

(19)



(11)

EP 2 595 192 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
18.05.2016 Bulletin 2016/20

(51) Int Cl.:
H01L 27/32 ^(2006.01)

(21) Application number: **12169499.6**

(22) Date of filing: **25.05.2012**

(54) Organic light emitting display device

Organische lichtemittierende Anzeigevorrichtung

Dispositif d'affichage électroluminescent organique

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

(30) Priority: **30.06.2011 KR 20110065141**

(43) Date of publication of application:
22.05.2013 Bulletin 2013/21

(73) Proprietor: **Samsung Display Co., Ltd.
Gyeonggi-do (KR)**

(72) Inventor: **Ko, Jung-Woo
446-711 Gyunggi-Do (KR)**

(74) Representative: **Mouteney, Simon James
Marks & Clerk LLP
90 Long Acre
London
WC2E 9RA (GB)**

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Description

BACKGROUND

1. Field

[0001] Embodiments of the present invention relate to an organic light emitting display device.

2. Description of Related Art

[0002] Organic light emitting display devices are self-emissive displays that emit light by electrically exciting organic compounds, and are being considered as next generation display devices that may address problems of liquid crystal display devices, as organic light emitting display devices may operate with low voltage, may have a thin profile, and have wide viewing angles and fast response speeds. Therefore, demands for organic light emitting display devices with high resolution are increasing.

[0003] A light emission layer in each of sub-pixels that emit light is patterned by colors for realizing full-white color, and to do this, a deposition process using a fine metal mask is performed. However, there is a limitation in finely patterning each of the sub-pixels according to the deposition process using a fine metal mask.

[0004] Accordingly, an aperture ratio, which is a ratio of an actual light emitting area to an entire display screen of the organic light emitting display device, is reduced as the resolution of the organic light-emitting display device increases. The reduction of the aperture ratio means that a light emitting area in each of the sub-pixels is reduced, and accordingly, the lifespan of the organic light emitting display device may be degraded.

[0005] US5311337 discloses a liquid crystal display that comprises a honeycomb structure of hexagonally-shaped sub-pixels. US2004/0246426 discloses an organic-light emitting display with a hexagonal arrangement of sub-pixels. US2005/0134175 discloses a plasma display panel comprising hexagon-based sub-pixels. JP2007017477 discloses a pixel array divided into pseudo hexagons.

SUMMARY

[0006] Embodiments of the present invention provide an organic light emitting display device with an increased lifespan by increasing an aperture ratio.

[0007] Embodiments of the present invention also provide an organic light emitting display device capable of reducing or preventing image quality degradation.

[0008] Embodiments of the present invention are as described in claims 1 to 16. According to an aspect of embodiments of the present invention, there is provided organic light emitting display device comprising: a plurality of sub-pixels arranged in a substantially honeycomb structure, each of the sub-pixels comprising a corre-

sponding one of a plurality of organic light emitting devices, wherein the plurality of sub-pixels comprises: a plurality of first sub-pixels for emitting light of a first color; a plurality of second sub-pixels for emitting light of a second color that is different from the first color; and a plurality of third sub-pixels for emitting light of a third color that is different from the first and second colors, wherein sub-pixels of different colors from among the plurality of sub-pixels are adjacent along a first axis and are adjacent along a second axis that is perpendicular to the first axis; the sub-pixels are arranged in zigzags when viewed along a first direction that is a transverse direction, while the sub-pixels are arranged linearly when viewed along a second direction that is a longitudinal direction that is perpendicular to the first direction and the first sub-pixel, the second sub-pixel and the third sub-pixel are sequentially arranged in a straight line along the second direction; the centers of the first sub-pixels in odd number columns and the centers of the first sub-pixels in even number columns are shifted in opposite directions along the first axis with respect to a second center line through centers of the second sub-pixels in each odd number and even number columns, and wherein a width of each of the first sub-pixels along the first axis is narrower than a width of each of the second sub-pixels along the first axis..

[0009] In an embodiment of the present invention, the three sides of the triangle may preferably have different lengths.

[0010] In an embodiment of the present invention, the first color may preferably be green, the second color may preferably be blue, and the third color may preferably be red.

[0011] In an embodiment of the present invention, a third center line through centers of the third sub-pixels in the second direction may preferably coincide with the second center line, the third sub-pixels being adjacent to corresponding ones of the first sub-pixels in the second direction.

[0012] In an embodiment of the present invention, a third center line through centers of the third sub-pixels in the second direction may preferably coincide with the first center line, the third sub-pixels being adjacent to corresponding ones of the first sub-pixels in the second direction.

[0013] In an embodiment of the present invention, a third center line through centers of the third sub-pixels in the second direction may preferably be separated from the second center line, the third sub-pixels being adjacent to corresponding ones of the first sub-pixels in the second direction.

[0014] In an embodiment of the present invention, a distance between the centers of two of the first sub-pixels that are nearest in the first direction may preferably be shorter than a distance between the centers of two of the second sub-pixels that are nearest in the first direction.

[0015] In an embodiment of the present invention, distance between the centers of two of the first sub-pixels

that are nearest in the first direction may preferably be shorter than a distance between the centers of two of the third sub-pixels that are nearest in the first direction.

[0016] In an embodiment of the present invention, a distance between the centers of two of the third sub-pixels that are nearest in the first direction may preferably be shorter than a distance between the centers of two of the second sub-pixels that are nearest in the first direction.

[0017] In an embodiment of the present invention, the first color may preferably be green, the second color may preferably be blue, and the third color may preferably be red.

[0018] In an embodiment of the present invention, the width of one of the first sub-pixels along the first axis may preferably be narrower than a width of the one of the first sub-pixels along the second axis.

[0019] In an embodiment of the present invention, centers of the first sub-pixels in a column arranged along the second axis may preferably be offset along the first axis from centers of the second sub-pixels arranged in the column.

[0020] In the present invention, the centers of the first sub-pixels in odd number columns and the centers of the first sub-pixels in even number columns are shifted in opposite directions along the first axis.

[0021] In an embodiment of the present invention, a width of each of the third sub-pixels along the first axis may preferably be narrower than a width of each of the second sub-pixels along the first axis.

[0022] In an embodiment of the present invention, the width of one of the third sub-pixels along the first axis may preferably be narrower than a width of the one of the third sub-pixels along the second axis.

[0023] In an embodiment of the present invention, centers of the third sub-pixels in a column arranged along the second axis may preferably be offset along the first axis from centers of the second sub-pixels arranged in the column.

[0024] In an embodiment of the present invention, the centers of the third sub-pixels in odd number columns and the centers of the third sub-pixels in even number columns may preferably be shifted along the first axis in opposite directions.

[0025] In an embodiment of the present invention, a width of each of the second sub-pixels along the first axis may preferably be narrower than a width of each of the second sub-pixels along the second axis.

[0026] In an embodiment of the present invention, the first color may preferably be green, the second color may preferably be blue, and the third color may preferably be red.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] The above and other features and aspects of embodiments of the present invention will become more apparent by describing in detail exemplary embodiments

thereof with reference to the attached drawings in which:

FIG. 1 is a plan view of sub-pixels in an organic light emitting display device according to an embodiment of the present invention;

FIG. 2 is a cross-sectional view of one of a plurality of sub-pixels of the embodiment shown in FIG. 1;

FIG. 3 is a plan view of first sub-pixels in one column from among the sub-pixels of the embodiment shown in FIG. 1;

FIG. 4 is a plan view of second sub-pixels in one column from among the sub-pixels of the embodiment shown in FIG. 1;

FIG. 5 is a plan view of sub-pixels in an organic light emitting display device according to another embodiment of the present invention; and

FIG. 6 is a plan view of sub-pixels in an organic light emitting display device according to yet another embodiment of the present invention.

DETAILED DESCRIPTION

[0028] Hereinafter, embodiments of an organic light emitting display device according to the present invention will be described with reference to accompanying drawings.

[0029] FIG. 1 is a plan view of sub-pixels in an organic light emitting display device according to an embodiment of the present invention.

[0030] Referring to FIG. 1, the organic light emitting display device according to the present embodiment includes sub-pixels, with each of the sub-pixels being substantially hexagon-shaped and arranged in a substantially honeycomb structure.

[0031] Each of the sub-pixels includes a pixel circuit including an organic light emitting device and a thin film transistor.

[0032] FIG. 2 is a cross-sectional view of one of the sub-pixels of the embodiment shown in FIG. 1.

[0033] As shown in FIG. 2, a thin film transistor T is formed on a substrate 40, and an organic light emitting device 50 that is electrically coupled to the thin film transistor T is located on the substrate 40.

[0034] A buffer layer 41 is formed on the substrate 40, and the thin film transistor T is located on the buffer layer 41.

[0035] The buffer layer 41 reduces or prevents impurity elements from penetrating into the substrate 40, and planarizes the surface of the substrate 40. The buffer layer 41 may be formed of various materials. For example, the buffer layer 41 may be formed of an inorganic material, such as silicon oxide, silicon nitride, silicon oxinitride, aluminum oxide, aluminum nitride, titanium oxide, or titanium nitride, may be formed of an organic material, such as polyimide, polyester, or acryl, or may be formed of a stacked structure thereof. However, the buffer layer 41 is not an essential element, that is, the buffer layer 41 is not necessary to practice the embodiments

of the present invention.

[0036] An active layer 42, which is formed of a semiconductor material, is patterned on the buffer layer 41. The active layer 42 may be formed of polycrystalline silicon; however, the present embodiment is not limited thereto, that is, the active layer 42 may be formed of other materials, such as an oxide semiconductor. For example, the active layer 42 may be a G-I-Z-O layer [e.g., a $(\text{In}_2\text{O}_3)_a(\text{Ga}_2\text{O}_3)_b(\text{ZnO})_c$ layer, wherein a, b, and c are respectively real numbers respectively satisfying conditions of $a \geq 0$, $b \geq 0$, and $c > 0$].

[0037] A gate insulating layer 43 is formed on the buffer layer 41 so as to cover the active layer 42, and a gate electrode 44 is formed on the gate insulating layer 43.

[0038] An interlayer dielectric 45 is formed on the gate insulating layer 43 so as to cover the gate electrode 44. A source electrode 46 and a drain electrode 47 are formed on the interlayer dielectric 45 to contact the active layer 42 through respective contact holes.

[0039] According to the present embodiment, at least one thin film transistor T is located in each of the sub-pixels. In addition, FIG. 2 shows one thin film transistor T; however, the present invention is not limited thereto. That is, a plurality of thin film transistors T may be located in each of the sub-pixels to configure a pixel circuit unit, and the pixel circuit unit may further include a capacitor.

[0040] The thin film transistor T is covered by a first insulating layer 48. The first insulating layer 48 is a layer-shaped structure including at least one layer formed on the interlayer dielectric 45, and may be formed of an organic material and/or an inorganic material. The organic material may be, for example, a polymer material such as acryl, polyimide, or polyester, and the inorganic material may be, for example, silicon oxide, silicon nitride, silicon oxinitride, aluminum oxide, aluminum nitride, titanium oxide, or titanium nitride.

[0041] A first electrode 51 is formed on the first insulating layer 48. The first electrode 51 is coupled to the drain electrode 47 via a via-hole formed in the first insulating layer 48.

[0042] In addition, a second insulating layer 54 is formed on the first insulating layer 48, and the second insulating layer 54 covers an edge of the first electrode 51. The second insulating layer 54 includes an opening 55 exposing a part of the first electrode 51. The second insulating layer 54 may be formed of an organic material such as acryl, polyimide, or polyester; however, the present invention is not limited thereto, that is, the second insulating layer 54 may be formed of an inorganic material or an organic/inorganic compound.

[0043] An organic emission layer 53 is formed on the first electrode 51 and the second insulating layer 54 so as to cover the part of the first electrode 51 that is exposed by the opening 55, and a second electrode 52 is formed on the organic emission layer 53 and the second insulating layer 54 so as to cover the organic emission layer 53.

[0044] The first electrode 51 is patterned independent-

ly on each of the sub-pixels, and the second electrode 52 is formed as a common electrode (e.g., an electrode that covers all the sub-pixels). The opening 55 of the second insulating layer 54 is formed in each of the sub-pixels, and an area of the opening 55 is substantially the same as an area of the light emitting region in the sub-pixel. In an embodiment of the present invention, in the sub-pixel having the hexagonal structure of the embodiment shown in FIG. 1, the opening 55 is formed to have a substantially hexagonal plane shape. The opening 55 and the first electrode 51 do not need to have the same plane shapes, and the first electrode 51 may be formed to have another shape, for example, a triangular or other polygonal shape.

[0045] The first electrode 51, the second electrode 52, and the organic emission layer 53 form the organic light emitting device 50.

[0046] The first electrode 51 and the second electrode 52 may have polarities that are opposite to each other, that is, may be formed respectively as an anode and a cathode. Alternatively, the first electrode 51 may be a cathode and the second electrode 52 may be an anode.

[0047] In any case, the electrode functioning as the anode includes a conductive material having a work function of a high absolute value, and the electrode functioning as the cathode includes a conductive material having a work function of a low absolute value. The conductive material having a high work function may be a transparent conductive oxide material such as, for example, indium tin oxide (ITO), In_2O_3 , ZnO, or indium zinc oxide (IZO), or a noble metal such as Au. The conductive material having a low work function may be, for example, Ag, Al, Mg, Li, Ca, LiF/Ca, or LiF/Al.

[0048] In a top emission type display device in which images are displayed toward a direction away from the substrate 40, the first electrode 51 includes a light reflective material, and the second electrode 52 is a light transmission type electrode.

[0049] To do this, when the first electrode 51 functions as the anode, a reflective body is formed of, for example, Ag, Mg, Al, Pt, Pd, Au, Ni, Nd, Ir, Cr, or a compound thereof, and then, ITO, IZO, ZnO, or In_2O_3 having the high work function, for example, is deposited on the reflective body. In addition, when the first electrode 51 functions as the cathode, the first electrode 51 is formed of, for example, Ag, Al, Mg, Li, Ca, LiF/Ca, or LiF/Al having low work function and is capable of reflecting light.

[0050] When the second electrode 52 functions as the cathode, the second electrode 52 may be formed to be thin for performing as a transfective layer by using a metal material such as, for example, Li, Ca, LiF/Ca, LiF/Al, Al, Mg, or Ag having low work function. The transparent conductive material such as, for example, ITO, IZO, ZnO, or In_2O_3 may be deposited on the metal transfective layer to address high resistance caused due to the thinness of the transfective layer. When the second electrode 52 functions as the anode, the second electrode 52 may be formed of, for example, ITO, IZO, ZnO, or In_2O_3 .

[0051] The first and second electrodes 51 and 52 may be formed of various other materials that are known to those of ordinary skill in the art.

[0052] The first and second electrodes 51 and 52 apply voltages of opposite polarities to the organic emission layer 53 between the first and second electrodes 51 and 52 to make the organic emission layer 53 emit light.

[0053] The organic emission layer 53 may be formed of a low-molecular weight organic material or a high-molecular weight organic material. If a low-molecular weight organic material is used, then the organic emission layer 63 may have a single or multilayer structure including at least one selected from the group consisting of a hole injection layer (HIL), a hole transport layer (HTL), an emission layer (EML), an electron transport layer (ETL), and an electron injection layer (EIL). Examples of available organic materials may include, for example, copper phthalocyanine (CuPc), N,N'-di(naphthalene-1-yl)-N,N'-diphenyl-benzidine (NPB), tris-8-hydroxyquinoline aluminum (Alq3), and the like. Such a low-molecular weight organic material may be deposited by vacuum deposition.

[0054] If a high-molecular weight organic material is used, the organic emission layer 53 may have a structure including the HTL and EML. Here, the HTL may be formed of, for example, poly(3,4-ethylenedioxythiophene) (PEDOT), and the EML may be formed of, for example, a polymer organic material based on PolyPhenylene Vinylene (PPV) and Polyfluorene in a screen printing method or an inkjet printing method.

[0055] The organic emission layer 53 is not limited to the above examples, and other examples may be applied.

[0056] FIG. 1 is a plan view of the sub-pixels of the above cross-sectional structures.

[0057] The organic light emitting display device of the present embodiment includes a plurality of sub-pixels as shown in FIG. 1.

[0058] The plurality of sub-pixels include a plurality of first sub-pixels 1 for emitting light of a first color, a plurality of second sub-pixels 2 for emitting light of a second color that is different from the first color, and a plurality of third sub-pixels 3 for emitting light of a third color that is different from the first and second colors.

[0059] The first through third colors may mix to emit white light, and in an embodiment, the first through third colors may preferably be respectively green, blue, and red. However, the present invention is not limited thereto, that is, the first through third colors may be, for example, yellow, cyan, and magenta, respectively.

[0060] In the present embodiment, the first color is preferably a color having high color perception. When the sub-pixels emit the green, blue, and red lights, the green color is the most recognizable color to humans, and thus, the first color is preferably green.

[0061] When the sub-pixels include green, blue, and red sub-pixels, the organic light emitting material forming the blue sub-pixels, that is, the second color, has the

shortest lifespan from among the three colors.

[0062] Each of the sub-pixels is hexagonally shaped, and the sub-pixels are arranged with a substantially honeycomb structure. The honeycomb structure corresponds to the plane shape of the opening 55 formed in the second insulating layer 54 shown in FIG. 2.

[0063] Therefore, each of the first sub-pixels 1 has a first opening 551 formed as a hexagon, each of the second sub-pixels 2 has a second opening 552 formed as the hexagon, and each of the third sub-pixels 3 has a third opening 553 formed as a hexagon. Therefore, the light emission region of the first sub-pixel 1 corresponds to the first opening 551, the light emission region of the second sub-pixel 2 corresponds to the second opening 552, and the light emission region of the third sub-pixel 3 corresponds to the third opening 553.

[0064] With respect to embodiments of the present invention, descriptions about the first sub-pixel 1 through the third sub-pixel 3 are for the light emission regions of the sub-pixels 1 through 3, and actually, the regions corresponding to the first through third openings 551 through 553.

[0065] In the present invention, the sub-pixels are arranged in a substantially honeycomb structure, and thus, the sub-pixels are arranged in zigzags when viewed along a first direction (e.g., along the x-axis, or in the x direction depicted in FIG. 1) that is a transverse direction, while the sub-pixels are arranged linearly when viewed along a second direction (e.g., along the y-axis, or in the y direction depicted in FIG. 1) that is a longitudinal direction that is perpendicular to the first direction. In addition, the first sub-pixel 1, the second sub-pixel 2, and the third sub-pixel 3 are sequentially arranged in a straight line along the second direction (y direction), and other ones of the first through third sub-pixels 1 through 3 are sequentially arranged in a straight line along the second direction (y direction) that is adjacent to the above line in the first direction (x direction). Here, around a given sub-pixel, only sub-pixels of different colors are arranged, and thus, centers of the first sub-pixel 1, the second sub-pixel 2, and the third sub-pixel 3 that are adjacent to each other form a triangle.

[0066] According to the sub-pixels arranged in a substantially honeycomb structure, the aperture ratio is greater than a structure in which the sub-pixels are arranged in a rectangular shape. Therefore, according to the present embodiment, an aperture ratio that is higher than that of an organic light emitting display device including sub-pixels arranged in a rectangular shape may be obtained.

[0067] In the above arrangement of the sub-pixels, the sub-pixels of one color are arranged at every other pixel along the first direction (x direction), and at every third sub-pixel along the second direction (y direction). Therefore, a user recognizes that one color is arranged in zigzag along the second direction (y direction) that is the longitudinal direction.

[0068] According to the present invention, a width of

the first sub-pixel 1 is narrower than those of the second sub-pixel 2 and, preferably, the third sub-pixel 3 in the first direction (x direction). Preferably, the width of the first sub-pixel 1 in the first direction (x direction) is narrower than the width of the first sub-pixel 1 in the second direction (y direction).

[0069] According to the present invention, centers of the first sub-pixels 1 arranged in the second direction (y direction) are shifted to a side in the first direction (x direction) with respect to a second center line through centers of the second sub-pixels in each odd number and even number columns. According to an embodiment of the present invention, a first center line that couples the centers of the first sub-pixels 1 arranged in the second direction (y direction) (e.g., a vertical line that passes through centers of first sub-pixels 1) is separated from the second center line that couples the centers of the second sub-pixels 2 arranged in the second direction (y direction) (e.g., a vertical line that passes through centers of second sub-pixels 2), the second sub-pixels 2 being adjacent to the first sub-pixels 1 in the second direction (y direction) (e.g., the first and second sub-pixels 1 and 2 being in a same column of pixels).

[0070] According to an embodiment of the present invention, a column (1) of the first sub-pixels 1 arranged in the second direction (y direction) and another column of the first sub-pixels 1 adjacent to column (1) in the first direction (x direction) are shifted in opposite directions (e.g., opposite directions of the x direction). Therefore, as shown in FIG. 1, the first sub-pixels 1 in the first column from the left and the first sub-pixels 1 in the second column from the left are shifted to face each other. That is, as shown in FIG. 1, the first sub-pixels 1 in odd number columns are shifted to the right, and the first sub-pixels 1 in even number columns are shifted to the left.

[0071] Centers of adjacent ones of the first through third sub-pixels 1 through 3 form a triangle. According to an embodiment of the present invention, one side of the triangle is shorter than the other sides of the triangle. According to the embodiment shown in FIG. 1, three sides of the triangle have different lengths.

[0072] Referring to FIGS. 3 and 4, according to the above-described structure, a horizontal distance between centers d1 between two adjacent first sub-pixels 1 (i.e. the distance between the centers in the first direction of two first sub-pixels that are nearest in the first direction but are offset in the second direction) is shorter than a horizontal distance between centers d2 between two adjacent second sub-pixels 2 (i.e. the distance between the centers in the first direction of two second sub-pixels that are nearest in the first direction but are offset in the second direction). Here, the horizontal distances d1 and d2 are distances in the first direction (x direction).

[0073] As described above, the first sub-pixels 1 are preferably the sub-pixels emitting the green light and have high color perception to humans. Therefore, when the horizontal distance d1 between the centers of the two adjacent first sub-pixels 1 is reduced, a width of the zig-

zag pattern of the first sub-pixels 1 arranged in the second direction (y direction) is narrower than that of the second sub-pixels 2 shown in FIG. 4, and thus, the zigzag pattern of the first sub-pixels 1 is more nearly straight. That is, the green sub-pixels that largely affect perception quality are arranged nearly in a straight line, and thus, degradation of image quality may be reduced or prevented.

[0074] Accordingly, the present invention allows the image quality to be improved without reducing the distances between openings formed in a second insulating layer in a conventional sub-pixel arrangement, and thus, processing margin may be ensured.

[0075] The arrangement structure of the first sub-pixels 1 may be formed by changing the sizes and locations of the first openings 551 formed in the second insulating layer 54 without changing a size of the first electrode in each of the sub-pixels, and without changing a structure of the pixel circuit unit.

[0076] Therefore, all fabrication processes of the organic light emitting display device may be performed without being changed.

[0077] FIG. 5 shows sub-pixels according to another embodiment of the present invention, in which third sub-pixels 3' are modified in a manner similar to the first sub-pixels 1 described above.

[0078] That is, a width of the third sub-pixel 3' is reduced to be narrower than a width of the second sub-pixel 2 in the first direction (x direction). Preferably, the width of the third sub-pixel 3' in the first direction (x direction) is narrower than the width of the third sub-pixel 3' in the second direction (y direction).

[0079] In an embodiment of the present invention, preferably centers of the third sub-pixels 3' arranged in the second direction are shifted to a side in the first direction (x direction). In an embodiment of the present invention, preferably the first center line coupling the centers of the first sub-pixels 1 along the second direction (y direction), and a third center line coupling centers of the third sub-pixels 3' along the second direction (y direction), the third sub-pixels 3' being adjacent to the first sub-pixels 1 along the second direction (y direction), coincide with each other. In addition, the first center line and the third center line are separated from the second center line coupling the centers of the second sub-pixels 2 along the second direction (y direction), the second sub-pixels 2 being adjacent to the first sub-pixels 1 along the second direction (y direction).

[0080] In an embodiment of the present invention, preferably a column of the third sub-pixels 3' arranged in the second direction (y direction) and another column of the third sub-pixels 3' that is adjacent in the first direction (x direction) to the above column are shifted in opposite directions (e.g., opposite directions along the x-axis). Therefore, the third sub-pixels 3' in the first and second columns from the left are shifted to face each other. That is, as shown in FIG. 5, the third sub-pixels 3' in odd number columns are shifted to the right, and the third sub-pixels 3' in even number columns are shifted to the

left.

[0081] In an embodiment of the present invention, preferably, centers of the first through third sub-pixels 1, 2, and 3' that are adjacent to each other form a triangle having three sides of different lengths.

[0082] In addition, a horizontal distance between centers of two adjacent third sub-pixels 3' is shorter than a horizontal distance between centers of two adjacent second sub-pixels 2.

[0083] In an embodiment of the present invention, preferably sizes of the third sub-pixels 3' are reduced in the same pattern as the first sub-pixels 1; however, the present invention is not limited thereto. That is, the sizes and locations of the third sub-pixels 3' may be changed regardless of the pattern of the first sub-pixels 1, and the first center line and the third center line need not coincide with each other.

[0084] In an embodiment of the present invention, preferably, the third sub-pixels 3', as well as the first sub-pixels 1, are arranged in nearly straight lines in the second direction (y direction), and thus, the image quality may be further improved. In addition, disadvantages of the hexagonal sub-pixel structure may be avoided, while still maintaining the advantages of the hexagonal sub-pixel structure.

[0085] FIG. 6 shows sub-pixels according to another embodiment of the present invention, in which structures of second sub-pixels 2' are changed in addition to the sub-pixels 1 and 3' of the embodiment of FIG. 5.

[0086] In the case of the second sub-pixels 2' emitting the blue light, the brightness of the light emitted from the second sub-pixels 2' may be degraded due to the short lifespan of the blue emitting material. Therefore, in an embodiment of the present invention, preferably, as exemplified by FIG. 6, the sizes of the second sub-pixels 2' are increased by an amount equal to the amount that the reduced sizes of the first sub-pixels 1 and the third sub-pixels 3' are decreased, thus, the blue emission area increases, and thus, the lifespan degradation of the blue emitting material and the brightness degradation may be reduced.

[0087] That is, in an embodiment of the present invention, as shown in FIG. 6, a width in the first direction (x direction) of the second sub-pixel 2' of the present embodiment is increased to be wider than the width of the second sub-pixel 2 in the first direction (x direction) of the embodiments shown in FIGS. 1 and 5. Therefore, the width of the second sub-pixel 2' in the first direction (x direction) may be greater than a width of the second sub-pixel 2' in the second direction (y direction).

[0088] In an embodiment of the present invention, the first center line coupling the centers of the first sub-pixels 1 along the second direction (y direction), and the third center line coupling the centers of the third sub-pixels 3' in the second direction (y direction), coincide with each other, the third sub-pixels 3' being adjacent to the first sub-pixels 1' along the second direction (y direction) (e.g., the third sub-pixels 3' being in the same column as

the first sub-pixels 1). In an embodiment of the present invention, the first center line and the third center line are separated from the second center line coupling the centers of the second sub-pixels 2' in the second direction (y direction), the second sub-pixels 2' being adjacent to the first sub-pixels 1 along the second direction (y direction) (e.g., the second sub-pixels 2' being in the same column as the first sub-pixels 1).

[0089] Since the second sub-pixel 2' emitting the blue light least affects the display image quality even when the sizes of the second sub-pixels 2' are increased, the image quality of the entire display device is not greatly reduced.

[0090] In addition, since the sizes of the second sub-pixels 2' are increased as much as the reduced sizes of the first sub-pixels 1 and the third sub-pixels 3' are decreased, the distances between the first openings 551 through the third openings 553' formed in the second insulating layer 54 are not decreased, and accordingly, a processing margin may be maintained to be the same as a conventional organic light emitting display device.

[0091] According to an embodiment of the present invention, the first and the third sub-pixels are arranged in patterns that are nearly in straight lines in the second direction, an image quality may be improved, and the lifespan of the second sub-pixels may be increased.

[0092] The above-described pixel structure of the present embodiment is not limited to the sub-pixels having hexagonal plane structures as shown in FIGS. 1 and 3 through 6, and may be applied to the sub-pixels having circular, oval, square, or other polygonal plane shapes. However, in the above cases, the sub-pixels of different colors are adjacent to each other in the first direction and the second direction.

[0093] According to embodiments of the present invention, the following effects may be obtained:

[0094] Since sub-pixels having substantially honeycomb structures, are formed, the aperture ratio may be improved, and the lifespan of an organic light emitting display device is also increased;

[0095] The first sub-pixels emitting the green light are arranged in a pattern that is nearly in a straight line in the longitudinal direction, thus reducing or preventing degradation of image quality;

[0096] In addition, distances between openings formed in a second insulating layer are preferably not reduced, and thus, a processing margin may be ensured;

[0097] In addition, the third sub-pixels, as well as the first sub-pixels, are preferably arranged in the pattern that is nearly in a straight line in the longitudinal direction, and thus, image quality may be further improved, and the disadvantages of the hexagonal sub-pixel structure may be avoided while improving the advantages of the hexagonal sub-pixel structure;

[0098] By preferably increasing the sizes of the second sub-pixels emitting the blue light, the lifespan of the second sub-pixels emitting the blue light may be increased, and brightness degradation may be reduced or prevented.

ed;

[0099] In addition, in a preferred embodiment, the sizes of the second sub-pixels are increased as much as the sizes of the first sub-pixels and the third sub-pixels are decreased, and thus, the distances between the first through second openings formed in the second insulating layer, and accordingly, a processing margin may remain unchanged.

[0100] While the present invention has been particularly shown and described with reference to embodiments thereof, it will be understood by those of ordinary skill in the art that various changes in form and details may be made therein without departing from the scope of the present invention as defined by the following claims, and equivalents thereof.

Claims

1. An organic light emitting display device comprising:

a plurality of sub-pixels arranged in a substantially honeycomb structure, each of the sub-pixels comprising a corresponding one of a plurality of organic light emitting devices,
wherein the plurality of sub-pixels comprises:

- a plurality of first sub-pixels (1) for emitting light of a first color;
- a plurality of second sub-pixels (2) for emitting light of a second color that is different from the first color; and
- a plurality of third sub-pixels (3) for emitting light of a third color that is different from the first and second colors,

wherein sub-pixels of different colors from among the plurality of sub-pixels are adjacent along a first axis and are adjacent along a second axis that is perpendicular to the first axis; the sub-pixels are arranged in zigzags when viewed along the first axis that is a transverse direction, while the sub-pixels are arranged linearly when viewed along the second axis that is a longitudinal direction to form columns, and the first sub-pixel, the second sub-pixel and the third sub-pixel are sequentially arranged in a straight line along the second axis;
and

wherein the width of each the first sub-pixels along the first axis is narrower than the width of each of the second sub-pixels along the first axis; and

characterized in that

the centers of the first sub-pixels in odd number columns and the centers of the first sub-pixels in even number columns are shifted in opposite directions along the first axis with respect to a

second center line through centers of the second sub-pixels in respective odd number and even number columns.

2. The organic light emitting display device of claim 1, wherein centers of adjacent ones of the first, second, and third sub-pixels form a triangle having one of three sides that is shorter than the other two of the sides.
3. The organic light emitting display device of claim 2, wherein the three sides of the triangle each have different lengths.
4. The organic light emitting display of any of claims 1 to 3, wherein a first center line through centers of the first sub-pixels along the second axis is separated along the first axis from a second center line through centers of the second sub-pixels along the second axis,
the second sub-pixels being adjacent to corresponding ones of the first sub-pixels along the second axis, the first and second sub-pixels being in a same column of pixels.
5. The organic light emitting display device of claim 4, wherein a third center line through centers of the third sub-pixels along the second axis coincides with the second center line, the third sub-pixels being adjacent to corresponding ones of the first sub-pixels along the second axis.
6. The organic light emitting display device of claim 4, wherein a third center line through centers of the third sub-pixels along the second axis coincides with the first center line, the third sub-pixels being adjacent to corresponding ones of the first sub-pixels along the second axis.
7. The organic light emitting display device of claim 4, wherein a third center line through centers of the third sub-pixels along the second axis is separated from the second center line, the third sub-pixels being adjacent to corresponding ones of the first sub-pixels along the second axis.
8. The organic light emitting display device of any of claims 4 to 7, wherein a distance between the centers of two of the first sub-pixels that are nearest along the first axis is shorter than a distance between the centers of two of the second sub-pixels that are nearest along the first axis.
9. The organic light emitting display device of any of claims 4, 5, 7 and 8, wherein a distance between the centers of two of the first sub-pixels that are nearest along the first axis is shorter than a distance between the centers of two of the third sub-pixels that are

nearest along the first axis.

10. The organic light emitting display device of any of claims 4, 6, 7, 8 and 9, wherein a distance between the centers of two of the third sub-pixels that are nearest along the first axis is shorter than a distance between the centers of two of the second sub-pixels that are nearest along the first axis. 5
11. The organic light emitting display device of any of claims 1 to 10, wherein the first color is green, the second color is blue, and the third color is red. 10
12. The organic light emitting display device of any of claims 1 to 11, wherein the width of one of the first sub-pixels along the first axis is narrower than the width of the one of the first sub-pixels along the second axis. 15
13. The organic light emitting display device of any of claims 1 to 12, wherein the width of each of the third sub-pixels along the first axis is narrower than the width of each of the second sub-pixels along the first axis. 20
14. The organic light emitting display device of any of claims 1 to 13, wherein the width of one of the third sub-pixels along the first axis is narrower than the width of the one of the third sub-pixels along the second axis. 25 30
15. The organic light emitting display device of any of claims 1 to 14, wherein the centers of the third sub-pixels in odd number columns and the centers of the third sub-pixels in even number columns are shifted along the first axis in opposite directions with respect to a second center line through centers of the second sub-pixels in respective odd number and even number columns. 35 40
16. The organic light emitting display device of any of claims 1 to 15, wherein the width of each of the second sub-pixels along the second axis is narrower than the width of each of the second sub-pixels along the first axis. 45

Patentansprüche

1. Organische lichtemittierende Anzeigevorrichtung, umfassend: 50

eine Mehrzahl von Subpixeln, welche im Wesentlichen in einer Wabenstruktur angeordnet sind, wobei jedes der Subpixel eine entsprechende einer Mehrzahl von organischen lichtemittierenden Vorrichtungen umfasst, wobei die Mehrzahl von Subpixeln umfasst:

eine Mehrzahl von ersten Subpixeln (1) zum Emittieren von Licht einer ersten Farbe; eine Mehrzahl von zweiten Subpixeln (2) zum Emittieren von Licht einer zweiten Farbe, welche sich von der ersten Farbe unterscheidet; und eine Mehrzahl von dritten Subpixeln (3) zum Emittieren von Licht einer dritten Farbe, welche sich von der ersten und zweiten Farbe unterscheidet; wobei die Subpixel unterschiedlicher Farben aus der Mehrzahl von Subpixeln entlang einer ersten Achse aneinander angrenzen und entlang einer zweiten, zur ersten Achse senkrechten Achse aneinander angrenzen; wobei die Subpixel, bei Betrachtung entlang der ersten Achse, welche eine Querrichtung ist, in einer Zickzack-Anordnung angeordnet sind, während die Subpixel, bei Betrachtung entlang der zweiten Achse, welche eine Längsrichtung ist, linear angeordnet sind, um Spalten zu bilden, und die ersten Subpixel, die zweiten Subpixel und die dritten Subpixel aufeinanderfolgend in einer geraden Linie entlang der zweiten Achse angeordnet sind; und wobei die Breite jedes der ersten Subpixel entlang der ersten Achse schmäler als die Breite jedes der zweiten Subpixel entlang der ersten Achse ist; und **dadurch gekennzeichnet, dass** die Mittelpunkte der ersten Subpixel in ungeradzahlig Spalten und die Mittelpunkte der ersten Subpixel in geradzahlig Spalten in entgegengesetzten Richtungen entlang der ersten Achse relativ zu einer zweiten Mittellinie durch Mittelpunkte der zweiten Subpixel in jeweiligen ungeradzahlig Spalten und geradzahlig Spalten versetzt sind.

2. Organische lichtemittierende Anzeigevorrichtung nach Anspruch 1, wobei die Mittelpunkte von aneinander angrenzenden ersten, zweiten und dritten Subpixeln ein Dreieck bilden, welches eine Seite aufweist, die kürzer ist als die anderen zwei Seiten.
3. Organische lichtemittierende Anzeigevorrichtung nach Anspruch 2, wobei die drei Seiten des Dreiecks jeweils unterschiedliche Längen aufweisen.
4. Organische lichtemittierende Anzeigevorrichtung nach einem der Ansprüche 1 bis 3, wobei eine erste Mittellinie durch Mittelpunkte der ersten Subpixel entlang der zweiten Achse entlang der ersten Achse von einer zweiten Mittellinie durch Mittelpunkte der zweiten Subpixel entlang der zweiten Achse ge-

trennt ist,

wobei die zweiten Subpixel an den entsprechenden der ersten Subpixel entlang der zweiten Achse angrenzen, wobei die ersten und zweiten Subpixel sich in einer selben Pixelspalte befinden.

5. Organische lichtemittierende Anzeigevorrichtung nach Anspruch 4, wobei eine dritte Mittellinie durch Mittelpunkte der dritten Subpixel entlang der zweiten Achse mit der zweiten Mittellinie zusammenfällt, wobei die dritten Subpixel an entsprechende Subpixel der ersten Subpixel entlang der zweiten Achse angrenzend sind. 5
6. Organische lichtemittierende Anzeigevorrichtung nach Anspruch 4, wobei eine dritte Mittellinie durch Mittelpunkte der dritten Subpixel entlang der zweiten Achse mit der ersten Mittellinie zusammenfällt, wobei die dritten Subpixel an entsprechende Subpixel der ersten Subpixel entlang der zweiten Achse angrenzend sind. 10
7. Organische lichtemittierende Anzeigevorrichtung nach Anspruch 4, wobei eine dritte Mittellinie durch Mittelpunkte der dritten Subpixel entlang der zweiten Achse von der zweiten Mittellinie getrennt ist, wobei die dritten Subpixel an entsprechende Subpixel der ersten Subpixel entlang der zweiten Achse angrenzend sind. 15
8. Organische lichtemittierende Anzeigevorrichtung nach einem der Ansprüche 4 bis 7, wobei ein Abstand zwischen den Mittelpunkten von zwei der ersten Subpixel, welche am nächsten entlang der ersten Achse liegen, kürzer als ein Abstand zwischen den Mittelpunkten von zwei der zweiten Subpixel ist, welche am nächsten entlang der ersten Achse liegen. 20
9. Organische lichtemittierende Anzeigevorrichtung nach einem der Ansprüche 4, 5, 7 und 8, wobei ein Abstand zwischen den Mittelpunkten von zwei der ersten Subpixel, welche am nächsten entlang der ersten Achse liegen, kürzer ist als ein Abstand zwischen den Mittelpunkten von zwei der dritten Subpixel, welche am nächsten entlang der ersten Achse liegen. 25
10. Organische lichtemittierende Anzeigevorrichtung nach einem der Ansprüche 4, 6, 7, 8 und 9, wobei ein Abstand zwischen den Mittelpunkten von zwei der dritten Subpixel, welche am nächsten entlang der ersten Achse liegen, kürzer als ein Abstand zwischen den Mittelpunkten von zwei der zweiten Subpixel ist, welche am nächsten entlang der ersten Achse liegen. 30
11. Organische lichtemittierende Anzeigevorrichtung nach einem der Ansprüche 1 bis 10, wobei die erste 35

Farbe grün ist, die zweite Farbe blau ist und die dritte Farbe rot ist.

12. Organische lichtemittierende Anzeigevorrichtung nach einem der Ansprüche 1 bis 11, wobei die Breite eines der ersten Subpixel entlang der ersten Achse schmaler ist als die Breite des einen der ersten Subpixel entlang der zweiten Achse. 5
13. Organische lichtemittierende Anzeigevorrichtung nach einem der Ansprüche 1 bis 12, wobei die Breite jedes der dritten Subpixel entlang der ersten Achse schmaler als die Breite jedes der zweiten Subpixel entlang der ersten Achse ist. 10
14. Organische lichtemittierende Anzeigevorrichtung nach einem der Ansprüche 1 bis 13, wobei die Breite eines der dritten Subpixel entlang der ersten Achse schmaler als die Breite des einen der dritten Subpixel entlang der zweiten Achse ist. 15
15. Organische lichtemittierende Anzeigevorrichtung nach einem der Ansprüche 1 bis 14, wobei die Mittelpunkte der dritten Subpixel in ungeradzahigen Spalten und die Mittelpunkte der dritten Subpixel in geradzahigen Spalten entlang der ersten Achse in entgegengesetzten Richtungen, in Bezug auf eine zweite Mittellinie durch Mittelpunkte der zweiten Subpixel in jeweiligen ungeradzahigen und geradzahigen Spalten versetzt sind. 20
16. Organische lichtemittierende Anzeigevorrichtung nach einem der Ansprüche 1 bis 15, wobei die Breite jedes der zweiten Subpixel entlang der zweiten Achse schmaler als die Breite jedes der zweiten Subpixel entlang der ersten Achse ist. 25

Revendications

1. Dispositif d'affichage électroluminescent organique, comprenant :

une pluralité de sous-pixels agencés en une structure essentiellement en nid d'abeille, chacun des sous-pixels comprenant un dispositif correspondant parmi une pluralité de dispositifs électroluminescents organiques, dans lequel la pluralité de sous-pixels comprend :

une pluralité de premiers sous-pixels (1) permettant d'émettre de la lumière d'une première couleur ;
une pluralité de deuxièmes sous-pixels (2) permettant d'émettre de la lumière d'une deuxième couleur qui est différente de la première couleur ; et

- une pluralité de troisièmes sous-pixels (3) permettant d'émettre de la lumière d'une troisième couleur qui est différente des première et deuxième couleurs, dans lequel des sous-pixels de couleurs différentes parmi la pluralité de sous-pixels sont adjacents le long d'un premier axe et sont adjacents le long d'un deuxième axe qui est perpendiculaire au premier axe ; les sous-pixels sont agencés en zigzag lorsqu'on les considère le long du premier axe qui correspond à une direction transversale, tandis que les sous-pixels sont agencés de manière linéaire si on les considère le long du deuxième axe qui correspond à une direction longitudinale afin de former des colonnes, et le premier sous-pixel, le deuxième sous-pixel et le troisième sous-pixel sont agencés de manière séquentielle en ligne droite le long du deuxième axe ; et dans lequel la largeur de chacun des premiers sous-pixels le long du premier axe est plus étroite que la largeur de chacun des deuxièmes sous-pixels long du premier axe ; et
- caractérisé en ce que**
- les centres des premiers sous-pixels dans des colonnes à numéro impair et les centres des premiers sous-pixels dans des colonnes à numéro pair sont décalés dans des directions opposées le long du premier axe par rapport à une deuxième ligne médiane passant par des centres des deuxièmes sous-pixels dans des colonnes à numéro impair et à numéro pair respectives.
2. Dispositif d'affichage électroluminescent organique selon la revendication 1, dans lequel des centres de sous-pixels adjacents parmi les premiers, deuxièmes, et troisièmes sous-pixels forment un triangle présentant un des trois côtés qui est plus court que les deux autres côtés.
 3. Dispositif d'affichage électroluminescent organique selon la revendication 2, dans lequel les trois côtés du triangle présentent respectivement différentes longueurs.
 4. Dispositif d'affichage électroluminescent organique selon l'une quelconque des revendications 1 à 3, dans lequel une première ligne médiane passant par des centres des premiers sous-pixels le long du deuxième axe est séparée le long du premier axe d'une deuxième ligne médiane passant par des centres des deuxièmes sous-pixels le long du deuxième axe, les deuxièmes sous-pixels étant adjacents à des

sous-pixels correspondants parmi les premiers sous-pixels le long du deuxième axe, les premiers et deuxièmes sous-pixels se trouvant dans une même colonne de pixels.

5. Dispositif d'affichage électroluminescent organique selon la revendication 4, dans lequel une troisième ligne médiane passant par des centres des troisièmes sous-pixels le long du deuxième axe coïncide avec la deuxième ligne médiane, les troisièmes sous-pixels étant adjacents à des sous-pixels correspondants parmi les premiers sous-pixels le long du deuxième axe.
6. Dispositif d'affichage électroluminescent organique selon la revendication 4, dans lequel une troisième ligne médiane passant par des centres des troisièmes sous-pixels le long du deuxième axe coïncide avec la première ligne médiane, les troisièmes sous-pixels étant adjacents à des sous-pixels correspondants parmi les premiers sous-pixels le long du deuxième axe.
7. Dispositif d'affichage électroluminescent organique selon la revendication 4, dans lequel une troisième ligne médiane passant par des centres des troisièmes sous-pixels le long du deuxième axe est séparée de la deuxième ligne médiane, les troisièmes sous-pixels étant adjacents à des sous-pixels correspondants parmi les premiers sous-pixels le long du deuxième axe.
8. Dispositif d'affichage électroluminescent organique selon l'une quelconque des revendications 4 à 7, dans lequel une distance entre les centres de deux des premiers sous-pixels qui sont les plus proches le long du premier axe est plus courte qu'une distance entre les centres de deux des deuxièmes sous-pixels qui sont les plus proches le long du premier axe.
9. Dispositif d'affichage électroluminescent organique selon l'une quelconque des revendications 4, 5, 7 et 8, dans lequel une distance entre les centres de deux des premiers sous-pixels qui sont les plus proches le long du premier axe est plus courte qu'une distance entre les centres de deux des troisièmes sous-pixels qui sont les plus proches le long du premier axe.
10. Dispositif d'affichage électroluminescent organique selon l'une quelconque des revendications 4, 6, 7, 8 et 9, dans lequel une distance entre les centres de deux des troisièmes sous-pixels qui sont les plus proches le long du premier axe est plus courte qu'une distance entre les centres de deux des deuxièmes sous-pixels qui sont les plus proches le long du premier axe.

11. Dispositif d'affichage électroluminescent organique selon l'une quelconque des revendications 1 à 10, dans lequel la première couleur est le vert, la deuxième couleur est le bleu, et la troisième couleur est le rouge. 5
12. Dispositif d'affichage électroluminescent organique selon l'une quelconque des revendications 1 à 11, dans lequel la largeur de l'un des premiers sous-pixels le long du premier axe est plus étroite que la largeur de l'un des premiers sous-pixels le long du deuxième axe. 10
13. Dispositif d'affichage électroluminescent organique selon l'une quelconque des revendications 1 à 12, dans lequel la largeur de chacun des troisièmes sous-pixels le long du premier axe est plus étroite que la largeur de chacun des deuxièmes sous-pixels le long du premier axe. 15
20
14. Dispositif d'affichage électroluminescent organique selon l'une quelconque des revendications 1 à 13, dans lequel la largeur de l'un des troisièmes sous-pixels le long du premier axe est plus étroite que la largeur de l'un des troisièmes sous-pixels le long du deuxième axe. 25
15. Dispositif d'affichage électroluminescent organique selon l'une quelconque des revendications 1 à 14, dans lequel les centres des troisièmes sous-pixels dans des colonnes à numéro impair et les centres des troisièmes sous-pixels dans des colonnes à numéro pair sont décalés le long du premier axe dans des directions opposées par rapport à une deuxième ligne médiane passant par des centres des deuxièmes sous-pixels dans des colonnes à numéro impair et à numéro pair respectives. 30
35
16. Dispositif d'affichage électroluminescent organique selon l'une quelconque des revendications 1 à 15, dans lequel la largeur de chacun des deuxièmes sous-pixels le long du deuxième axe est plus étroite que la largeur de chacun des deuxièmes sous-pixels le long du premier axe. 40
45

50

55

FIG. 1

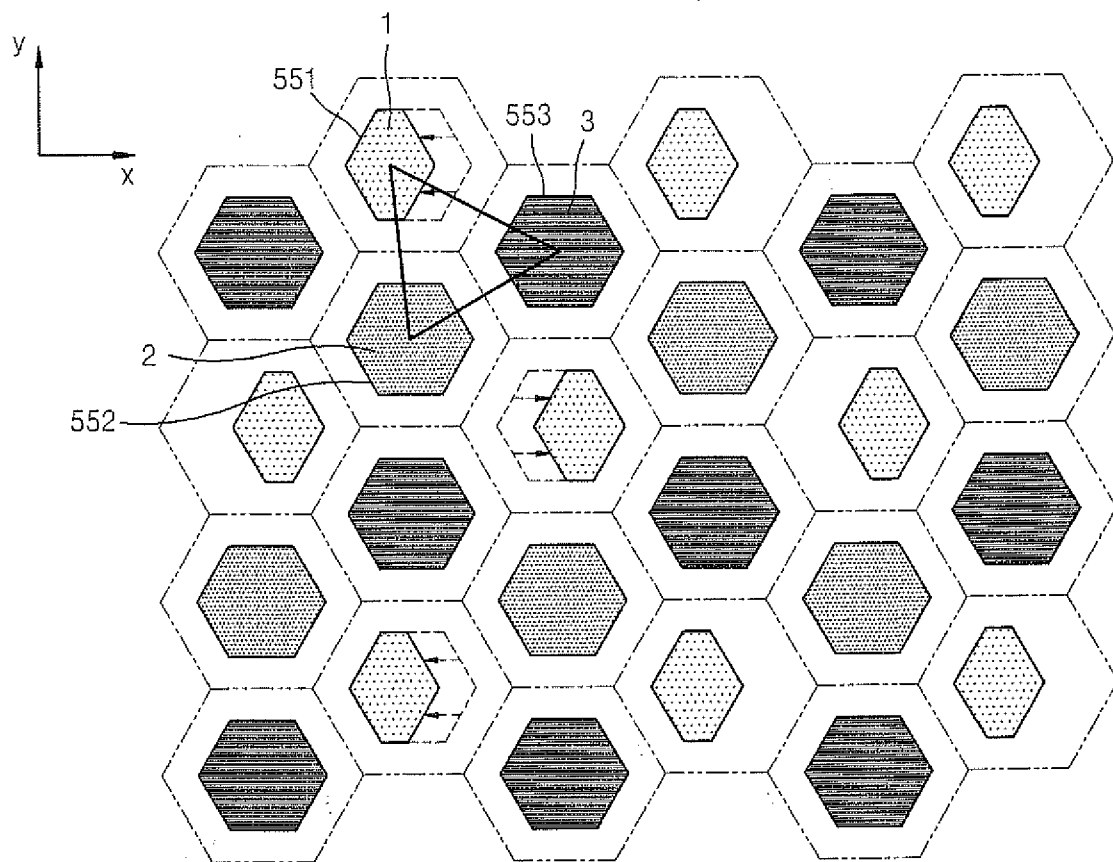


FIG. 2

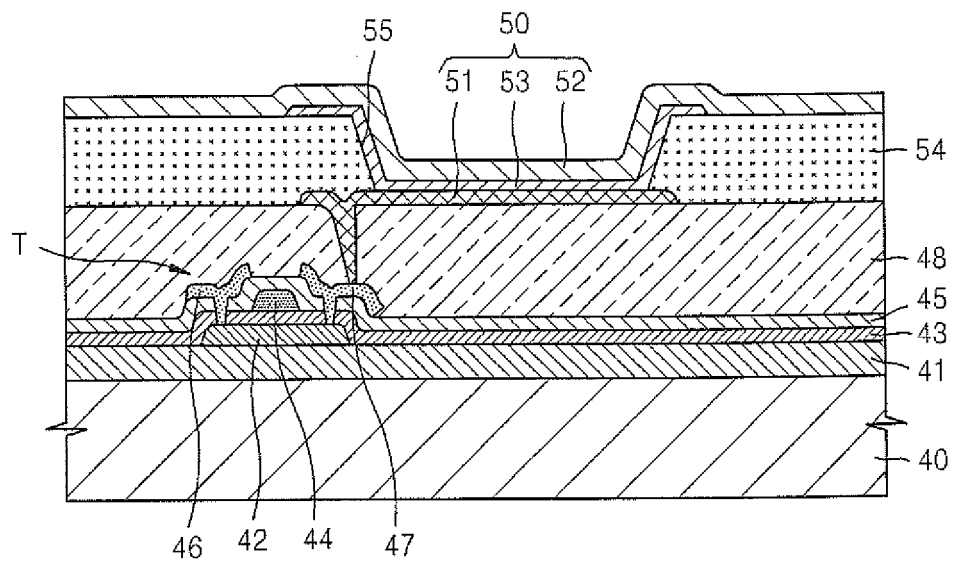


FIG. 3

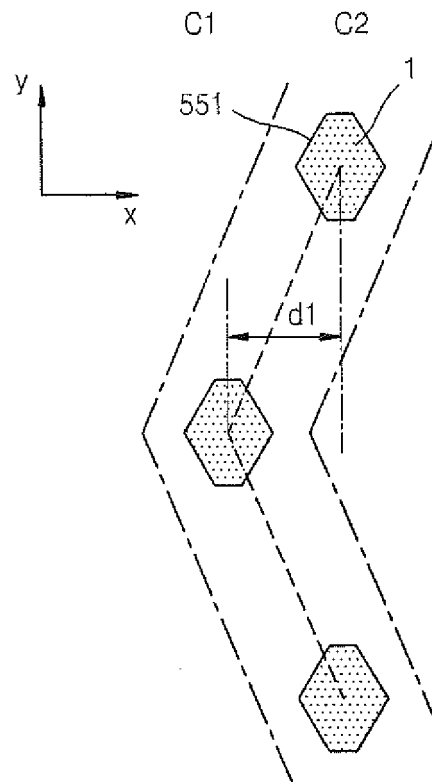


FIG. 4

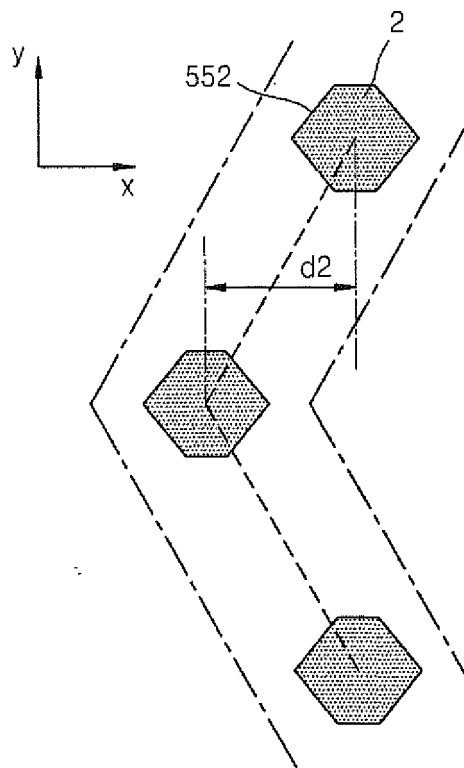


FIG. 5

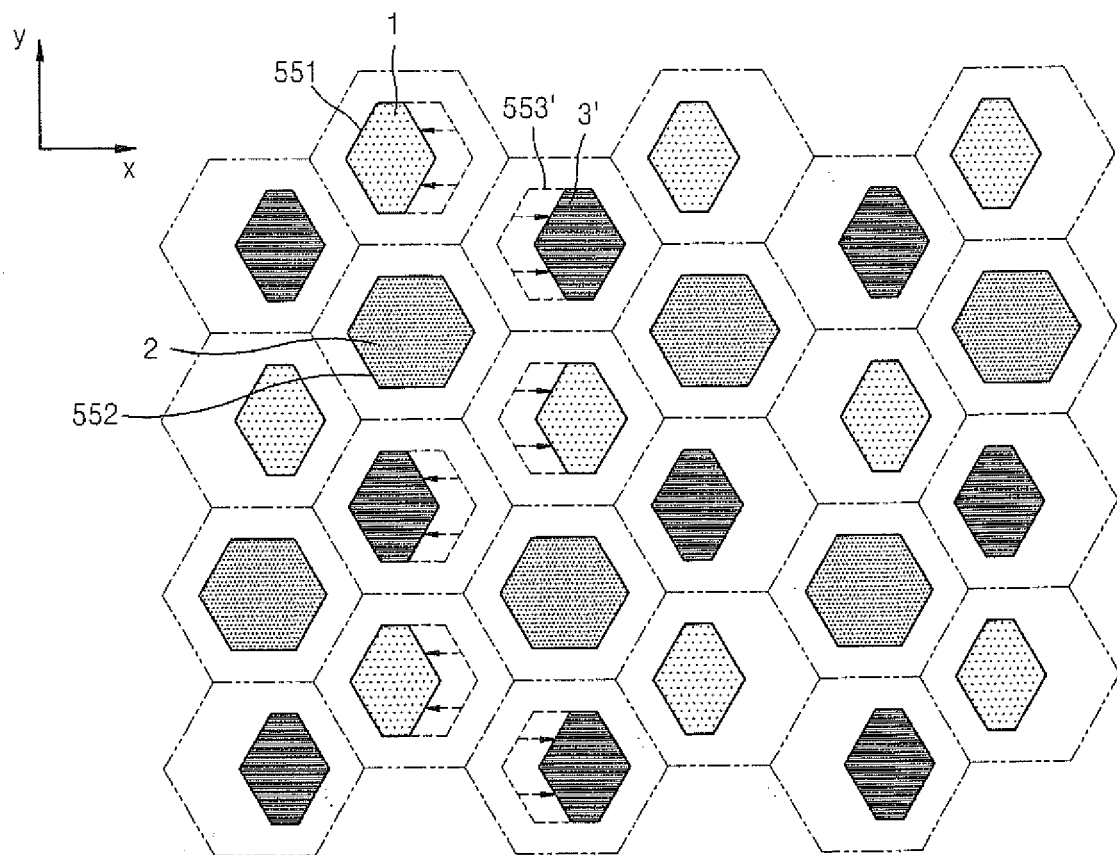
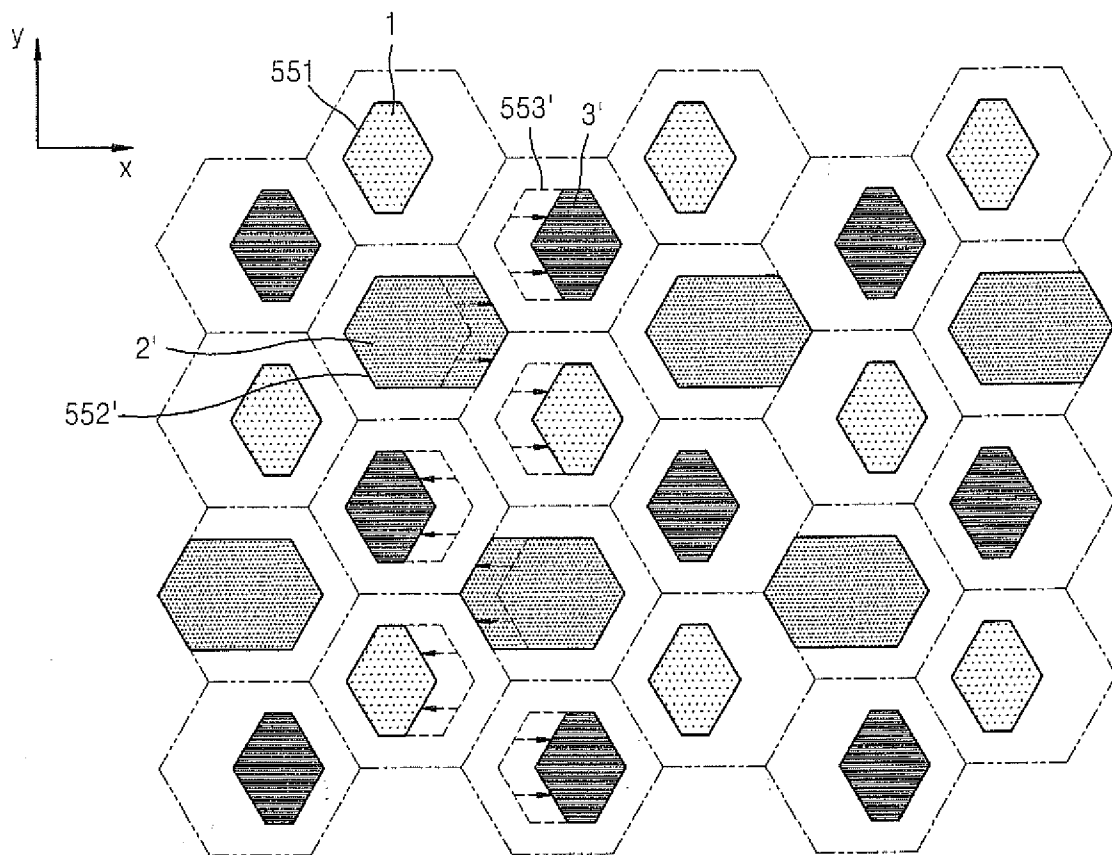


FIG. 6



REFERENCES CITED IN THE DESCRIPTION

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专利名称(译)	有机发光显示装置		
公开(公告)号	EP2595192B1	公开(公告)日	2016-05-18
申请号	EP2012169499	申请日	2012-05-25
[标]申请(专利权)人(译)	三星显示有限公司		
申请(专利权)人(译)	三星DISPLAY CO. , LTD.		
当前申请(专利权)人(译)	三星DISPLAY CO. , LTD.		
[标]发明人	KO JUNG WOO		
发明人	KO, JUNG-WOO		
IPC分类号	H01L27/32		
CPC分类号	G09G3/3208 G09G2300/0452 H01L27/3216 H01L27/3218 H05B33/02 H01L51/5203 H01L2251/5315		
优先权	1020110065141 2011-06-30 KR		
其他公开文献	EP2595192A2 EP2595192A3		
外部链接	Espacenet		

摘要(译)

一种有机发光显示装置，包括以大致六边形结构布置的多个子像素，每个子像素包括多个有机发光装置中的对应的一个，其中，所述多个子像素包括：用于发射第一颜色光的多个第一子像素，用于发射第二颜色光的多个第二子像素，以及用于发射第三颜色光的多个第三子像素，并且其中相邻的中心第一，第二和第三子像素中的一些形成三角形，该三角形具有三个边中的一个，该边比另外两个边短。

FIG. 1

