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(54) **ORGANIC LIGHT EMITTING DISPLAY APPARATUS AND THIN FILM DEPOSITION MASK FOR MANUFACTURING THE SAME**

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**C23C 14/04** (2006.01)  
**H01L 51/00** (2006.01)

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CPC ..... **H01L 27/3223** (2013.01); **C23C 14/042** (2013.01); **H01L 51/0011** (2013.01)

(58) **Field of Classification Search**  
CPC ..... H01L 27/3223  
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

|              |      |        |            |       |              |
|--------------|------|--------|------------|-------|--------------|
| 2003/0137242 | A1 * | 7/2003 | Seki       | ..... | H01L 27/3246 |
|              |      |        |            |       | 313/506      |
| 2004/0124781 | A1   | 7/2004 | Bae et al. |       |              |
| 2005/0194893 | A1 * | 9/2005 | Lee        | ..... | H01L 51/0005 |
|              |      |        |            |       | 313/504      |
| 2010/0003812 | A1   | 1/2010 | Eldershaw  |       |              |
| 2010/0013853 | A1   | 1/2010 | Takatori   |       |              |
| 2015/0129851 | A1 * | 5/2015 | Lee        | ..... | H01L 51/5262 |
|              |      |        |            |       | 257/40       |

FOREIGN PATENT DOCUMENTS

|    |             |   |         |
|----|-------------|---|---------|
| CN | 1514679     | A | 7/2004  |
| CN | 101097910   | A | 1/2008  |
| CN | 101442068   | A | 5/2009  |
| CN | 101577071   | A | 11/2009 |
| JP | 2000-150344 | A | 5/2000  |

\* cited by examiner

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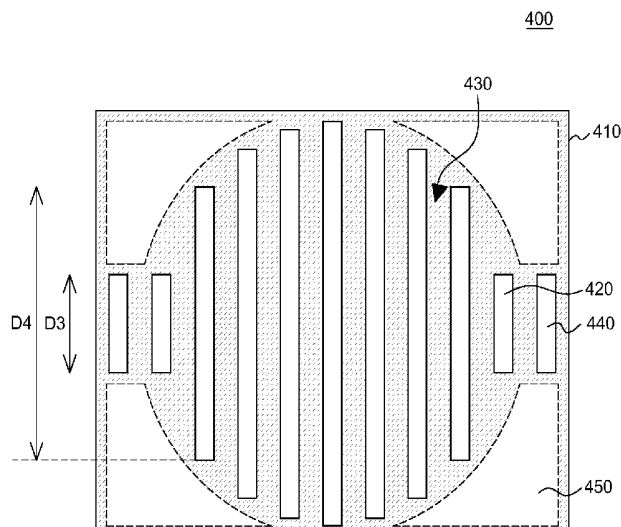
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(57) **ABSTRACT**

Provided is an organic light emitting display apparatus. The organic light emitting display apparatus includes a substrate having a light emitting area and a bezel area surrounding the light emitting area; and an organic light emitting element. The organic light emitting element includes an organic layer disposed in a plurality of columns in the light emitting area on the substrate. Each of the plurality of columns includes a different number of pixels disposed therein. The organic layer corresponds to the plurality of columns.

**13 Claims, 6 Drawing Sheets**



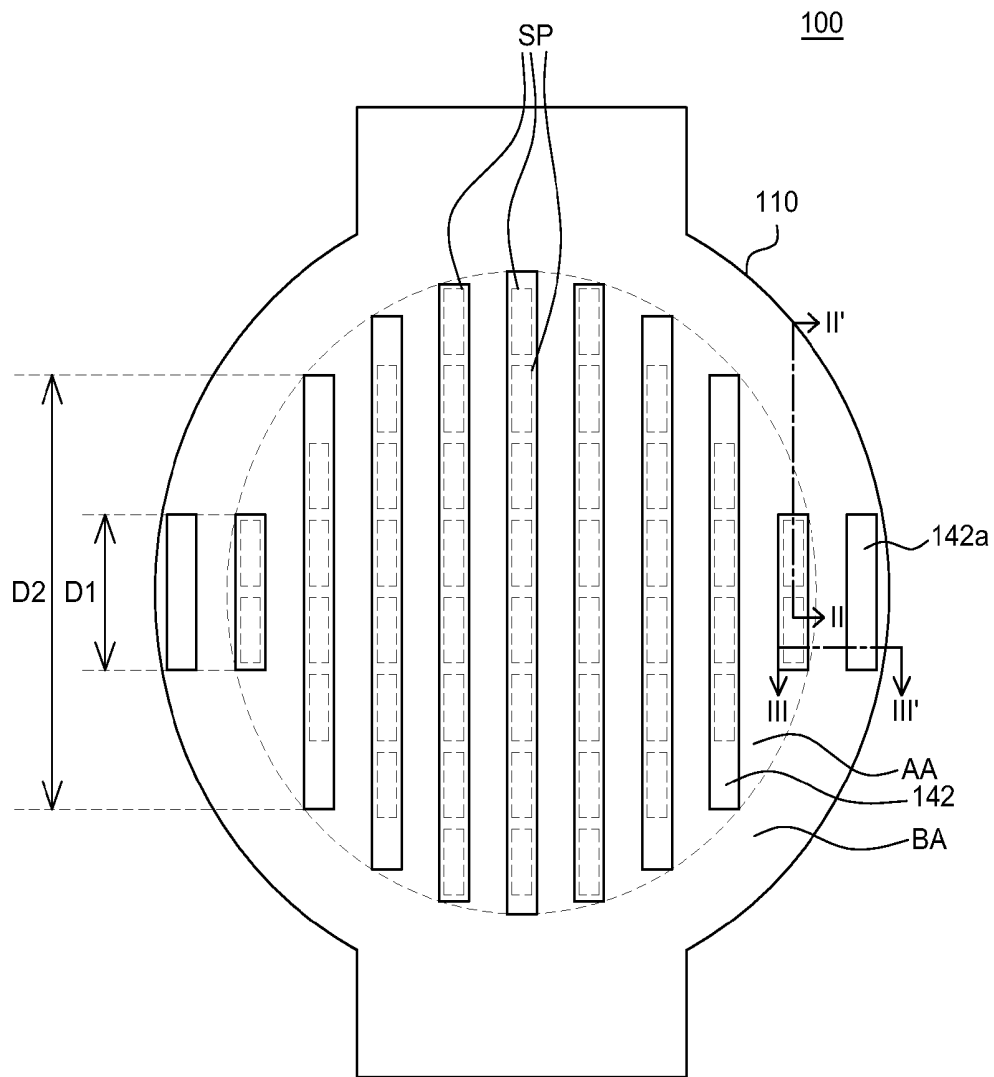


FIG. 1

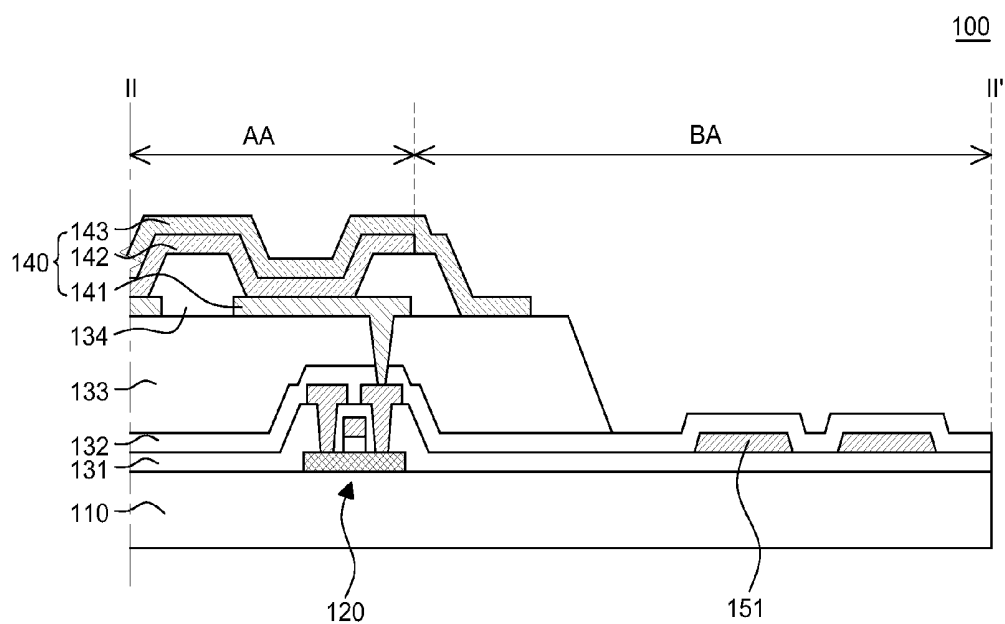


FIG. 2

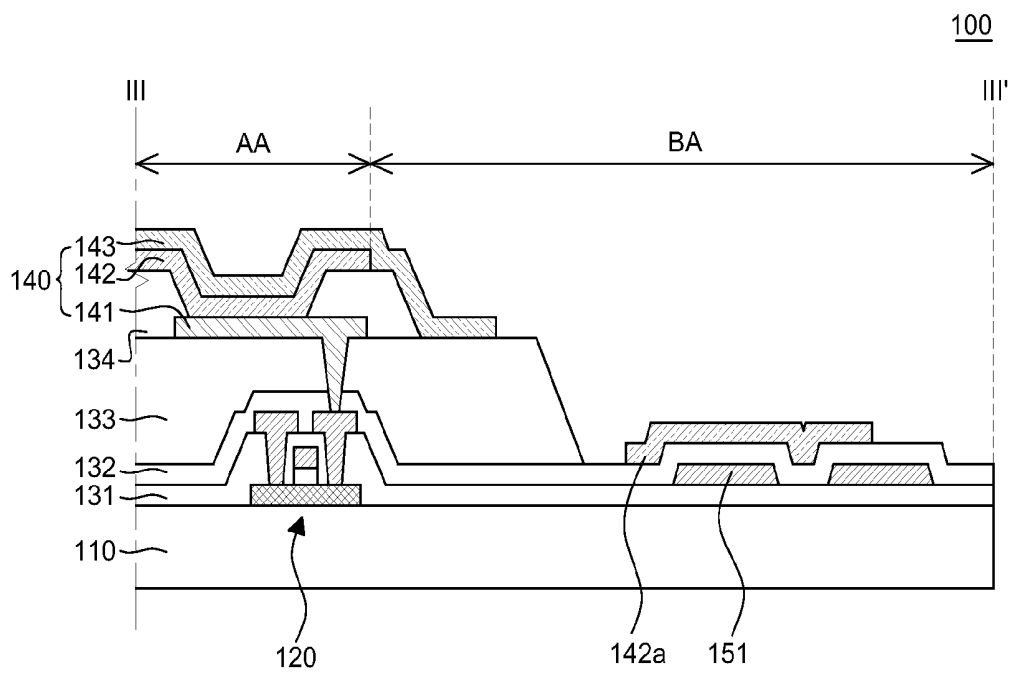


FIG. 3

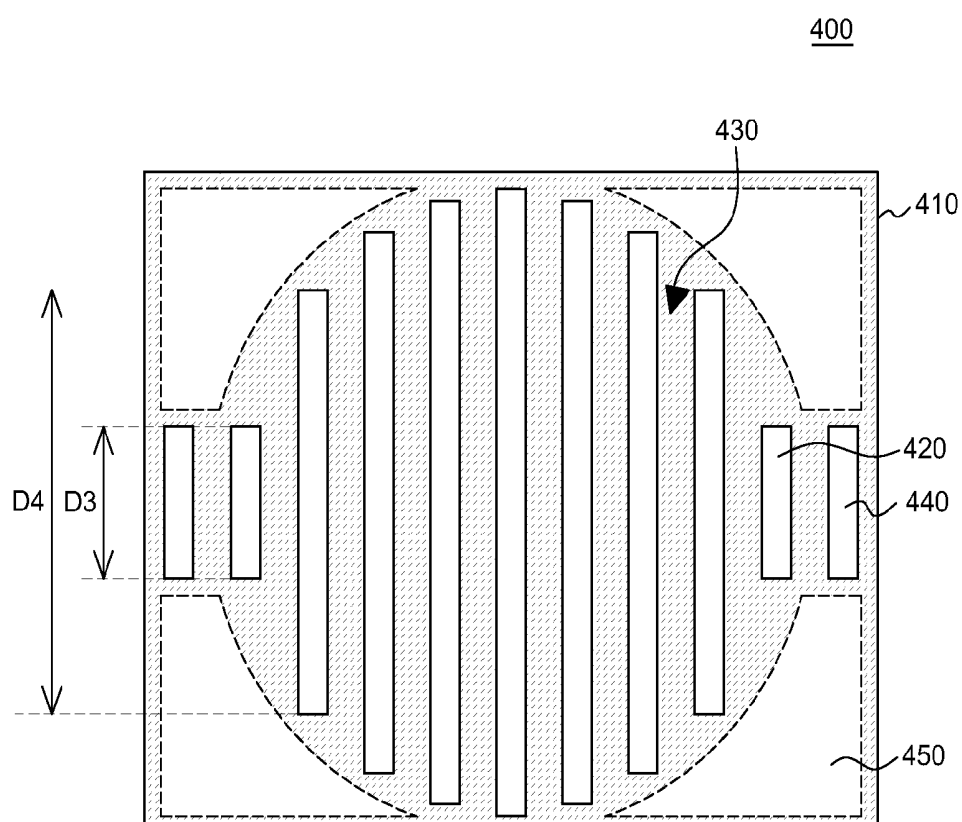


FIG. 4

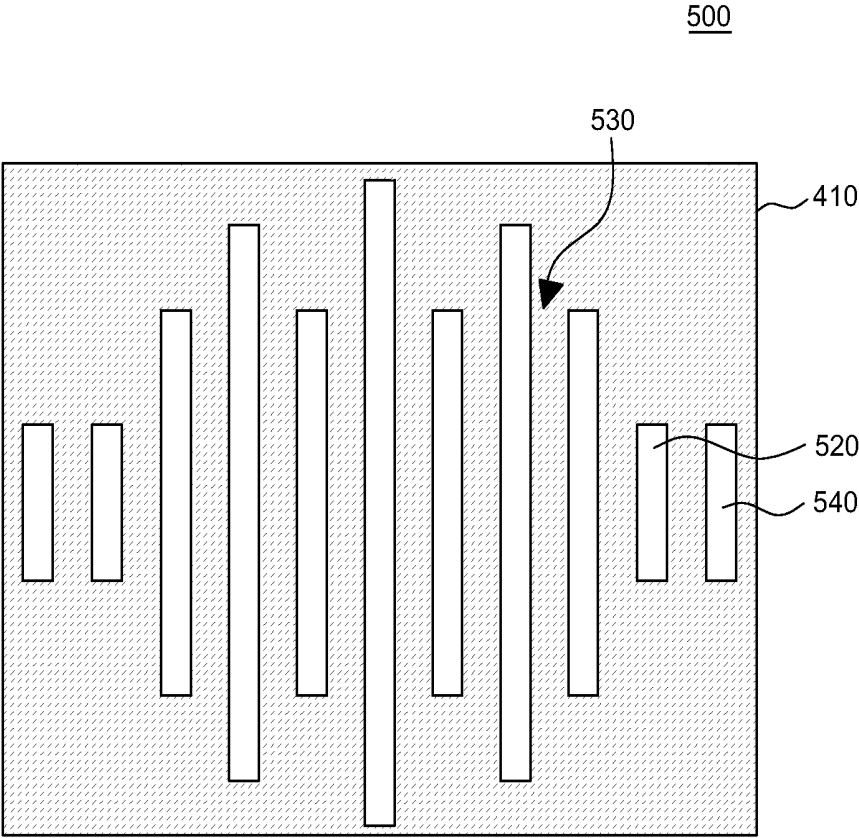


FIG. 5

600

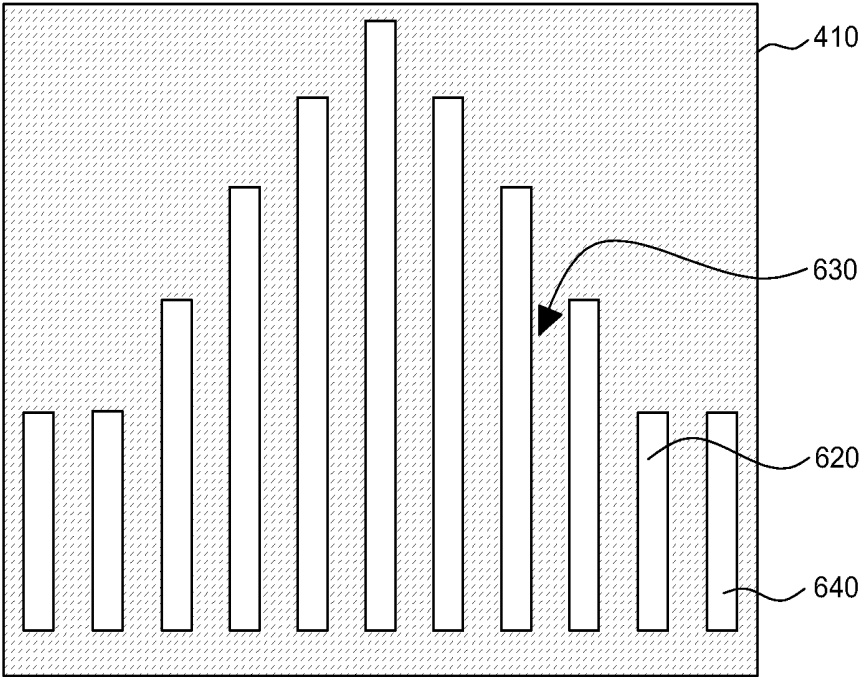


FIG. 6

# ORGANIC LIGHT EMITTING DISPLAY APPARATUS AND THIN FILM DEPOSITION MASK FOR MANUFACTURING THE SAME

## CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the priority of Korean Patent Application No. 2014-0175061 filed on Dec. 8, 2014, in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference.

## BACKGROUND OF THE INVENTION

### Field of the Invention

The present disclosure relates to an organic light emitting display apparatus and a thin film deposition mask for manufacturing the same. More particularly, the present disclosure relates to organic light emitting display apparatuses of various shapes and a thin film deposition mask for manufacturing the same.

### Description of the Related Art

In order to manufacture electronic devices of various shapes, display apparatuses having various shapes have been developed. Particularly, an organic light emitting display (OLED) apparatus is a self-light emitting display apparatus that does not need a separate light source, unlike a liquid crystal display (LCD) apparatus. Thus, the organic light emitting display apparatus can be easily manufactured into various shapes. Further, the organic light emitting display apparatus can be manufactured into a lightweight and slim profile, as compared with the liquid crystal display apparatus. Therefore, the organic light emitting display apparatus has an advantage of being applied to electronic devices of various shapes.

Further, the organic light emitting display apparatus is advantageous in terms of power consumption since it is driven with a low voltage. Also, the organic light emitting display apparatus has a high response speed, a wide viewing angle, and a high contrast ratio.

An organic layer configured to emit light in an organic light emitting display apparatus is made of an organic material. Further, the organic layer is formed on a substrate of the organic light emitting display apparatus by various methods. As a method for forming an organic material, there may be employed a method of using a metal mask having high durability and strength in order to form an organic layer of a desired shape in a short time.

In order to manufacture organic light emitting display apparatuses of various shapes other than a rectangular shape, a metal mask including a slit for forming an organic layer of a desired shape is needed. However, a size and a position of the slit of the metal mask may be changed from those of a conventional rectangular structure in order to have various shapes. In this case, there is a problem of a considerable decrease in thickness uniformity of the organic layer.

## SUMMARY OF THE INVENTION

An organic light emitting display apparatus of the prior art has a rectangular shape. Thus, pixels are disposed as a plurality of columns having the same length. However, in organic light emitting display apparatuses of various other

shapes, for example, a circular organic light emitting display apparatus, pixels are disposed as a plurality of columns having different lengths.

In order to form an organic layer into a plurality of columns, a method of using a mask including slits having the same length and that is used to manufacture a rectangular organic light emitting display apparatus may be used. Further, a method of using a mask including slits corresponding to the plurality of columns may be used.

If the mask including the slits having the same length is used, an organic layer may be formed to have uniform thickness. Further, the organic layer can be universally applied to organic light emitting display apparatuses of various shapes. However, a material of the thus formed organic layer may be additionally formed on an unwanted area.

If the material of the organic layer is additionally formed on the unwanted area, a current passing through the organic layer may leak to the additionally formed material of the organic layer. Further, conductive materials may be short-circuited by conductive materials of the organic layer.

If the mask including the slits corresponding to the plurality of columns is used, an organic layer may be formed on a wanted area. However, there may be a decrease in thickness uniformity of the organic layer. In particular, if adjacent slits have different lengths, there may be a decrease in thickness uniformity of an organic layer formed through a longer slit.

An object to be achieved by the present disclosure is to provide a non-rectangular organic light emitting display apparatus and a thin film deposition mask for manufacturing the same. In the organic light emitting display apparatus, formation of a material of an organic layer on an unwanted area is minimized and also, the organic layer has a high thickness uniformity.

The objects of the present disclosure are not limited to the aforementioned objects, and other objects, which are not mentioned above, will be apparent to a person having ordinary skill in the art from the following description.

According to an aspect of the present disclosure, there is provided an organic light emitting display apparatus. The organic light emitting display apparatus includes: a substrate including a light emitting area and a bezel area surrounding the light emitting area; and an organic light emitting element. The organic light emitting element includes an organic layer and is disposed in a plurality of columns in the light emitting area on the substrate. Each of the plurality of columns includes a different number of pixels disposed therein. The organic layer is disposed to correspond to the plurality of columns.

According to another feature of the present disclosure, the organic light emitting display apparatus further includes a dummy organic layer. The dummy organic layer is disposed parallel to the plurality of columns and has the same length as an organic layer in the outermost column of the plurality of columns.

According to yet another feature of the present disclosure, the dummy organic layer is formed of the same material as the organic layer.

According to still another feature of the present disclosure, the dummy organic layer is on both sides of the organic layer in the outermost column.

According to still another feature of the present disclosure, the plurality of columns is disposed such that the number of the pixels is increased toward the plurality of columns at center.

According to still another feature of the present disclosure, the light emitting area has a circular shape.

According to still another feature of the present disclosure, the light emitting area has a polygonal shape.

According to another aspect of the present disclosure, there is provided a thin film deposition mask. The thin film deposition mask includes: a base; and a slit portion. The slit portion includes a plurality of slits penetrating the base, having different lengths, and formed in parallel to each other.

According to another feature of the present disclosure, the slit portion further includes at least one dummy slit which is parallel to the plurality of slits and has the same length as the outermost slit of the plurality of slits.

According to yet another feature of the present disclosure, the at least one dummy slit is on both sides of the plurality of slits.

According to still another feature of the present disclosure, the plurality of slits is disposed such that lengths of the plurality of slits are increased toward the plurality of slits at a center.

According to still another feature of the present disclosure, the slit portion has a circular shape.

According to still another feature of the present disclosure, the slit portion has a polygonal shape.

According to still another feature of the present disclosure, the thin film deposition mask further includes a buffer adjacent to the slit portion.

By using a thin film deposition mask of the present disclosure, it is possible to realize uniform thickness of an organic layer in non-rectangular organic light emitting display apparatuses of various shapes. Accordingly, it is possible to provide an organic light emitting display apparatus improved in reliability.

The effects of the present disclosure are not limited to the aforementioned effects, and other various effects are included in the present specification.

### BRIEF DESCRIPTION OF THE DRAWINGS

The above and other aspects, features and other advantages of the present disclosure will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a schematic plan view of an organic light emitting display apparatus according to an exemplary embodiment of the present disclosure;

FIG. 2 is a schematic cross-sectional view of the organic light emitting display apparatus taken along a line II-II' of FIG. 1;

FIG. 3 is a schematic cross-sectional view of the organic light emitting display apparatus taken along a line III-III' of FIG. 1;

FIG. 4 is a schematic plan view of a thin film deposition mask for manufacturing an organic light emitting display apparatus according to an exemplary embodiment of the present disclosure; and

FIG. 5 and FIG. 6 are schematic plan views of thin film deposition masks for manufacturing an organic light emitting display apparatus according to various exemplary embodiments of the present disclosure.

### DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

Advantages and features of the present disclosure, and methods for accomplishing the same will be more clearly understood from exemplary embodiments described below

with reference to the accompanying drawings. However, the present disclosure is not limited to the following exemplary embodiments but may be implemented in various different forms. The exemplary embodiments are provided only to complete disclosure of the present disclosure and to fully provide a person having ordinary skill in the art to which the present disclosure pertains with the category of the disclosure, and the present disclosure will be defined by the appended claims.

The shapes, sizes, ratios, angles, numbers, and the like illustrated in the accompanying drawings for describing the exemplary embodiments of the present disclosure are merely examples, and the present disclosure is not limited thereto. Like reference numerals generally denote like elements throughout the present specification. Further, in the following description, a detailed explanation of known related technologies may be omitted to avoid unnecessarily obscuring the subject matter of the present disclosure. The terms such as "including," "having," and "consist of" used herein are generally intended to allow other components to be added unless the terms are used with the term "only". Any references to singular may include plural unless expressly stated otherwise.

Components are interpreted to include an ordinary error range even if not expressly stated.

When the position relation between two parts is described using the terms such as "on", "above", "below", and "next", one or more parts may be positioned between the two parts unless the terms are used with the term "immediately" or "directly" is not used.

When an element or layer is referred to as being "on" another element or layer, it may be directly on the other element or layer, or intervening elements or layers may be present.

Although the terms "first", "second", and the like are used for describing various components, these components are not confined by these terms. These terms are merely used for distinguishing one component from the other components. Therefore, a first component to be mentioned below may be a second component in a technical concept of the present disclosure.

Throughout the whole specification, the same reference numerals denote the same elements.

Since size and thickness of each component illustrated in the drawings are represented for convenience in explanation, the present disclosure is not necessarily limited to the illustrated size and thickness of each component.

The features of various embodiments of the present disclosure can be partially or entirely bonded to or combined with each other and can be interlocked and operated in technically various ways, and the embodiments can be carried out independently of or in association with each other.

Hereinafter, various exemplary embodiments of the present disclosure will be described in detail with reference to the accompanying drawings.

FIG. 1 is a schematic plan view of an organic light emitting display apparatus according to an exemplary embodiment of the present disclosure. FIG. 2 is a schematic cross-sectional view of the organic light emitting display apparatus taken along a line II-II' of FIG. 1. FIG. 3 is a schematic cross-sectional view of the organic light emitting display apparatus taken along a line III-III' of FIG. 1. For convenience in explanation, FIG. 1 illustrates only a part of an organic layer 142 and a dummy organic layer 142a on a substrate 110. Referring to FIG. 1 to FIG. 3, an organic light emitting display apparatus 100 includes the substrate 110, a

thin film transistor **120**, and an overcoat layer **133**. The organic light emitting display apparatus **100** further includes an organic light emitting element **140** including the organic layer **142**, the dummy organic layer **142a**, and a wiring **151**.

The organic light emitting display apparatus **100** is a top emission type in which light emitted from the organic layer **142** is released toward an upper side of the substrate **110** on which the thin film transistor **120** is formed.

The substrate **110** supports various elements formed on the substrate **110**. Referring to FIG. 1, the substrate **110** has a partially circular shape when viewed from above. FIG. 1 illustrates the substrate **110** of the organic light emitting display apparatus **100** which can be applied to a watch-type electronic device, as an example, but is not limited thereto. The substrate **110** may have a fully circular shape or other various polygonal shapes instead of the partially circular shape.

Referring to FIG. 1 and FIG. 2, the substrate **110** includes a light emitting area **AA** and a bezel area **BA**. The light emitting area **AA** includes a plurality of sub-pixel areas **SP** where the organic light emitting element **140** is formed. The light emitting area **AA** is defined by the formed organic layer **142**. To explain the organic layer **142** formed by using a thin film deposition mask according to an exemplary embodiment of the present disclosure, FIG. 1 illustrates deposition of the organic layer **142** of one color. That is, the plurality of sub-pixel areas **SP** illustrated in FIG. 1 is sub-pixel areas **SP** for one color. The bezel area **BA** is an area surrounding the light emitting area **AA** and formed along an outer edge of the substrate **110**. Further, in the bezel area **BA**, a circuit unit and the wiring **151** for driving the organic light emitting element **140** are disposed.

The substrate **110** may be formed of an insulating material. For example, the substrate **110** may be formed of a flexible material. The flexible material may include polyimide (PI), polyetherimide (PEI), polyethylene terephthalate (PET), polycarbonate (PC), polymethylmethacrylate (PMMA), polystyrene (PS), styrene acrylonitrile copolymer (SAN), silicon-acryl resin, and the like.

The thin film transistor **120** including an active layer, a gate electrode, a source electrode, and a drain electrode is formed on the substrate **110**. The gate electrode and the active layer are insulated by a gate insulation layer. The gate electrode, the source electrode and the drain electrode are insulated by an interlayer insulation layer **131**. The thin film transistor **120** is not limited thereto, and thin film transistors having various structures, for example, a coplanar structure or a bottom gate structure, may be used. The organic light emitting display apparatus **100** may include various wirings formed of the same material as the source electrode and the drain electrode, or the gate electrode.

A passivation layer **132** is formed on the thin film transistor **120** to cover an exposed part of the source electrode, drain electrode and active layer. The passivation layer **132** is configured to protect the constituent elements of the thin film transistor **120** from moisture or oxygen. Referring to FIG. 2, the passivation layer **132** is formed extending from the light emitting area **AA** toward the bezel area **EA**→**BA** of the substrate **110**. Further, the passivation layer **132** is formed on the entire surface of the substrate **110** to cover the wiring **151**.

The overcoat layer **133** is formed on the passivation layer **132**. The overcoat layer **133** includes a contact hole through which at least a part of the drain electrode or source electrode of the thin film transistor **120** is exposed. The organic light emitting element **140** including an anode **141**, the organic layer **142**, and a cathode **143** is formed on the

overcoat layer **133**. The anode **141** is connected with the source electrode or drain electrode of the thin film transistor **120** through the contact hole of the overcoat layer **133**. A bank **134** is disposed on both sides of the anode **141**. The bank **134** is formed in a tapered shape.

The organic layer **142** is a layer for emitting light and thus formed of an organic light emitting material for emitting light. The organic layer **142** is not limited thereto, and may be formed of materials for emitting lights of various colors. Referring to FIG. 1, the organic layer **142** is formed within the light emitting area **AA**.

Referring to FIG. 1, the organic layer **142** is disposed as a plurality of columns having different lengths within the light emitting area **AA**. A length **D1** of the outermost column of the plurality of columns is smaller than a length **D2** of its adjacent column. In each of the plurality of columns, pixels are disposed. The number of the disposed pixels varies depending on a length of the column. The pixels are disposed such that the number of pixels is increased toward the plurality of columns at center. Therefore, the lengths of the plurality of columns are gradually increased. Further, a line connecting the outer periphery of the organic layer **142** has a substantially circular shape. The light emitting area **AA** is also defined as a circular shape corresponding to the area of the organic layer **142**.

FIG. 2 is a cross-sectional view of the organic layer **142** of the organic light emitting display apparatus **100** cut along a longitudinal direction. Referring to FIG. 2, the organic layer **142** is disposed over a plurality of anodes **141**. Further, the organic layer **142** is formed to an end portion of the light emitting area **AA**.

If a thin film deposition mask including slits having the same length is used according to the prior art, a material of an organic layer may be formed beyond the light emitting area **AA** and thus may be formed on the bezel area **BA**. The material of the organic layer formed on the bezel area **BA** may connect conductive materials such as a VSS wiring and the cathode or form a current leakage path from the organic layer. Therefore, the material of the organic layer formed on the bezel area **BA** may deteriorate reliability of an organic light emitting display apparatus.

However, the organic layer **142** of the organic light emitting display apparatus **100** according to an exemplary embodiment of the present disclosure is formed by using a thin film deposition mask including slits having different lengths. Therefore, the organic layer **142** can be formed only on a target area. Since it is possible to avoid problems caused by extra material of the organic layer **142**, reliability of the non-rectangular organic light emitting display apparatus **100** can be improved.

Further, the organic light emitting display apparatus **100** includes the dummy organic layer **142a** adjacent to the outermost column of the plurality of columns. The dummy organic layer **142a** is a structure provided by the thin film deposition mask according to an exemplary embodiment of the present disclosure. The dummy organic layer **142a** is provided to form the organic layer **142** to have uniform thickness on the entire surface of the substrate **110**. The dummy organic layer **142a** is disposed parallel to the organic layer **142**. The dummy organic layer **142a** has the same length **D1** as the organic layer **142** in the outermost column. The dummy organic layer **142a** is disposed on both sides of the organic layer **142** in the outermost column.

FIG. 3 is a cross-sectional view of the organic light emitting display apparatus **100** cut along a perpendicular direction to the longitudinal direction of the organic layer **142**. The dummy organic layer **142a** formed parallel to the

organic layer **142** may be disposed in the bezel area BA. FIG. 3 illustrates that the dummy organic layer **142a** is disposed on the passivation layer **132**, but is not limited thereto. The dummy organic layer **142a** may be disposed on the overcoat layer **133** and may be partially in contact with the cathode **143**. However, the dummy organic layer **142a** is not disposed in an area where the cathode **143** is connected with the VSS wiring. Further, FIG. 1 illustrates the dummy organic layer **142a** as a single column, but is not limited thereto. The dummy organic layer **142a** may be formed into a plurality of columns. The dummy organic layer **142a** may have different thickness from that of the organic layer **142**.

The dummy organic layer **142a** functions as a stabilization layer at the initial stage of forming organic layer **142** in order to form a uniform thickness. The dummy organic layer **142a** is formed prior to forming the organic layer **142** within the light emitting area AA. Then, the organic layer **142** is formed in sequence from the outermost column to the center column. Therefore, the organic layer **142** in the outermost column has relatively uniform thickness compared to the case in which the dummy organic layer **142a** that is formed at the initial stage of a forming process is absent. In the non-rectangular organic light emitting display apparatus **100** according to an exemplary embodiment of the present disclosure, it is possible to realize the organic layer **142** having more uniform thickness by using the dummy organic layer **142a**.

The cathode **143** is formed on the organic layer **142**. If the organic light emitting display apparatus **100** is of a top emission type, the cathode **143** is formed of a very thin metal material or transparent conductive oxide (TCO) having a low work function. If the cathode **143** is formed of a metal material, the cathode **143** has a thickness of several hundred Å or less. If the cathode **143** has such thickness, the cathode **143** becomes a substantially semi-transparent layer and thus becomes a substantially transparent layer.

An encapsulation part may be formed on the organic light emitting element **140**. The encapsulation part may have a thin film encapsulation structure in which an organic material layer and an inorganic material layer are alternately laminated. In the thin film encapsulation structure, the inorganic material layer protects the organic light emitting element **140** from moisture, air or physical shock which may be infiltrated from the outside. The organic material layer is configured to cover impurities or particles which may be produced during a process.

FIG. 1 illustrates the organic light emitting display apparatus **100** as a top emission organic light emitting display apparatus **100**, but is not limited thereto. The organic light emitting display apparatus **100** may be a bottom emission type in which light emitted from an organic layer is released toward a substrate on which a thin film transistor is formed.

FIG. 4 is a schematic plan view of a thin film deposition mask for manufacturing an organic light emitting display apparatus according to an exemplary embodiment of the present disclosure. A thin film deposition mask **400** is a mask used in a process for depositing the organic layer **142** of the organic light emitting display apparatus **100** described above with reference to FIG. 1 to FIG. 3. The process using the thin film deposition mask **400** is not particularly limited as long as a material of an organic layer is deposited in sequence from one side of the mask.

Referring to FIG. 4, the thin film deposition mask **400** includes a base **410** and a slit portion. The base **410** may be formed of nickel, a nickel alloy, or other metals. The slit portion includes a plurality of slits **420** penetrating the base **410**, having different lengths D3 and D4, and formed in

parallel to each other. A rib **430** is formed between the slits **420**. A length of the rib **430** may vary depending on a length of the slit **420**. The plurality of slits **420** is disposed such that the lengths of the slits **420** are increased toward the plurality of slits at center. Further, a line connecting the plurality of slits **420** has a circular shape, and the slit portion may have a circular shape when viewed from above.

Further, the slit portion includes at least one dummy slit **440** for forming a dummy organic material layer and improving thickness uniformity of the organic layer. The dummy slit **440** is parallel to the plurality of slits **420** and has the same length D3 as the outermost slit **420**. The dummy slit **440** is disposed on both sides of the plurality of slits **420**. That is, the plurality of slits **420** may be disposed symmetrically around the center.

A material of the organic layer may be first deposited through the dummy slit **440**. In this case, the material of the organic layer may not be deposited to the desired thickness. However, when an actual organic layer is deposited through the outermost slit **420** having the same length followed by the repeated dummy slits **440**, the process may be stabilized. Thus, it is possible to achieve uniform thickness of the organic light emitting display apparatus **100**.

Further, the thin film deposition mask **400** includes a buffer **450** disposed adjacent to the slit portion. The buffer **450** may be disposed in an area other than the slit portion, i.e., an area where the plurality of slits **420** is not disposed. The buffer **450** is a portion protruding from the base **410** of the thin film deposition mask **400**. The buffer **450** is configured to uniformly increase the widths of the plurality of slits **420** when the thin film deposition mask **400** is stretched before it is disposed for deposition of the organic layer. Accordingly, when the organic layer is formed, thickness uniformity of the organic layer and width uniformity between the columns can be further improved.

FIG. 5 and FIG. 6 are schematic plan views of thin film deposition masks for manufacturing an organic light emitting display apparatus according to various exemplary embodiments of the present disclosure. The bases **410** and ribs **530** and **630** of thin film deposition masks **500** and **600** illustrated in FIG. 5 and FIG. 6 are substantially the same as the base **410** and the rib **430** illustrated in FIG. 4. Therefore, redundant explanation thereof will be omitted. Further, although illustration of a buffer is omitted from FIG. 5 and FIG. 6, the buffer may be formed on the base **410** without limitation.

In order to manufacture organic light emitting display apparatuses of various shapes, the thin film deposition masks **500** and **600** may include slit portions of various shapes. The slit portions may include a plurality of slits **520** and **620** having different lengths and disposed in a desired pattern. Thus, an organic layer including a plurality of columns can be formed into various polygonal shapes.

Referring to FIG. 5, the plurality of slits **520** is generally increased but partially decreased in length from the outermost periphery toward the center. The slits have the greatest length at the center. Referring to FIG. 6, lower ends of the plurality of slits **620** are disposed side by side. Further, the plurality of slits **620** is increased in length from the outermost periphery toward the center. Since the slits **620** are disposed as such, an organic layer of a polygonal shape can be formed. Further, a thickness deviation of an organic layer can be minimized by using dummy slits **540** and **640**.

Although the exemplary embodiments of the present disclosure have been described in detail with reference to the accompanying drawings, the present disclosure is not limited thereto and may be embodied in many different forms

without departing from the technical concept of the present disclosure. Therefore, the exemplary embodiments of the present disclosure are provided for illustrative purposes only but not intended to limit the technical concept of the present disclosure. The scope of the technical concept of the present disclosure is not limited thereto. Therefore, it should be understood that the above-described exemplary embodiments are illustrative in all aspects and do not limit the present disclosure. The protective scope of the present disclosure should be construed based on the following claims, and all the technical concepts in the equivalent scope thereof should be construed as falling within the scope of the present disclosure.

What is claimed is:

1. An organic light emitting display apparatus, comprising:

a substrate including a light emitting area and a bezel area surrounding the light emitting area;  
 an organic light emitting element in the light emitting area on the substrate, the organic light emitting element including an organic layer arranged in a plurality of columns; and  
 a dummy organic layer positioned on both sides of the organic layer in an outermost column of the plurality of columns,  
 wherein the plurality of columns is disposed such that a number of the pixels disposed therein is increased toward the plurality of columns at center,  
 wherein the organic layer corresponds to the plurality of columns, and  
 wherein the dummy organic layer is adjacent to the outermost column and parallel to the organic layer in the outermost column, and has a same length as the organic layer in the outermost column.

2. The organic light emitting display apparatus of claim 1, wherein the dummy organic layer achieves uniform thickness for the organic layer.

3. The organic light emitting display apparatus of claim 2, wherein the dummy organic layer is a same material as the organic layer.

4. The organic light emitting display apparatus of claim 2, wherein the dummy organic layer is on an overcoat layer and partially in contact with a cathode.

5. The organic light emitting display apparatus of claim 1, wherein the dummy organic layer has different thickness from that of the organic layer.

6. The organic light emitting display apparatus of claim 1, wherein the light emitting area has a circular shape.

7. The organic light emitting display apparatus of claim 1, wherein the light emitting area has a polygonal shape.

8. The apparatus of claim 2, wherein the dummy organic layer contacts with a cathode disposed on the organic layer and is not disposed in an area where the cathode is connected with wiring so as to suppress current leakage.

9. An apparatus comprising:

a flexible substrate configured for an image display device;

a matrix of light emitting pixels on the substrate, said matrix having an overall non-rectangular shape with a first set of one or more pixel columns having a different length than a second set of one or more pixel columns; and

one or more columns of non-emitting dummy pixels adjacent to and along at least two opposing outer edge pixel columns of said matrix, and

wherein the lengths from the pixel columns at or near the center of the matrix sequentially decrease towards the pixel columns at an edge of the matrix,

a length of the columns of non-emitting dummy pixels is same as a length of the outer edge pixel columns.

10. The apparatus of claim 9, wherein said dummy pixels contain organic layers initially deposited to determine manufacturing stabilization in achieving uniform thickness for organic layers subsequently deposited in the pixel columns for light emitting pixels.

11. The apparatus of claim 10, wherein the columns of non-emitting dummy pixels are not disposed in an area where a cathode is connected with a VSS wiring.

12. The apparatus of claim 10, wherein said matrix has a circular edge and said flexible substrate is configured within a wearable electronic device.

13. The apparatus of claim 12, wherein said non-rectangular shape is the result of a manufacturing process employing a mask having slits or polygon-shaped openings used in depositing organic layers in the pixel columns on the substrate, said mask having a first set of one or more slits/openings having a different length than a second set of one or more slits/openings.

\* \* \* \* \*

|                |                                                    |         |            |
|----------------|----------------------------------------------------|---------|------------|
| 专利名称(译)        | 有机发光显示装置和用于制造该有机发光显示装置的薄膜沉积掩模                      |         |            |
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| 外部链接           | <a href="#">Espacenet</a> <a href="#">USPTO</a>    |         |            |

#### 摘要(译)

提供了一种有机发光显示设备。该有机发光显示设备包括：具有发光区域和围绕该发光区域的边框区域的基板；和有机发光元件。有机发光元件包括在基板上的发光区域中以多列布置的有机层。多个列中的每一列包括设置在其中的不同数量的像素。有机层对应于多个列。

