US 20050067954A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2005/0067954 A1

Nishikawa et al. (43) Pub. Date: Mar. 31, 2005

(54) ORGANIC EL PANEL

(76) Inventors: **Ryuji Nishikawa**, Gifu-shi (JP); **Tetsuji Omura**, Ogaki-shi (JP)

Correspondence Address:
CANTOR COLBURN, LLP
55 GRIFFIN ROAD SOUTH
BLOOMFIELD, CT 06002

(21) Appl. No.: **10/954,092**

(22) Filed: **Sep. 29, 2004**

(30) **Foreign Application Priority Data**

Sep. 30, 2003 (JP) 2003-342664

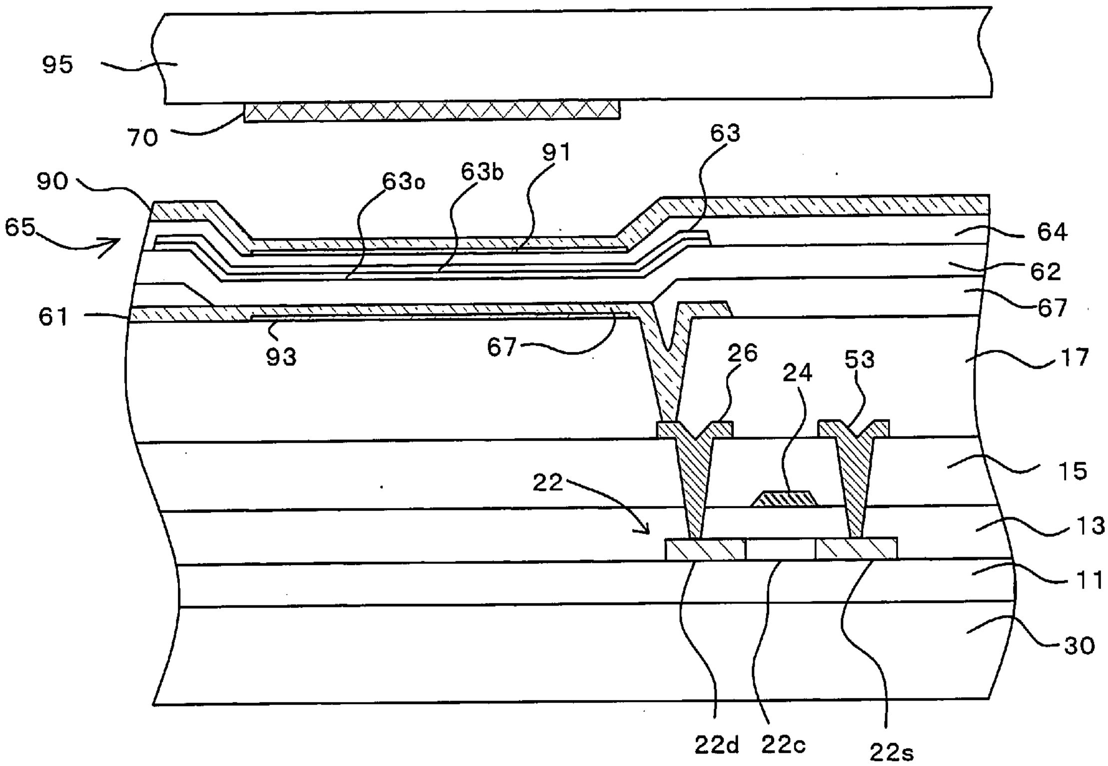
Publication Classification

(51) Int. Cl.[7] **H05B 33/00**

(52) U.S. Cl. **313/506**; 313/501

(57) **ABSTRACT**

A semi-transmissive film is provided underneath a transparent electrode of an organic EL element for a specific color. The optical length of the interval between the upper surface of the semi-transmissive film and the lower surface of a counter electrode serving as a reflective layer is configured such that this interval functions as a microresonator for selecting light having a specific wavelength. In an organic EL element for another color, the semi-transmissive film is omitted. According to this arrangement, emissive efficiency of an organic EL element for a color naturally having low emissive efficiency can be selectively enhanced.



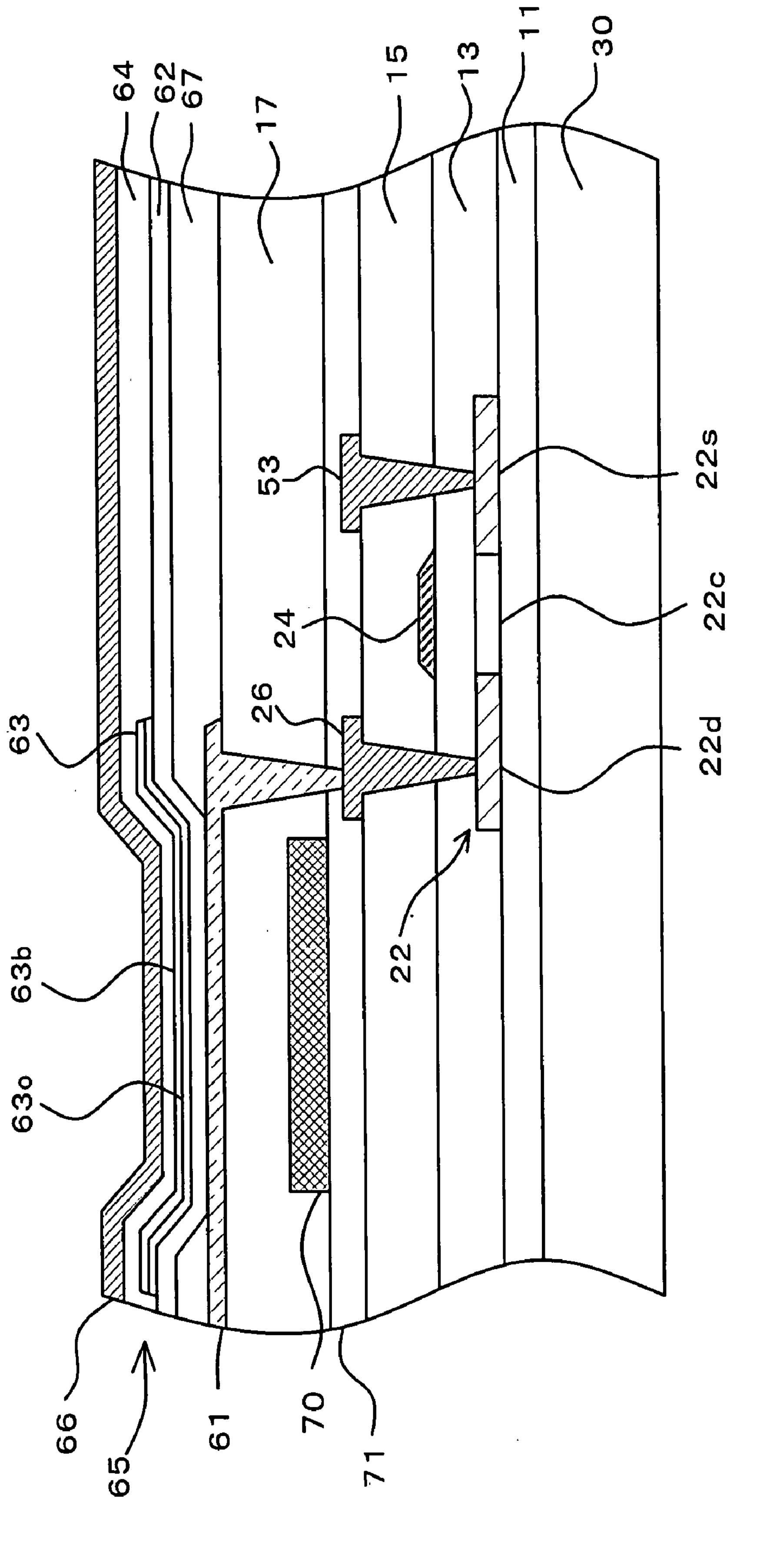

64
62
67
17
15
13
11
30
53
22s
24
22c
26
63
22d
22
63b
63o
66
65
61
70
71

Fig. 1

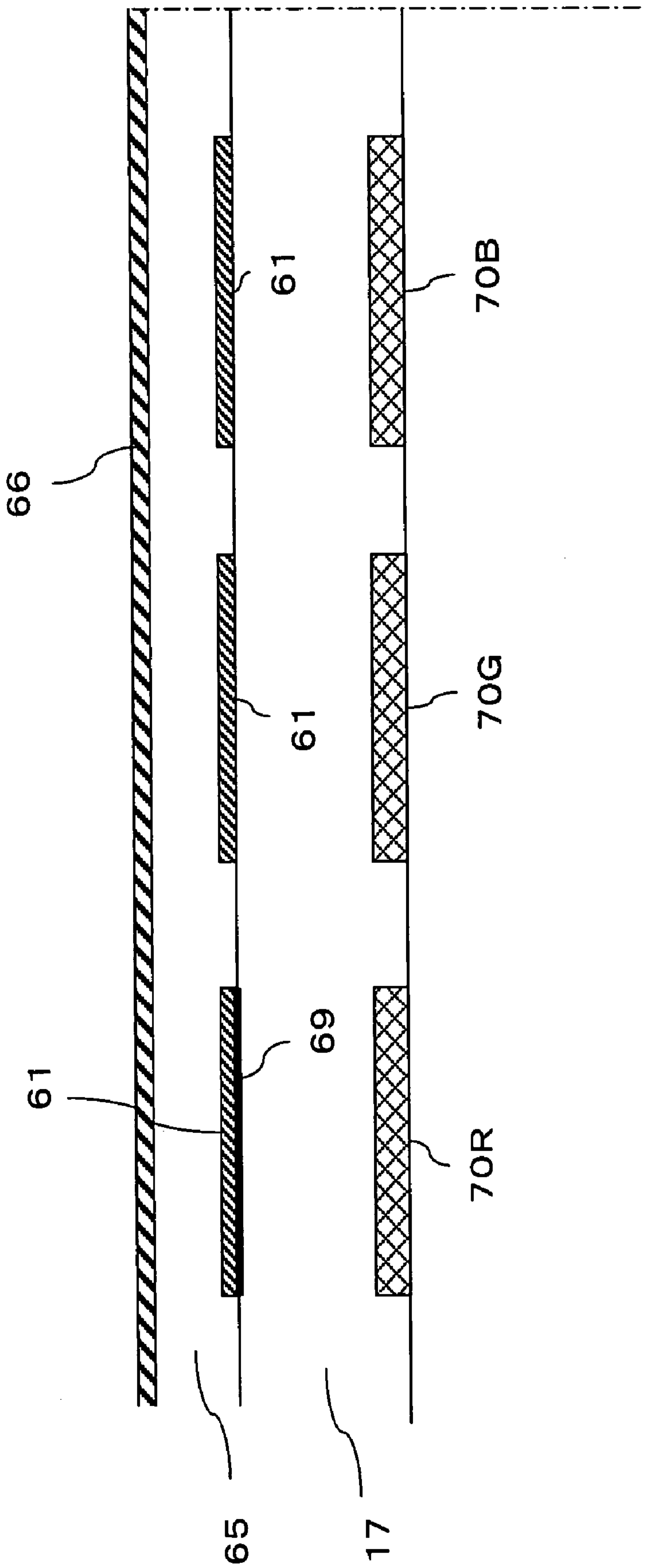


Fig. 2

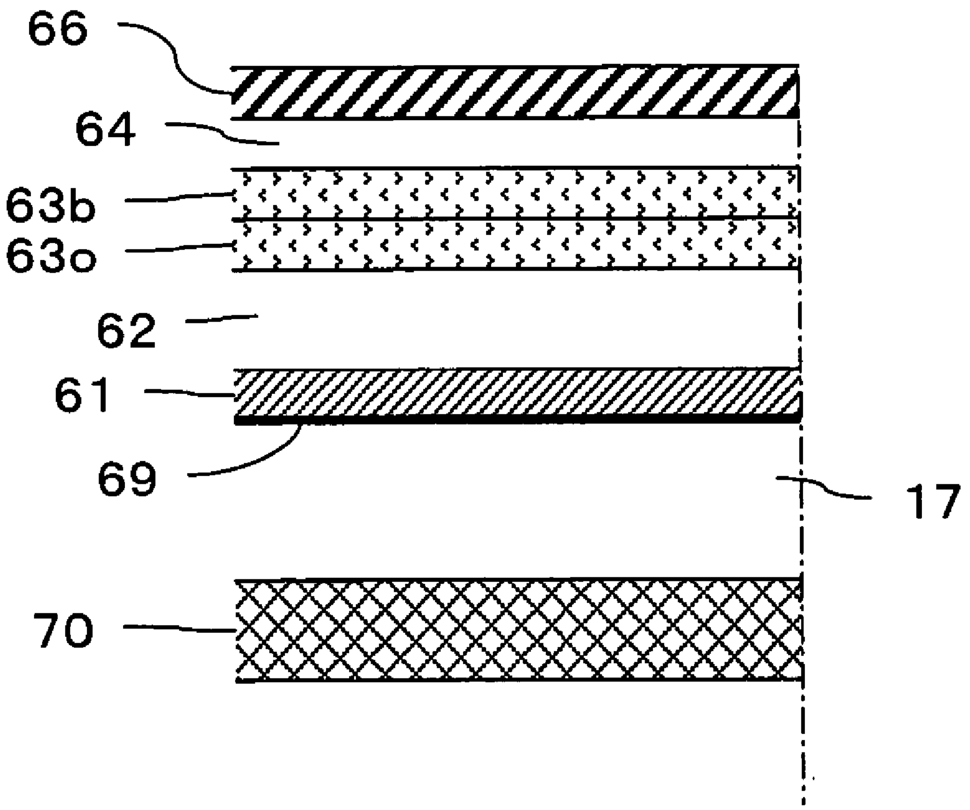


Fig. 3

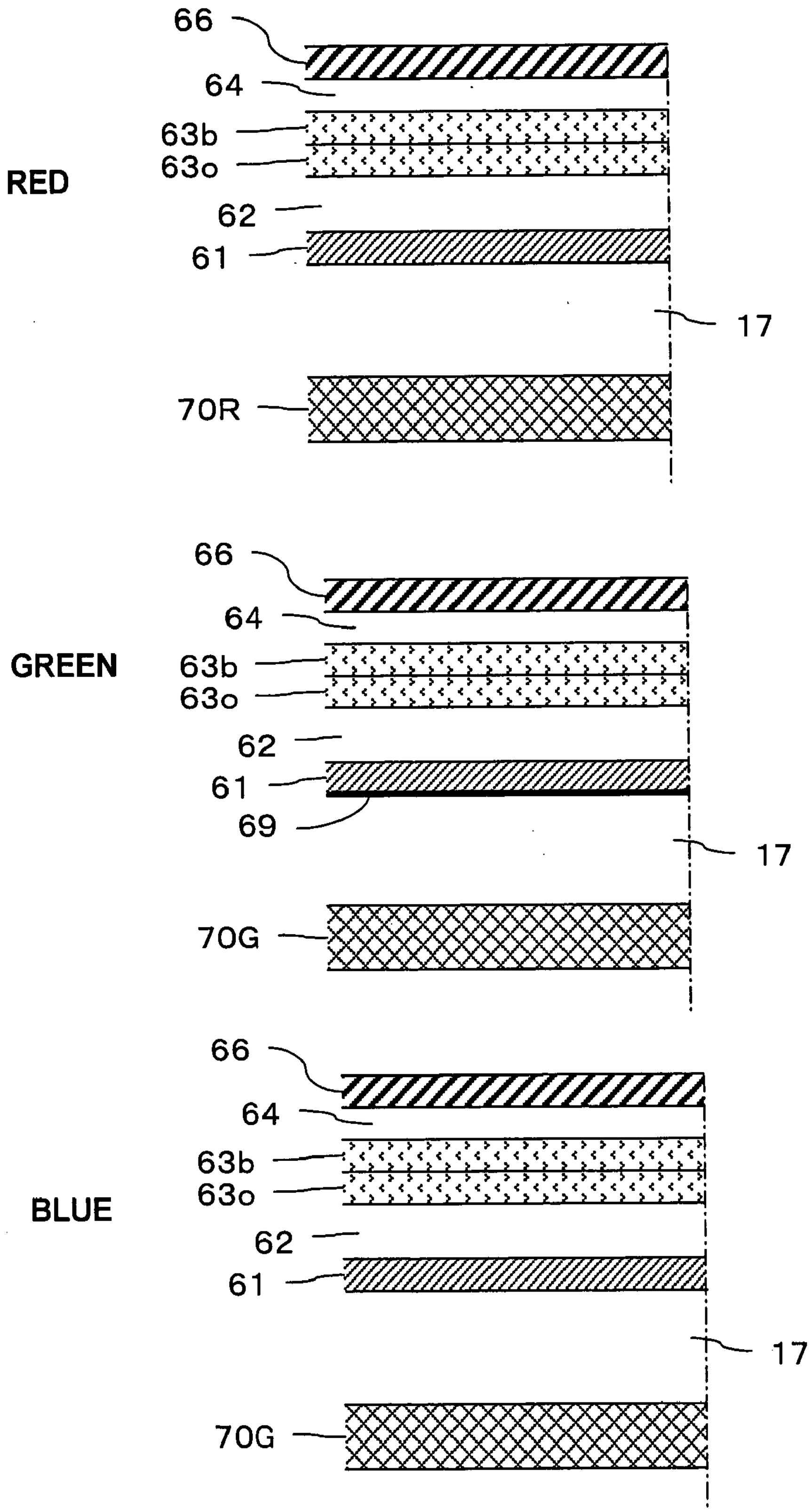

66
64
63b
63o
RED
62
61
17
70R
66
64
GREEN
63b
63o
62
61
69
17
70G
66
64
63b
63o
BLUE
62
61
17
70G

Fig. 4

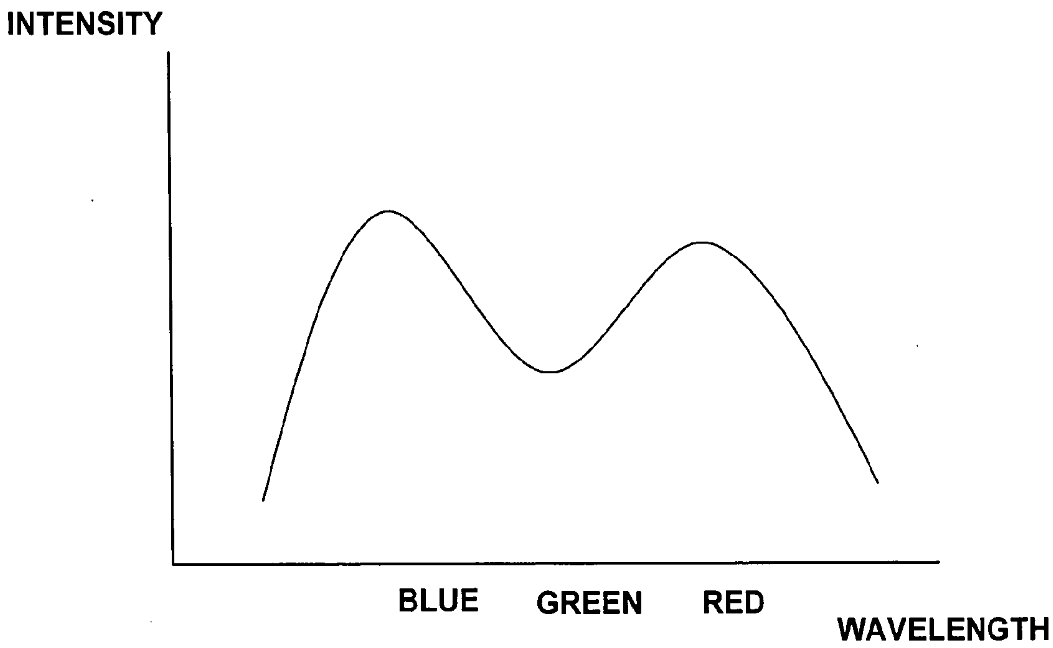


Fig. 5

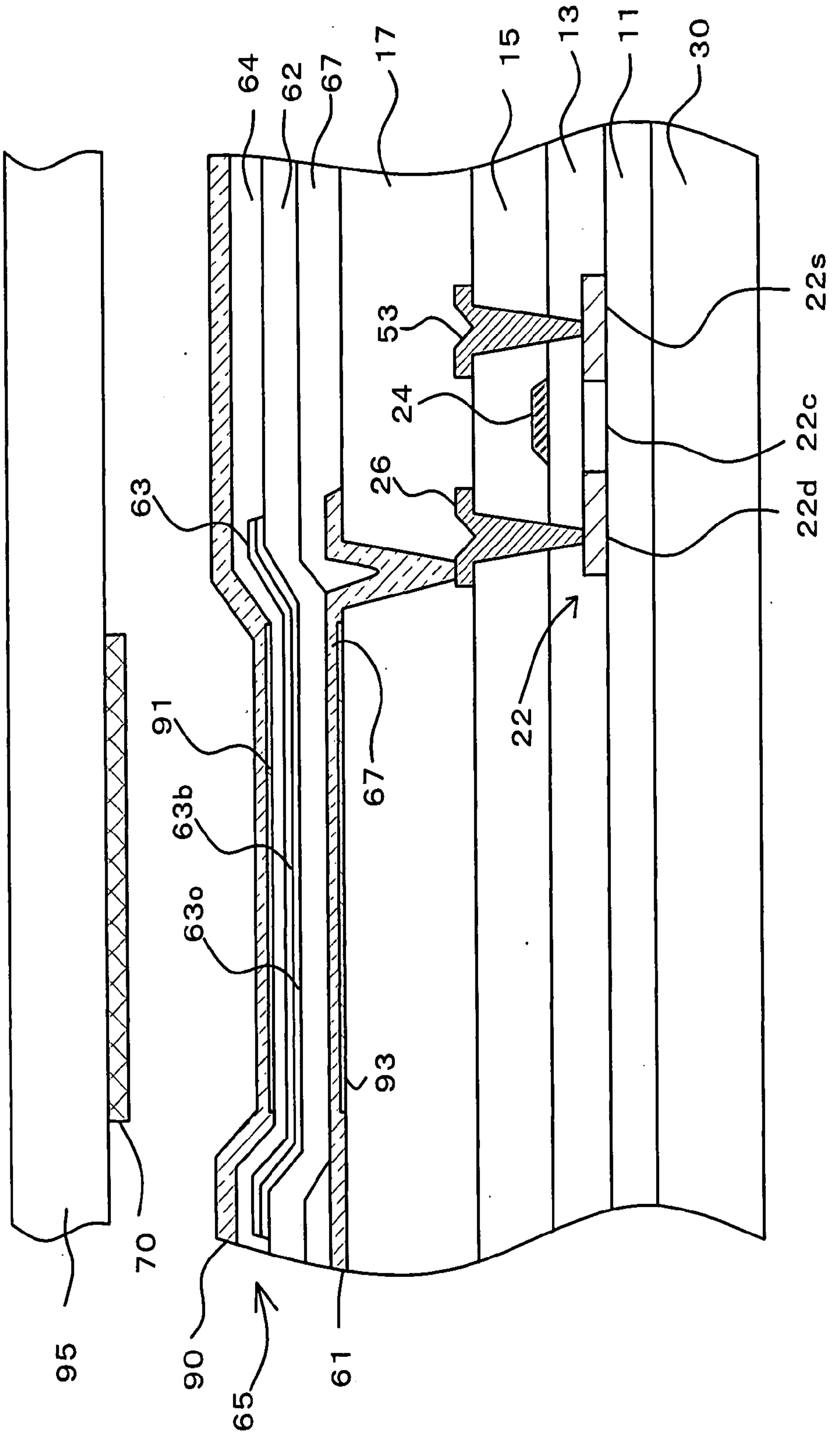

64
62
67
17
15
13
11
30
22s
53
24
22c
26
22d
63
22
91
63b
63o
67
93
95
70
90
65
61

Fig. 6

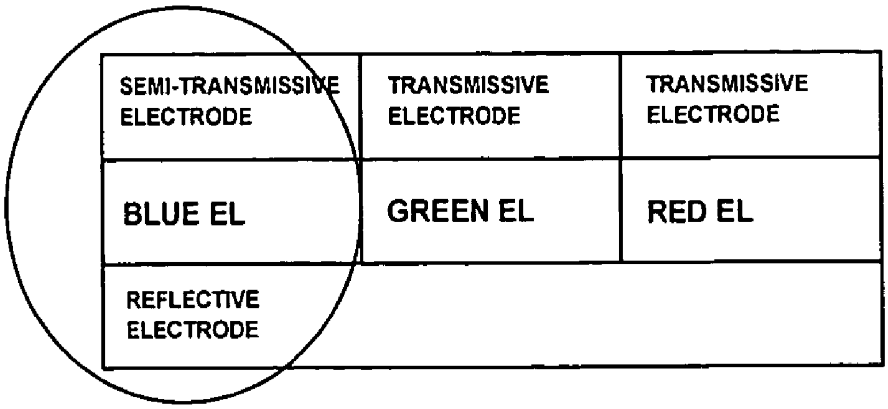

SEMI-TRANSMISSIVE ELECTRODE
TRANSMISSIVE ELECTRODE
TRANSMISSIVE ELECTRODE
BLUE EL
GREEN EL
RED EL
REFLECTIVE ELECTRODE

Fig. 7

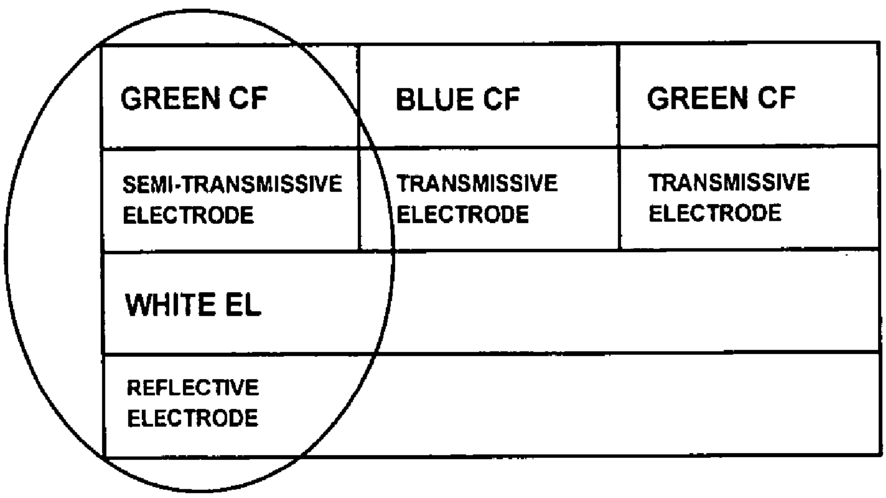

GREEN CF
BLUE CF
GREEN CF
SEMI-TRANSMISSIVE ELECTRODE
TRANSMISSIVE ELECTRODE
TRANSMISSIVE ELECTRODE
WHITE EL
REFLECTIVE ELECTRODE

Fig. 8

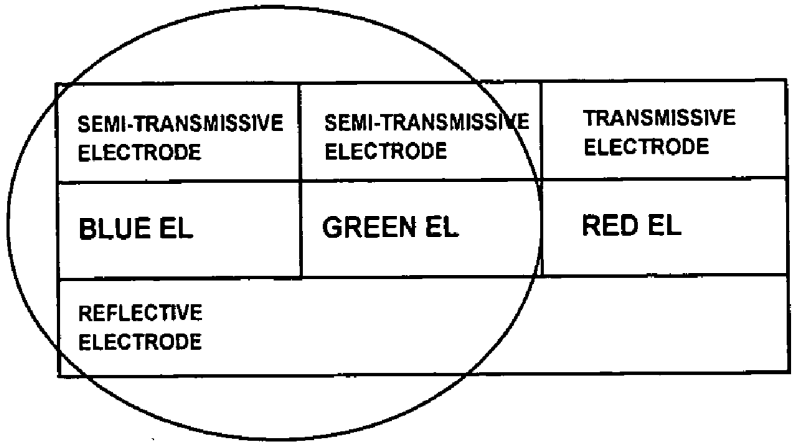

SEMI-TRANSMISSIVE ELECTRODE
SEMI-TRANSMISSIVE ELECTRODE
TRANSMISSIVE ELECTRODE
BLUE EL
GREEN EL
RED EL
REFLECTIVE ELECTRODE

Fig. 9

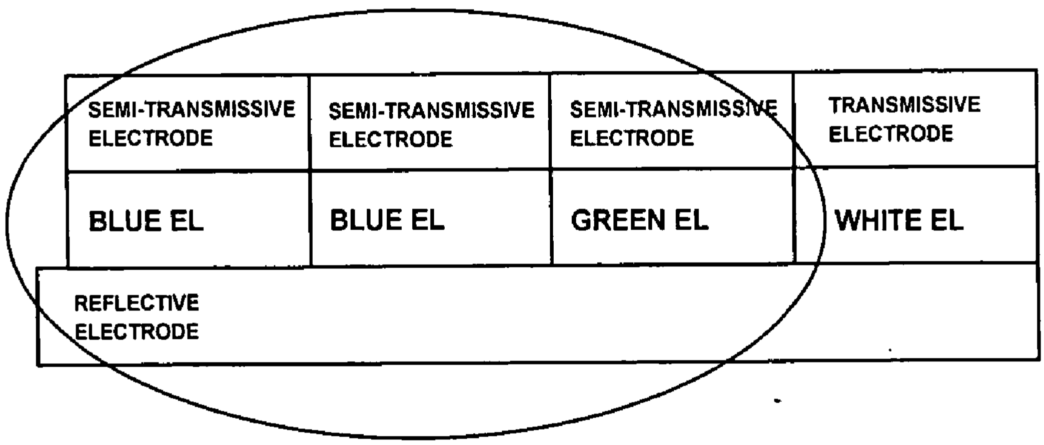

SEMI-TRANSMISSIVE ELECTRODE
SEMI-TRANSMISSIVE ELECTRODE
SEMI-TRANSMISSIVE ELECTRODE
TRANSMISSIVE ELECTRODE
BLUE EL
BLUE EL
GREEN EL
WHITE EL
REFLECTIVE ELECTRODE

Fig. 10

ORGANIC EL PANEL

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The priority Japanese application No. 2003-342664 upon which this patent application is based is hereby incorporated by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to an organic EL panel formed by arranging a plurality of organic EL elements each comprising an organic layer provided between first and second electrodes and emitting light when a voltage is applied between the first and second electrodes.

[0004] 2. Description of the Related Art

[0005] In recent years, organic electroluminescence (hereinafter referred to as "EL") displays have gained attention as one type of flat display which would replace liquid crystal displays in the coming generation. In a display panel of an organic EL display (hereinafter referred to as "organic EL panel"), the color of light emitted from each pixel may be determined depending on the emissive material used in the organic emissive layer of each pixel. By allowing the pixels to emit light of different colors using different emissive materials, RGB indication can be achieved.

[0006] However, when employing this method, the panel manufacturing process becomes difficult and complex because measures must be effected to compensate for differences in emissive efficiency of the emissive materials for different colors, and steps for applying different emissive materials to corresponding pixels must be carried out separately.

[0007] In order to achieve full color indication, other methods for determining pixel colors are proposed. In such methods, light of a single color alone is initially emitted, and color filters or color conversion layers are employed to obtain light of other colors. However, according to these methods, it is difficult to achieve sufficient emissive efficiency for each color.

[0008] Another alternative method using microcavities is disclosed in the following document: Takahiro NAKAYAMA and Atsushi KADOTA, "Element Incorporating Optical Resonator Structure, Third Meeting (1993)", in "From the Basics to the Frontiers in the Research of Organic EL Materials and Devices", Dec. 16 and 17, 1993, Tokyo University Sanjo Conference Hall, Japan Society of Applied Physics, Organic Molecular Electronics and Bioelectronics Division, JSAP Catalog Number AP93 2376, p. 135-143. According to this method, a microcavity which functions as a microresonator is provided in each pixel to extract light having a specific wavelength. Using this microresonator, light having a specific wavelength can be selectively intensified.

[0009] According to the conventional method using microcavities, it is necessary to change the optical length of the microresonator indifferent emissive elements according to color. Because of this requirement, it was difficult to manufacture a panel having a large number of pixels.

SUMMARY OF THE INVENTION

[0010] The present invention provides an organic EL panel with microresonators that can be manufactured easily.

[0011] According to the present invention, with respect to a specific color, a microresonator (microcavity) is configured with an organic emissive layer and a transparent electrode disposed between a counter electrode and a semi-transmissive film. Accordingly, in an organic EL element for the specific color, light ejected through the semi-transmissive film is limited to a specific wavelength while the specific wavelength is intensified. On the other hand, no microresonator is formed for an organic EL element for another color. As a result, in the EL element without microresonator, light generated in the organic layer is ejected without further processing.

[0012] By employing a panel configuration in which a semi-transmissive film is omitted to avoid forming a microresonator in certain organic EL elements, the structure concerning optical length in an EL element without microresonator can be made identical with that of an EL element having a microresonator, except for the omission of the semi-transmissive film. A panel having such a configuration can be manufactured easily.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] **FIG. 1** is a cross-sectional view showing a configuration of a pixel portion of an organic EL panel.

[0014] **FIG. 2** shows an example configuration of organic EL elements for the respective colors of R, G, and B, according to the present invention.

[0015] **FIG. 3** shows a configuration of an organic EL element which emits white light.

[0016] **FIG. 4** shows an example configuration for the respective colors of R, G, and B using white-emitting organic EL elements, according to the present invention.

[0017] **FIG. 5** is a diagram showing an example spectrum of a white-emitting organic EL element.

[0018] **FIG. 6** shows an example configuration of a white-emitting organic EL element having a top-emission structure.

[0019] **FIGS. 7-10** are schematic diagrams showing example configurations in which microresonators are provided depending on colors of pixels.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0020] Preferred embodiments of the present invention will next be described referring to the drawings.

[0021] **FIG. 1** is a cross-sectional view showing a configuration of a light-emitting region and a drive TFT (thin film transistor) within one pixel. It should be noted that each pixel actually includes a plurality of TFTs. The drive TFT is the TFT which controls a current supplied from a power line to an organic EL element within the pixel. On a glass substrate **30**, a buffer layer **11** composed of a lamination of an SiN layer and an SiO_2 layer is formed over the entire surface. Further on top, an active layer **22** made of polysilicon is disposed in predetermined areas (where TFTs are to be created).

[0022] Covering the active layer **22** and the buffer layer **11**, a gate insulation film **13** is formed over the entire surface. The gate insulation film **13** may be formed by laminating an SiO_2 layer and an SiN layer. On top of the gate insulation film **13** at a position above a channel region **22***c*, a gate electrode **24** composed of chromium or the like is arranged. Subsequently, impurities are doped into the active layer **22** while using the gate electrode **24** as a mask. As a result of this process, in the active layer **22**, the channel region **22***c* without impurities is provided in the central portion under the gate electrode **24**, while a source region **22***s* and a drain region **22***d* doped with impurities are formed on both sides of the channel region **22***c*.

[0023] Next, covering the gate insulation film **13** and the gate electrode **24**, an interlayer insulation film **15** is formed over the entire surface. Contact holes are then created in the interlayer insulation film **15** at positions corresponding to the source region **22***s* and the drain region **22***d*. The source region **22***s* and the drain region **22***d* are located under the interlayer insulation film **15**. Subsequently, a source electrode **53** and a drain electrode **26** are provided through these contact holes and on the upper surface of the interlayer insulation film **15**, so as to connect with the source region **22***s* and the drain region **22***d*, respectively. It should be noted that the source electrode **53** is connected to a power line (not shown). While the drive TFT formed as described above is a p-channel TFT in this example, the drive TFT may alternatively be constituted as an n-channel TFT.

[0024] Covering the interlayer insulation film **15**, source electrode **53**, and drain electrode **26**, a film **71** of SiN or the like is formed over the entire surface. A color filter **70** is next formed on top of the SiN film **71** at a position corresponding to the light-emitting region in each pixel.

[0025] Covering the SiN film **71** and the color filter **70**, a planarization film **17** is provided over the entire surface. On the planarization film **17** at the position of the light-emitting region, a semi-transmissive film **69** composed of a thin film of Ag or the like is formed. A transparent electrode **61** which serves as an anode is then disposed on the semi-transmissive film **69**. At a position above the drain electrode **26**, a contact hole is created through the planarization film **17**. Via this contact hole, the drain electrode **26** and the transparent electrode **61** are connected.

[0026] While an organic film such as acrylic resin is typically used to form the interlayer insulation film **15** and planarization film **17**, it is also possible to employ TEOS or an inorganic film. A metal such as aluminum may be favorably used to create the source electrode **53** and drain electrode **26**. For the transparent electrode **61**, ITO is typically employed.

[0027] The transparent electrode **61** is typically formed in a region covering more than half of the entire area of each pixel. The transparent electrode **61** normally has a substantially rectangular overall shape with a contacting portion protruding laterally and downward through the contact hole for connection with the drain electrode **26**. As can be seen in **FIG. 1**, the semi-transmissive film **69** is formed slightly smaller than the anode **61**.

[0028] On top of the transparent electrode **61**, an organic layer **65** and a counter electrode **66** are arranged. The organic layer **65** comprises a hole transport layer **62** formed over the entire surface, an organic emissive layer **63** formed slightly larger than the light-emitting region, and an electron transport layer **64** formed over the entire surface. The counter electrode **66**, which serves as a cathode, is made of metal such as aluminum, and is formed over the entire surface.

[0029] At a position on the upper surface of the peripheral portion of the transparent electrode **61** and underneath the hole transport layer **62**, a planarization film **67** is provided. The planarization film **67** limits the portion in which the hole transport layer **62** directly contacts the transparent electrode **61**, thereby defining the light-emitting region in each pixel. It should be noted that, while an organic film such as acrylic resin is typically used for the planarization film **67**, it is also possible to employ TEOS or an inorganic film.

[0030] The hole transport layer **62**, the organic emissive layer **63**, and the electron transport layer **64** are composed of materials that are conventionally used in an organic EL element. The color of emitted light is determined depending on the material (usually the dopant) of the organic emissive layer **63**. For example, the hole transport layer **62** maybe composed of NPB, the organic emissive layer **63** for emitting red light may be composed of TBADN+DCJTB, the organic emissive layer **63** for emitting green light may be composed of Alq_3+CFDMQA, the organic emissive layer **63** for emitting blue light may be composed of TBADN+NPB, and the electron transport layer **64** may be composed of Alq_3.

[0031] In the above-described arrangement, when the drive TFT is turned on by a voltage set in the gate electrode **24**, current from the power line flows from the transparent electrode **61** to the counter electrode **66**. This current causes light emission in the organic emissive layer **63**. The emitted light passes through the transparent electrode **61**, planarization film **17**, interlayer insulation film **15**, gate insulation film **13**, and glass substrate **30**, to be ejected downward in **FIG. 1**.

[0032] In the present embodiment, a semi-transmissive film **69** composed of a thin film of silver (Ag) or the like is provided on the underside of the transparent electrode **61** at the position of the light-emitting region. Accordingly, light generated in the organic emissive layer **63** is reflected by the semi-transmissive film **69**. Because the counter electrode **66** functions as a reflective layer, the light is repetitively reflected between the semi-transmissive film **69** and the counter electrode **66**.

[0033] The interval structure between the semi-transmissive film **69** and the counter electrode **66** is configured such that this interval optically functions as a microresonator for a specific color. In other words, the optical length of the interval is set to a value obtained by multiplying the wavelength of a desired color by an integer or a reciprocal of an integer (such as 1/2, 1, and 2). For example, the values of refractive index for the materials constituting each layer in the interval may be approximately as follows: 1.9 for ITO constituting the transparent electrode **61**; 1.46 for SiO_2 constituting the gate insulation film **13**; 2.0 for SiN also used for the gate insulation film **13**; and 1.7 for the organic layer **65** including the organic emissive layer **63**. By multiplying the physical thickness of each layer between the semi-transmissive film **69** and the counter electrode **66** by a corresponding refractive index, and then summing the calculated values, the optical thickness of the interval can be obtained. In the present embodiment, this optical thickness is set to a value relative to the wavelength of light to be extracted. With this arrangement, the interval between the semi-transmissive film **69** and the counter electrode **66** functions as a microresonator, and enables efficient extraction of light having a desired wavelength. More specifically, light emitted from the organic emissive layer **63** is repetitively reflected between the semi-transmissive film **69** and the counter electrode **66**, and, as a result, light components having a specific wavelength are selectively passed through the semi-transmissive film **69**. By further repeating such reflection within the microresonator, the probability that light having the specific wavelength will be ejected can be increased, resulting in enhanced efficiency.

[0034] According to the present embodiment, the color filter **70** is arranged in a layer between the interlayer insulation film **15** and the planarization film **17**. The color filter **70** may be composed of a material such as a photosensitive resin or polymer having a pigment mixed therein, similarly to color filters used in a liquid crystal display and a CCD camera.

[0035] The color filter **70** serves to selectively pass the ejected light so as to limit the wavelength of the obtained light, thereby enabling reliable control of the obtained color. In the present embodiment, because the microresonator limits light passing through the semi-transmissive film **69** as described above, the color filter **70** is not a fundamental requirement and may be omitted.

[0036] However, the microresonator basically regulates only the wavelength of light that is incident from a direction perpendicular to the surface of the semi-transmissive film **69**. Accordingly, the wavelength of light ejected from the microresonator is highly dependent on the viewing direction, such that different colors are likely to be detected when the panel is viewed at an angle. By providing the color filter **70** as in the present embodiment to pass the ejected light through the color filter **70**, the obtained light would unfailingly have a specific wavelength. In this manner, the viewing angle dependency of the panel can be substantially eliminated.

[0037] The position of the color filter **70** is not limited to the top of the interlayer insulation film **15**. Alternatively, the color filter **70** may be formed on the upper surface or the underside of the glass substrate **30**. A light-shielding film is often provided on the upper surface of the glass substrate **30** in order to prevent external light from irradiating on the drive TFT. In such a case, the color filter **70** may be formed in the same layer as the light-shielding film to simplify the manufacturing process.

[0038] **FIG. 2** diagrammatically shows three pixels of R, G, and B. As can be seen, the semi-transmissive film **69** is provided for the pixel of one color alone, while no semi-transmissive film is provided for the pixels of other colors. This arrangement is employed because the interval between the semi-transmissive film **69** and the counter electrode **66** is configured to form a microresonator for the one color alone (red R in the present example). In the pixel for the one color, light of this color is intensified and passed through the semi-transmissive film **69**. In the pixels for the other colors, emitted light is ejected downward without further processing by a microresonator.

[0039] Light emission of the three colors of RGB can be achieved using different organic materials. However, each organic material has a different emissive efficiency (amount of light emission/current) By employing a microresonator for a pixel of the color having the lowest emissive efficiency so as to intensify the emitted light, a more uniform light emission can be accomplished. Furthermore, the life of organic EL elements can be equalized among different colors because necessary currents for uniform light emission among different colors are equalized.

[0040] Because the color filters **70** are provided in the present embodiment, the color of light emitted by each pixel can be white. In order to achieve emission of white light, the organic emissive layer **63** may be constituted with a two-layer structure including a blue emissive layer **63***b* and an orange emissive layer **63***o*, as shown in **FIG. 3**. According to this arrangement, holes and electrons combine in regions near the border between the two emissive layers **63***b* and **63***o*, thereby generating both blue light and orange light. The light of the two colors in combination are emitted as white light. The orange organic emissive layer **63***o* may be composed of materials such as NPB+DBzR.

[0041] When employing a white organic emissive layer **63** as described above, the organic emissive layer **63** can be formed over the entire surface, without the need to separately perform the emissive layer forming process for the pixels of different colors. The organic emissive material can be simply deposited without using masks. When adopting this configuration, it is preferable to control the thickness of the transparent electrode **61** in order to adjust the optical length of the microresonator. In this manner, all layers disposed above the transparent electrode **61** can be formed over the entire surface without using masks, further facilitating the panel manufacturing process.

[0042] In the present embodiment, light of the color having the lowest emissive efficiency among the emitted white light is intensified and selected using a microresonator, and further selected by a color filter **70** to be ejected.

[0043] More specifically, as shown in **FIG. 4**, the distance from the underside of the transparent electrode **61** to the underside of the cathode **66** is identical among all of the pixels. This distance is configured to have an optical length which selects and intensifies light of one color (green G, for example). In the pixel for this one color, the semi-transmissive film **69** is disposed beneath the transparent electrode **60**. In the pixels of other colors (red R and blue B, for example), no semi-transmissive film is provided.

[0044] According to this arrangement, in the G pixel, the microresonator extracts a specific color (green) from among the emitted white light as described above, and the extracted light is passed and ejected through a green color filter **70**. In the R and B pixels, the white light emitted from the organic emissive layer **63** is simply passed through the color filters **70** to be ejected as light of predetermined colors (red and blue, respectively).

[0045] In this embodiment, the only difference among the pixels is whether or not the semi-transmissive film **69** is provided. Further, the optical length can be set easily, and the panel manufacturing process can be very much simplified. Moreover, light for one color can be intensified using the microresonator. When white light obtained by emission of two colors is used, one color among the three primary colors tends to have lower intensity compared to the other two colors. By employing the microresonator for the low-intensity color, a favorable color display can be achieved. For example, when light emission is executed by two emissive layers of blue and orange, the intensity of green light becomes lower than the other colors, as shown in **FIG. 5**. In order to equalize intensity, the semi-transmissive film **69** is provided for the green pixel so as to configure the microresonator to intensify the green light. In this manner, effective color display can be accomplished.

[0046] While the above-described embodiments refer to a bottom emission type panel in which light is ejected via the glass substrate **30**, an EL panel according to the present invention may alternatively be configured as top emission type in which light is ejected via the cathode.

[0047] **FIG. 6** shows a configuration of a pixel portion of a top emission type panel. In this example, a transparent cathode **90** composed of ITO is employed as the cathode. Further, a semi-transmissive film **91** is disposed on the underside of the transparent cathode **90**.

[0048] Furthermore, a metal reflective layer **93** is formed under the transparent electrode **61**. The interval structure between the surface of the metal reflective layer **93** and the semi-transmissive film **91** functions as the microresonator.

[0049] In this embodiment, the color filter **70** is provided on the underside of a sealing substrate **95**. It should be noted that the sealing substrate **95** connects to the substrate **30** at its peripheral portion alone, and serves to seal the upper space of the substrate **30** having components such as the organic EL element formed thereon. The top emission structure shown in **FIG. 6** can be employed in any of the above-described configurations according to the present invention.

[0050] While the TFTs in the above embodiments are described as top gate type TFTs, bottom gate type TFTs may alternatively be used.

[0051] **FIGS. 7-10** diagrammatically illustrate example configurations of the present invention. To simplify explanation, only the characteristic structures are shown in these drawings.

[0052] **FIG. 7** shows an example in which a semi-transmissive electrode (composed of the transparent electrode and the semi-transmissive film) is provided to configure a microresonator (microcavity) for one color alone. In this example, the semi-transmissive electrode is provided to configure the microresonator only in the pixel including a blue organic emissive layer (blue EL). For the green and red organic emissive layers (green EL and red EL), transparent electrodes are provided instead, such that light emitted from the organic emissive layer is ejected without further processing. It should be noted that a reflective electrode is provided covering the entire surface underneath the organic emissive layer. Light emitted from the organic emissive layer is reflected by the reflective electrode and ejected through the transparent electrode.

[0053] In **FIG. 8**, an organic emissive layer which emits white light (white EL) is provided over the entire surface. Further, a semi-transmissive electrode is formed underneath a green color filter (green CF), while transmissive electrodes are disposed under a blue color filter (blue CF) and a red color filter (red CF). In this arrangement, only the green pixel, which outputs green light by way of the green CF, includes a microresonator (microcavity) constituted with the semi-transmissive electrode. Accordingly, in the green pixel, green light within the white light emitted from the white EL is intensified. The overall resulting light is passed through the green CF such that the ejected light is limited to green light. Meanwhile, the white light emitted from the white EL is passed through the blue CF in the blue pixel so as to limit the ejected light to blue light, and through the red CF in the red pixel so as to limit the ejected light to red light, thereby enabling RGB display.

[0054] **FIG. 9** shows an example in which semi-transmissive electrodes are provided to configure microresonators (microcavities) for two colors, while employing the three colors of blue EL, green EL, and red EL as the organic emissive layer. More specifically, the semi-transmissive electrodes are provided to configure the microresonators in green and blue pixels, while a transmissive electrode is provided in a red pixel so as to allow red light emitted from the organic emissive layer (red EL) to be ejected without further processing.

[0055] **FIG. 10** shows an example in which semi-transmissive electrodes are provided to configure microresonators (microcavities) for the three colors of RGB, while employing four colors of blue EL, green EL, red EL, and white EL as the organic emissive layer. More specifically, the semi-transmissive electrodes are provided to configure the microresonators in red, green, and blue pixels, while a transmissive electrode is provided in a white pixel so as to allow white light emitted from the organic emissive layer (white EL) to be ejected without further processing.

What is claimed is:

1. An organic EL panel formed by arranging a plurality of pixels each including an organic EL element, wherein

the organic EL element includes an organic layer provided between first and second electrodes, and emits light when a voltage is applied between the first and second electrodes to allow a current to flow in the organic layer;

the plurality of pixels include pixels for a plurality of colors for ejecting light of colors differing from one another;

a microresonator is provided for a pixel for at least one specific color, the microresonator for repetitively reflecting light emitted from the organic layer within an interval having a predetermined optical length, and thereby intensifying and selecting light having a specific wavelength; and

microresonator is omitted in a pixel for at least another color.

2. An organic EL panel as defined in claim 1, wherein

the plurality of pixels include pixels of three colors of red, green, and blue, and the microresonator is provided for a pixel having the lowest emissive efficiency among the three colors.

3. An organic EL panel as defined in claim 2, wherein

the plurality of pixels include the organic EL elements which emit red, green, and blue light, respectively.

4. An organic EL panel as defined in claim 2, wherein

the plurality of pixels include the organic EL elements which emit white light, and color filters of red, green and blue, respectively.

5. An organic EL panel as defined in claim 1, wherein

the microresonator is configured to repetitively reflect light between a reflective layer and a semi-transmissive layer, so as to eject light having a specific wavelength through the semi-transmissive layer; and

the semi-transmissive layer is provided for an organic EL element in a pixel for a specific color, while semi-transmissive layer is omitted in an organic EL element in a pixel for another color.

6. An organic EL panel as defined in claim 1, wherein the microresonator is configured by providing:

a semi-transmissive layer included in the first electrode, which reflects light emitted from the organic layer; and

a reflective layer included in the second electrode, for reflecting light emitted from the organic layer; wherein

an interval between the reflective layer and the semi-transmissive layer is configured to have the predetermined optical length, such that when light generated in the organic layer is repetitively reflected between the reflective layer and the semi-transmissive layer, the interval between the reflective layer and the semi-transmissive layer functions as the microresonator which intensifies and selects light having a specific wavelength and ejects the selected light through the semi-transmissive layer.

7. An organic EL panel as defined in claim 6, wherein

the first electrode is a laminated structure composed of the semi-transmissive layer and a transparent electrode; and

the second electrode is a metal electrode which functions as the reflective layer.

8. An organic EL panel as defined in claim 7, wherein

among the semi-transmissive layer and the transparent electrode, the transparent electrode is located closer to the organic layer.

9. An organic EL panel as defined in claim 8, wherein

the first electrode is an anode, while the second electrode is a cathode.

10. An organic EL panel as defined in claim 1, wherein the microresonator is configured by providing:

a reflective layer included in the first electrode, for reflecting light emitted from the organic layer; and

a semi-transmissive layer included in the second electrode, which reflects light emitted from the organic layer; wherein

an interval between the reflective layer and the semi-transmissive layer is configured to have a predetermined optical length, such that when light generated in the organic layer is repetitively reflected between the reflective layer and the semi-transmissive layer, the interval between the reflective layer and the semi-transmissive layer functions as the microresonator which intensifies and selects light having a specific wavelength and ejects the selected light through the semi-transmissive layer.

11. An organic EL panel as defined in claim 10, wherein

the first electrode is a laminated structure composed of a metal film which functions as the reflective layer and a transparent electrode; and

the second electrode is a laminated structure composed of the semi-transmissive layer and a transparent electrode.

12. An organic EL panel as defined in claim 1, wherein

a thin film transistor for driving an organic EL element is provided corresponding to each of the plurality of organic EL elements;

the plurality of organic EL elements are formed in a layer located above the corresponding thin film transistors, with a planarization film disposed between the organic EL elements and the thin film transistors; and

a semi-transmissive layer and a color filter are arranged adjacent to respective surfaces of the planarization film.

13. An organic EL panel as defined in claim 1, wherein

the plurality of organic EL elements are formed on a pixel substrate;

a counter substrate is arranged opposing the pixel substrate; and

a color filter is formed on the counter substrate.

14. An organic EL panel as defined in claim 1, wherein

the plurality of pixels include pixels of four colors of red, green, blue, and white; and

the microresonators are provided in pixels of three colors of red, green, and blue, while microresonator is omitted in a white pixel.

* * * * *

专利名称(译)	有机EL面板		
公开(公告)号	US20050067954A1	公开(公告)日	2005-03-31
申请号	US10/954092	申请日	2004-09-29
[标]申请(专利权)人(译)	西川隆司 大村TETABUJI		
申请(专利权)人(译)	西川隆司 大村哲二		
当前申请(专利权)人(译)	SANYO ELECTRIC CO. , LTD		
[标]发明人	NISHIKAWA RYUJI OMURA TETSUJI		
发明人	NISHIKAWA, RYUJI OMURA, TETSUJI		
IPC分类号	H05B33/24 G09F9/30 H01L27/32 H01L51/50 H01L51/52 H05B33/00 H05B33/02 H05B33/12 H05B33/14 H05B33/22 H05B33/26 H05B33/28		
CPC分类号	H01L27/3211 H01L51/5265 H01L27/3244 H01L27/322		
优先权	2003342664 2003-09-30 JP		
外部链接	Espacenet USPTO		

摘要(译)

半透射膜设置在有机EL元件的透明电极下面，用于特定颜色。半透射膜的上表面和用作反射层的对电极的下表面之间的间隔的光学长度被配置为使得该间隔用作用于选择具有特定波长的光的微谐振器。在另一种颜色的有机EL元件中，省略了半透射膜。根据这种布置，可以选择性地增强有机EL元件对于自然具有低发光效率的颜色的发光效率。