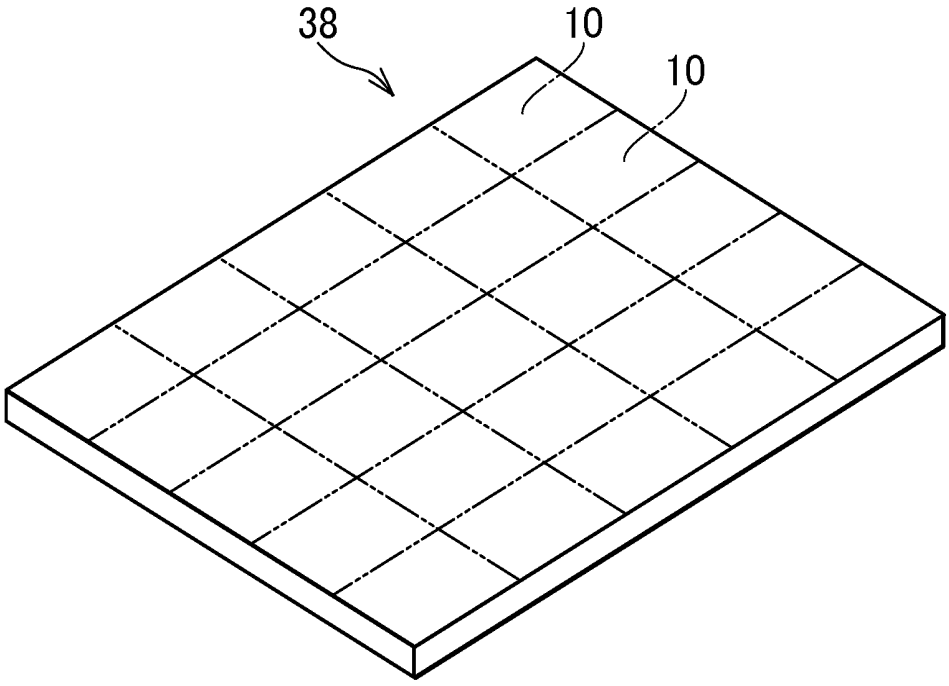


FIG.3

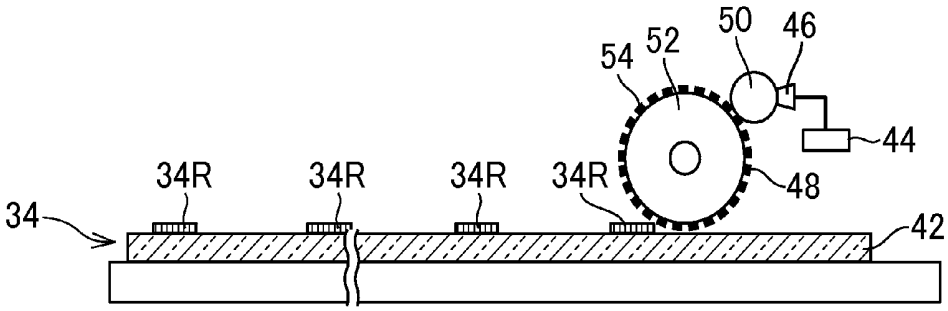


FIG.4

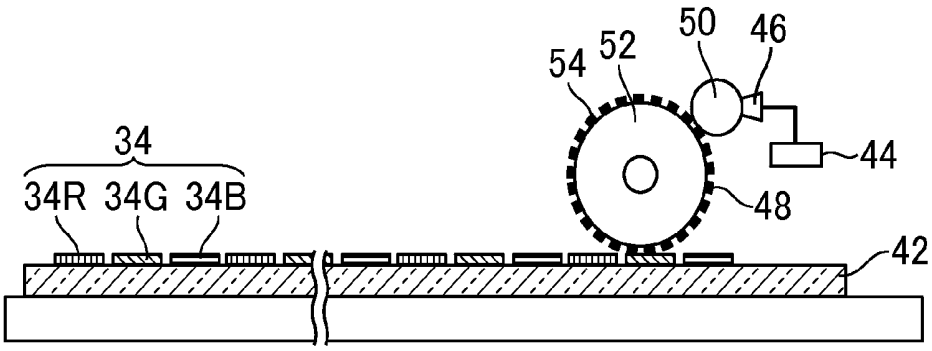


FIG.5

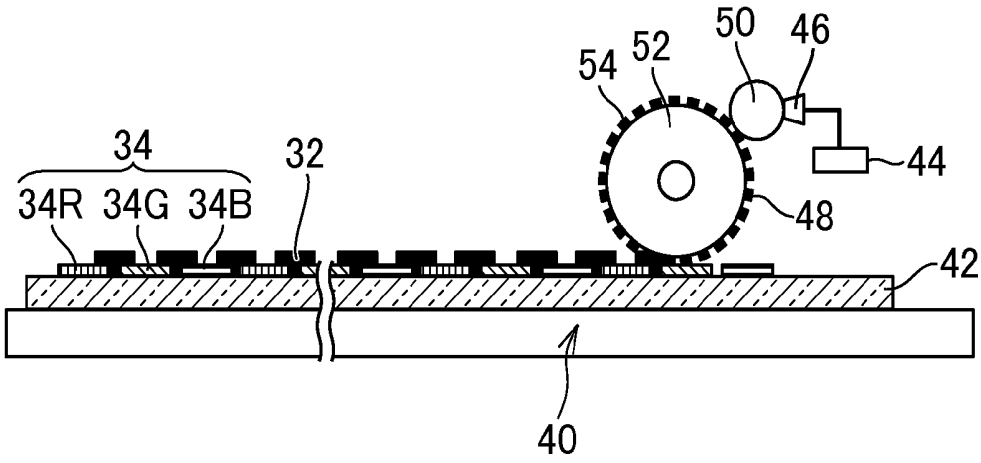


FIG.6

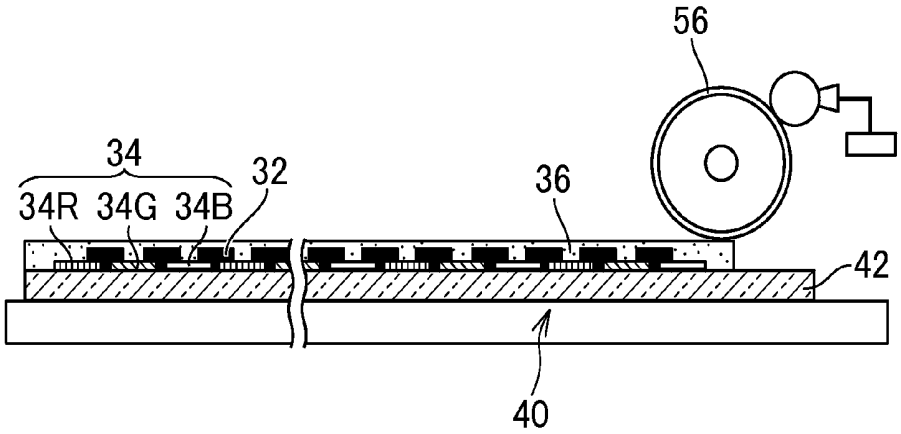


FIG.7

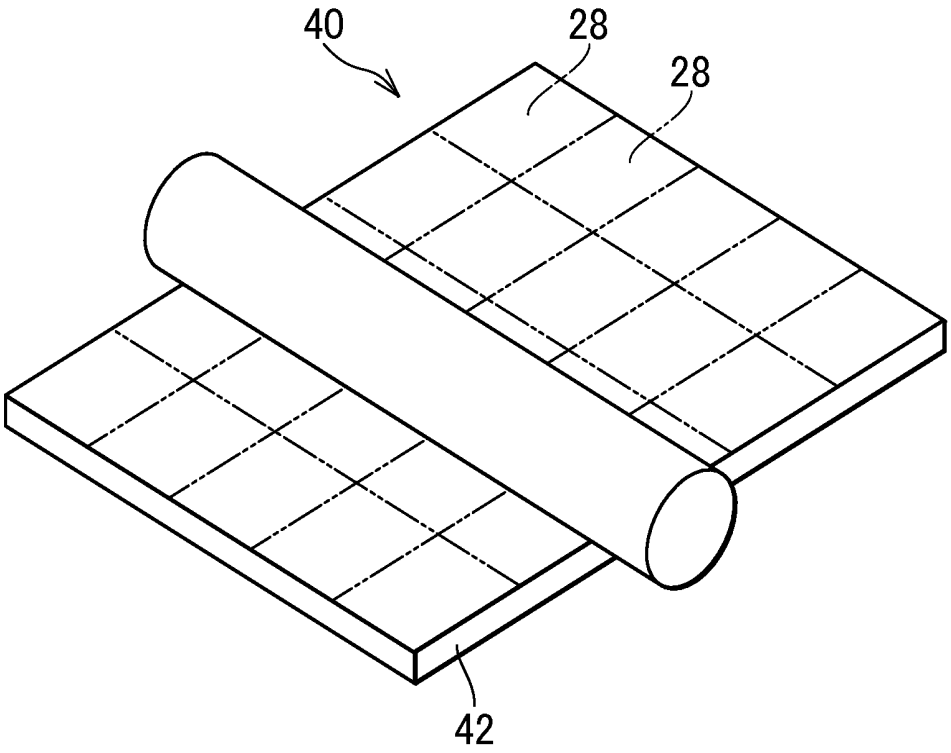


FIG.8

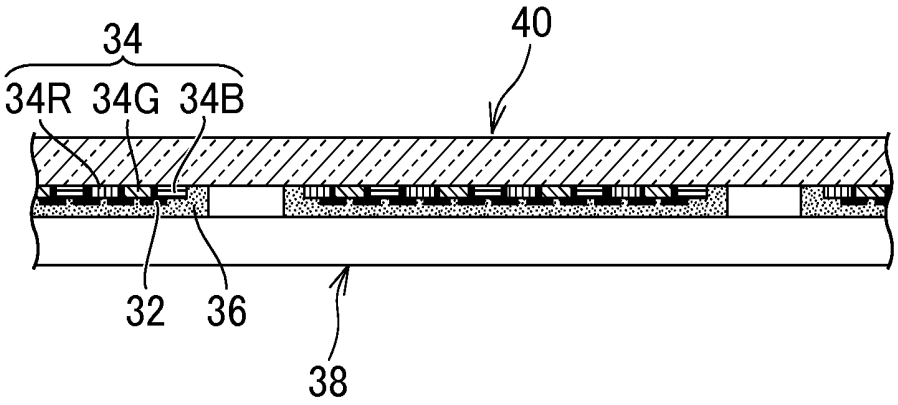
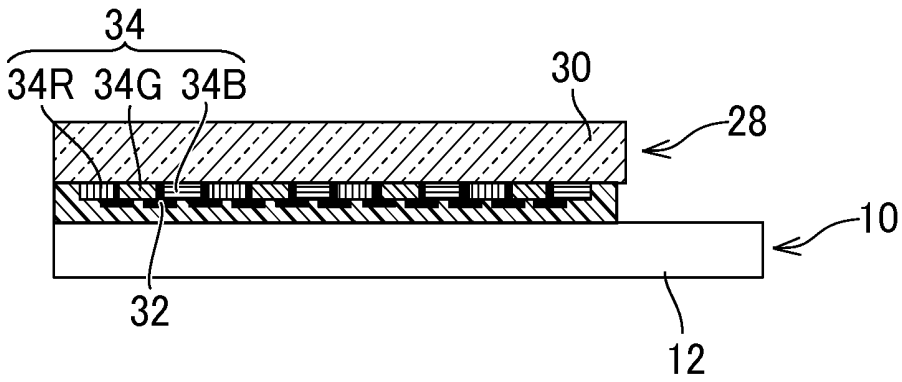


FIG.9



METHOD FOR MANUFACTURING ORGANIC ELECTROLUMINESCENT DISPLAY DEVICE

CROSS-REFERENCE TO RELATED APPLICATION

[0001] The present application claims priority from Japanese application JP2014-030690 filed on Feb. 20, 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 a method for manufacturing an organic electroluminescent display device.

[0004] 2. Description of the Related Art

[0005] Organic electroluminescent display devices have an organic film sandwiched between an anode and a cathode. Most of the organic electroluminescent display devices have a stack of organic films, one of which is a light-emitting layer. Such an organic film, acting as a light-emitting layer, is formed uniformly across a plurality of pixels if the emission of light of a single color, such as white light, is needed.

[0006] JP 2006-32010 A discloses an organic electroluminescent display device that produces a multicolor display by a combination of white light-emitting organic electroluminescent elements and color filters.

[0007] In high-definition display devices, adjacent pixels get closer to each other as the pixels become finer. Thus, light generated in any pixel may undesirably enter the adjacent pixel. This may cause color crosstalk when the colors of adjacent pixels are different.

SUMMARY OF THE INVENTION

[0008] It is an object of the present invention to prevent color crosstalk between adjacent pixels.

[0009] (1) A method for manufacturing an organic electroluminescent display device according to an aspect of the present invention includes the following steps. A circuit substrate is prepared. The circuit substrate has an anode, a cathode, an organic electroluminescent film sandwiched between the anode and the cathode, and a sealing film sealing the organic electroluminescent film. A color filter substrate is prepared. The circuit substrate and the color filter substrate are bonded together with an adhesive layer. In the step of preparing the color filter substrate, a plurality of color layers, each colored one of a plurality of colors, are disposed on a substrate, and an adhesive is then printed on the substrate so that the adhesive layer covering the plurality of color layers is formed. According to the present invention, the adhesive layer, which is formed by printing the adhesive, can be thinner. Such a thin adhesive layer places the circuit substrate and the color filter substrate closer to each other, thus making it harder for light generated in any pixel to enter the adjacent pixel. This can prevent color crosstalk between adjacent pixels.

[0010] (2) In the method according to the item (1), the adhesive may be slow curing, and the adhesive layer maybe cured after the circuit substrate and the color filter substrate are bonded together.

[0011] (3) In the method according to the item (1), the plurality of color layers may be formed by printing.

[0012] (4) In the method according to the item (1), the step of preparing the color filter substrate may further include forming a black matrix by printing.

[0013] (5) The method according to any one of the items (1) to (4) may further include the following steps. A multiple circuit substrate, which is yet to be cut into a plurality of circuit substrates, is prepared. A multiple color filter substrate, which is yet to be cut into a plurality of color filter substrates, is prepared. The multiple circuit substrate and the multiple color filter substrate are bonded together with the adhesive layer. The multiple circuit substrate and the multiple color filter substrate are then cut into a plurality of bonded pairs of the circuit substrate and the color filter substrate.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] FIG. **1** is a cross-sectional view of an organic luminescent display device manufactured by a method according to an embodiment of the present invention;

[0015] FIG. **2** is a perspective view showing a multiple circuit substrate used in the present embodiment;

[0016] FIG. **3** is a diagram for explaining a process for manufacturing a multiple color filter substrate used in the present embodiment;

[0017] FIG. **4** is a diagram showing a large substrate, on which a plurality of color layers, each colored one of a plurality of colors, are disposed;

[0018] FIG. **5** is a diagram for explaining a process for forming a black matrix;

[0019] FIG. **6** is a cross-sectional view for explaining a process for forming an adhesive layer;

[0020] FIG. **7** is a perspective view for explaining the process for forming the adhesive layer;

[0021] FIG. **8** is a diagram for explaining a process for boding the multiple circuit substrate and the multiple color filter substrate with the adhesive layer; and

[0022] FIG. **9** is a diagram for explaining a process for cutting the multiple circuit substrate and the multiple color filter substrate.

DETAILED DESCRIPTION OF THE INVENTION

[0023] An embodiment of the present invention will now be described with reference to the accompanying drawings.

[0024] FIG. **1** is a cross-sectional view of an organic luminescent display device manufactured by a method according to the embodiment of the present invention.

[0025] The organic electroluminescent display device can be used in, for example, televisions, monitors for personal computers, laptop personal computers, personal digital assistants (PDAs), mobile phones, digital still cameras, digital video cameras, or monitors for car navigation systems.

[0026] The organic electroluminescent display device has a circuit substrate **10**. The circuit substrate **10** includes a plurality of layers. One of the layers is a first substrate **12** made of, for example, glass. A circuit layer **14**, including thin film transistors (not shown), is formed on the first substrate **12**.

[0027] A plurality of anodes **16** are formed to couple to the source electrode or the drain electrode of the thin film transistors (not shown). Reflective layers **18**, which reflect light, are located under the anodes **16**. A bank layer **20** made of an insulator is formed so as to leave part of each anode **16** uncovered.

[0028] An organic electroluminescent film **22** is formed in contact with the anodes **16** through openings in the bank layer

20. The organic electroluminescent film **22** includes at least a light-emitting layer. What is known as such a structure is, for example, a laminate of a hole-injecting layer, a hole-transport layer, the light-emitting layer, an electron-transport layer, and an electron-injecting layer, in this order from the anodes **16**. The organic electroluminescent film **22** is formed to continuously cover the anodes **16** and configured to emit white light.

[0029] A cathode **24** is formed on the organic electroluminescent film **22**. The organic electroluminescent film **22** is covered with a sealing film **26** made of, for example, an inorganic material, such as SiN, SiO, or SiON.

[0030] The organic electroluminescent display device has a color filter substrate **28**. The color filter substrate **28** is separated from the circuit substrate **10** to face the side of the circuit substrate **10** near the organic electroluminescent film **22**. The color filter substrate **28** includes a plurality of layers. One of the layers is a second substrate **30** made of, for example, glass.

[0031] A black matrix **32** and a plurality of color layers **34** are formed in a portion of the color filter substrate **28** near the circuit substrate **10**. The color layers **34** include color layers **34**R, **34**G, and **34**B each colored one of a plurality of colors, such as red, green, and blue. The black matrix overlaps with edges of the color layers **34**. The color layers **34** enables the organic electroluminescent display device to display images in full color, although the light generated in the organic electroluminescent film **22** is white.

[0032] The circuit substrate **10** and the color filter substrate **28** are bonded together with an adhesive layer **36**. Specifically, the adhesive layer **36** interposes between the sealing film **26** of the circuit substrate **10**, and the black matrix **32** and the color layers **34** of the color filter substrate **28**. The adhesive layer **36** with a large thickness may cause light generated in any pixel to undesirably enter the adjacent pixel. To solve this problem, the adhesive layer **36** is formed thinner in this embodiment.

[0033] The following describes a method for manufacturing the organic electroluminescent display device according to the embodiment of the present invention.

[0034] FIG. **2** is a perspective view showing a multiple circuit substrate used in the present embodiment. A multiple circuit substrate **38** is yet to be cut into a plurality of circuit substrates **10** (see FIG. **1**). The multiple circuit substrate **38** has the organic electroluminescent film **22** shown in FIG. **1**, and the anodes **16** and the cathode **24**, between which the organic electroluminescent film **22** is sandwiched, in each area to be the circuit substrate **10**. The multiple circuit substrate **38** has the sealing film **26** (see FIG. **1**) spreading over the entire area to be the plurality of circuit substrates **10**. The sealing film **26** seals the organic electroluminescent film **22**. The process for manufacturing the multiple circuit substrate **38** is so well known that no further description of it is provided herein.

[0035] FIGS. **3** to **5** are diagrams for explaining a process for manufacturing a multiple color filter substrate used in the present embodiment. A multiple color filter substrate **40** (see FIG. **7**) is yet to be cut into a plurality of color filter substrates **28**. As shown in FIG. **3**, a large substrate **42** is prepared for manufacture of the multiple color filter substrate **40**. The large substrate **42** is yet to be cut into a plurality of second substrates **30** (see FIG.

[0036] **1**). The plurality of color layers **34**, each colored one of the plurality of colors, are disposed on the large substrate **42** by printing. When flexographic printing is used in the process, an ink **48**, supplied from an ink tank **44** to an ink chamber **46**, is applied to a flexographic printing plate **54** on a printing cylinder **52** via an anilox roll **50** for adjusting the amount of ink, and then transferred to the large substrate **42**. The color layers **34**R of a first color are thus formed. As shown in FIG. **4**, the color layers **34**G of a second color and the color layers **34**B of a third color are similarly formed.

[0037] FIG. **4** is a diagram showing the large substrate **42**, on which the plurality of color layers **34**, each colored one of the plurality of colors, are disposed. The color layers **34** of each color are formed in turn in this embodiment, whereas the color layers **34** of each color may be formed all together.

[0038] FIG. **5** is a diagram for explaining a process for forming the black matrix **32**. In this embodiment, the black matrix **32** is also formed by printing. A printing process similar to that for forming the color layers **34**, described above, can be applied to the black matrix **32**. The multiple color filter substrate **40**, which is yet to be cut into the plurality of color filter substrates **28**, is prepared by such a process.

[0039] FIG. **6** is a cross-sectional view for explaining a process for forming the adhesive layer **36**. FIG. **7** is a perspective view for explaining the process for forming the adhesive layer **36**.

[0040] In this embodiment, an adhesive **56** is printed on the large substrate **42** to cover the plurality of color layers **34**. A printing process similar to that for forming the color layers **34**, described above, can be applied to the adhesive layer **36**. The adhesive layer **36** is thus formed. The adhesive **56** is preferably ultraviolet curable and slow curing. The adhesive **56** of low viscosity enables the adhesive layer **36** to be formed thinner.

[0041] As shown in FIG. **8**, the multiple circuit substrate **38** and the multiple color filter substrate **40** are bonded together with the adhesive layer **36**. The adhesive layer **36** is then cured by ultraviolet irradiation. The outer surface of the multiple circuit substrate **38** and the outer surface of the multiple color filter substrate **40** may be each thinned by grinding.

[0042] After the multiple circuit substrate **38** and the multiple color filter substrate **40** are bonded together, they are cut into a plurality of bonded pairs of the circuit substrate **10** and color filter substrate **28**, as shown in FIG. **9**. According to the present embodiment, the adhesive layer **36**, which is formed by printing the adhesive **56**, can be thinner. Such a thin adhesive layer **36** places the circuit substrate **10** and the color filter substrate **28** closer to each other, thus making it harder for light generated in any pixel to enter the adjacent pixel. This can prevent color crosstalk between adjacent pixels.

[0043] While there have been described what are at present considered to be certain embodiments of the invention, it will be understood that various modifications may be made thereto, and it is intended that the appended claims coverall such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A method for manufacturing an organic electroluminescent display device, comprising:

preparing a circuit substrate having an anode, a cathode, an organic electroluminescent film sandwiched between the anode and the cathode, and a sealing film sealing the organic electroluminescent film;

preparing a color filter substrate; and

bonding the circuit substrate and the color filter substrate with an adhesive layer, wherein

the step of preparing the color filter substrate comprises:

disposing a plurality of color layers, each colored one of a plurality of colors, on a substrate; and

printing an adhesive on the substrate to form the adhesive layer covering the plurality of color layers.

2. The method according to claim **1**, wherein

the adhesive is slow curing, and

the adhesive layer is cured after the circuit substrate and the color filter substrate are bonded together.

3. The method according to claim **1**, wherein

the plurality of color layers are formed by printing.

4. The method according to claim **1**, wherein

the step of preparing the color filter substrate further comprises forming a black matrix by printing.

5. The method according to claim **1**, further comprising:

preparing a multiple circuit substrate yet to be cut into a plurality of the circuit substrates;

preparing a multiple color filter substrate yet to be cut into a plurality of the color filter substrates;

bonding the multiple circuit substrate and the multiple color filter substrate with the adhesive layer; and

cutting the multiple circuit substrate and the multiple color filter substrate into a plurality of bonded pairs of the circuit substrate and the color filter substrate.

* * * * *

专利名称(译)	制造有机电致发光显示装置的方法		
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申请号	US14/627374	申请日	2015-02-20
[标]申请(专利权)人(译)	株式会社日本显示器		
申请(专利权)人(译)	日本展示INC.		
当前申请(专利权)人(译)	日本展示INC.		
[标]发明人	MATSUMOTO YUKO SATO TOSHIHIRO		
发明人	MATSUMOTO, YUKO SATO, TOSHIHIRO		
IPC分类号	H01L51/56 H01L51/52 H01L27/32 H01L51/00		
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优先权	2014030690 2014-02-20 JP		
外部链接	Espacenet USPTO		

摘要(译)

制备电路基板。电路基板具有阳极，阴极，夹在阳极和阴极之间的有机电致发光膜，以及密封有机电致发光膜的密封膜。制备滤色器基板。电路基板和滤色器基板用粘合剂层粘合在一起。在制备滤色器基板的步骤中，将多个颜色层（每个颜色层中的一种颜色为多种颜色）设置在基板上，然后在基板上印刷粘合剂，使得粘合剂层覆盖多种颜色形成了层。