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Huang et al.

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(54) **METHOD OF DRIVING DUAL PIXEL OF ACTIVE MATRIX ORGANIC LIGHTING EMITTING DIODE DISPLAY**

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G09G 3/3233 (2016.01)
G09G 3/3225 (2016.01)

(52) **U.S. Cl.**
CPC ***G09G 3/3225*** (2013.01); ***G09G 3/3233*** (2013.01); *G09G 2300/0426* (2013.01); *G09G 2300/0443* (2013.01); *G09G 2300/0452* (2013.01); *G09G 2300/0465* (2013.01); *G09G 2300/0842* (2013.01); *G09G 2330/021* (2013.01)

(58) **Field of Classification Search**
CPC G09G 2330/021; G09G 2300/0452; G09G 2300/0426; G09G 3/32; G09G 3/3208; G09G 3/3233; G09G 3/3607; G09G 2300/0443
See application file for complete search history.

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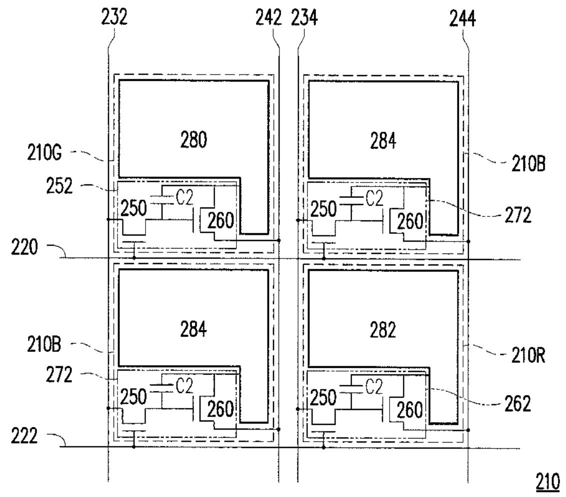
(57) **ABSTRACT**

A pixel array includes a plurality of pixels. Each pixel has a first sub-pixel, a second sub-pixel, and a pair of third sub-pixels. The first sub-pixel of each pixel and the first sub-pixels of three adjacent pixels are arranged in a two by two array, the second sub-pixel of each pixel and the second sub-pixels of three adjacent pixels are arranged in a two by two array, and one of each of the third sub-pixels of each pixel and one of the third sub-pixels of three adjacent pixels are arranged in a two by two array. A scan line is connected to a switch unit of each of the sub-pixels in a pixel.

6 Claims, 4 Drawing Sheets



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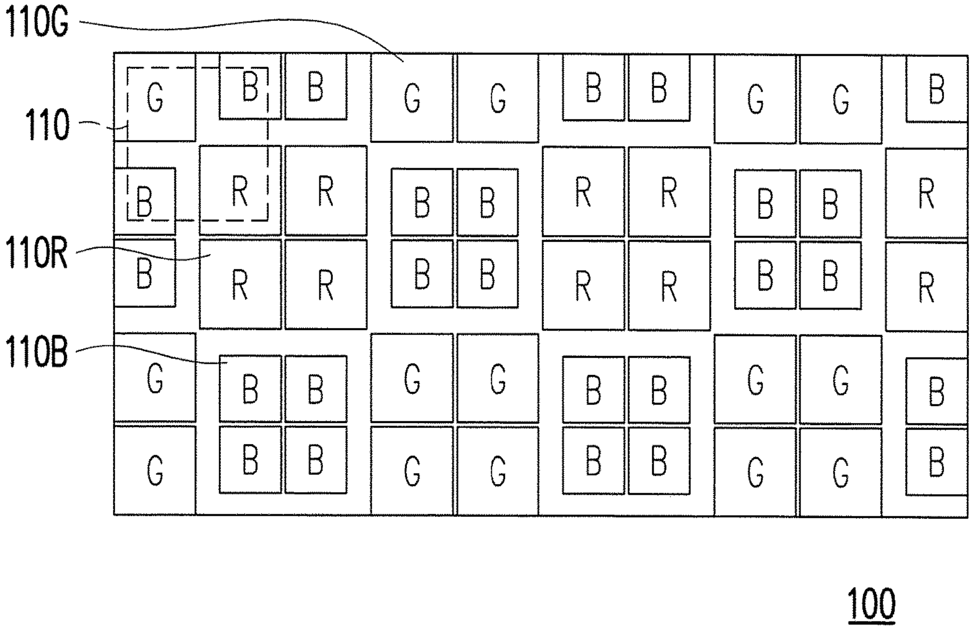
110G
110
110R
110B
G
B
B
G
G
B
B
G
G
B
B
R
R
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B
R
R
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G
B
100

FIG. 1

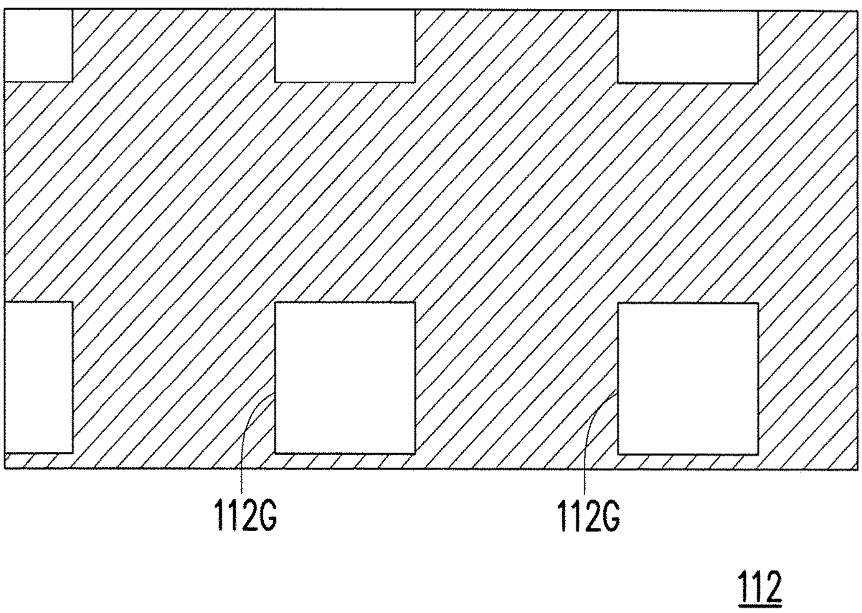
112G
112G
112

FIG. 2

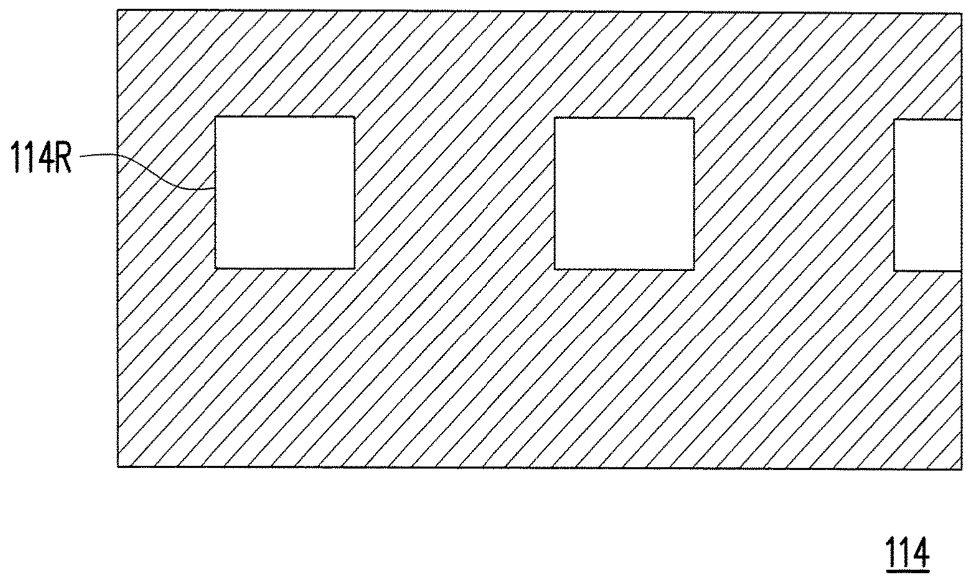

FIG. 3

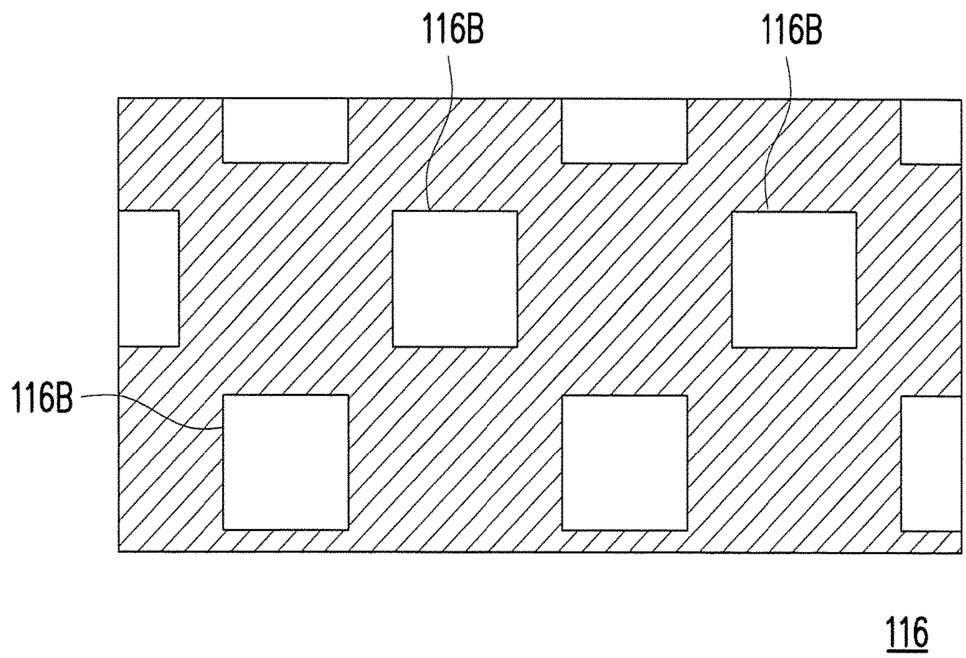

FIG. 4

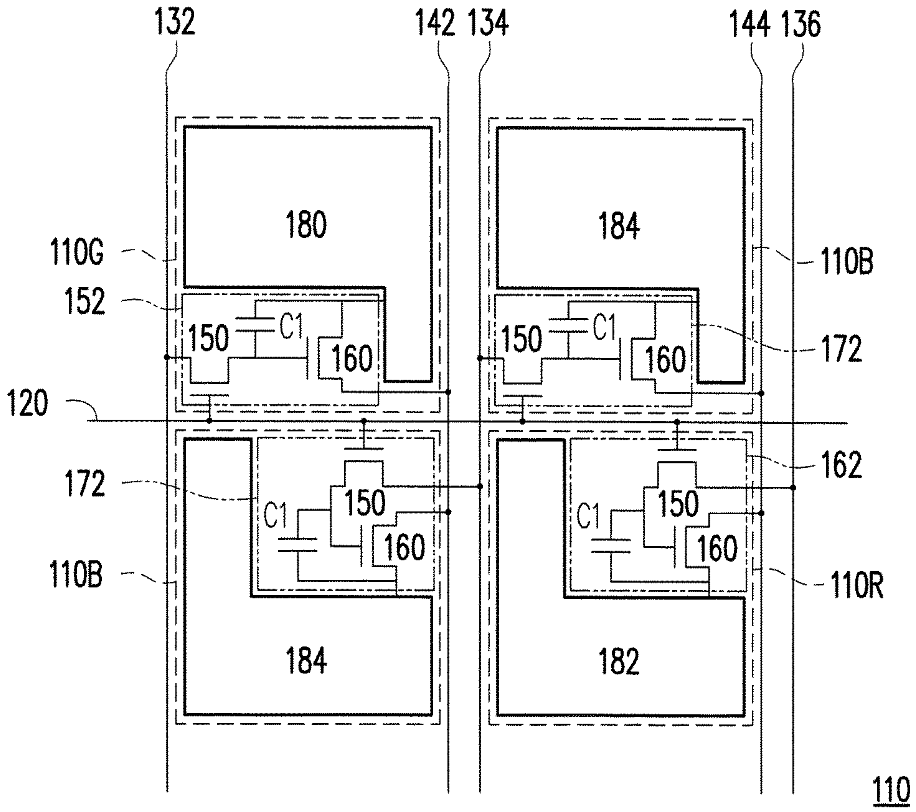
132
142
134
144
136
180
184
110G
110B
152
150
C1
160
172
120
162
184
182
110R
110

FIG. 5

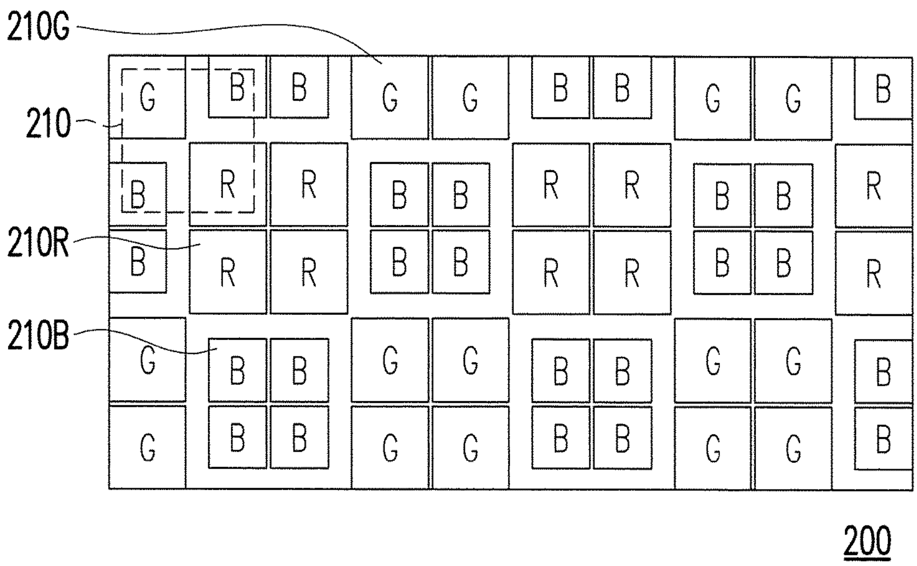
210G
210
210R
210B
G
B
R
200

FIG. 6

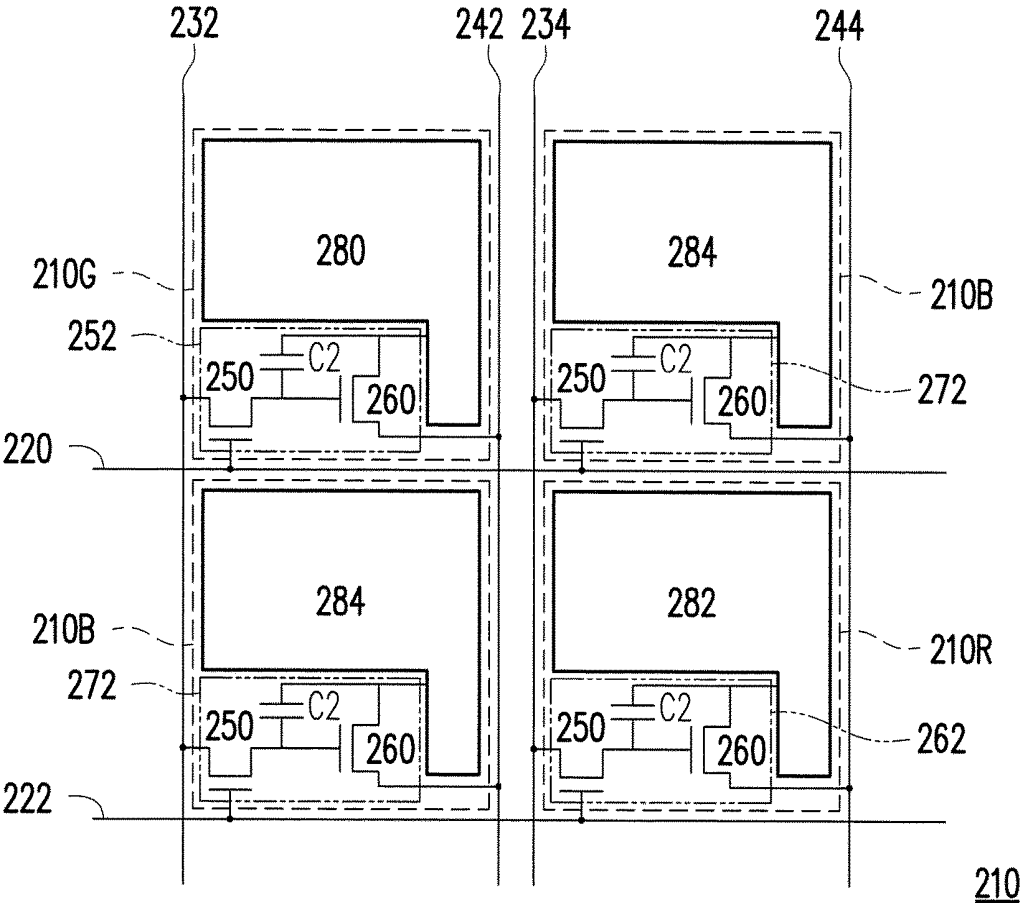
232
242
234
244
280
284
210G
210B
252
C2
250
260
272
220
284
282
210B
210R
272
262
222
210

FIG. 7

METHOD OF DRIVING DUAL PIXEL OF ACTIVE MATRIX ORGANIC LIGHTING EMITTING DIODE DISPLAY

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation application of and claims the priority benefit of U.S. application Ser. No. 14/831,134, filed on Aug. 20, 2015, now allowed. The entirety of the above-mentioned patent applications is hereby incorporated by reference herein and made a part of specification.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention generally relates to a pixel array of an active matrix organic lighting emitting display and a method of driving the same.

2. Description of Related Art

Active matrix organic light emitting diode displays, which have the advantages of absence of color filter, self-luminescence and low power consumption, is always viewed as the best candidate to substitute for the liquid crystal display and become the main display technology of the next generation.

In a conventional active matrix organic light emitting diode display, a pixel array has multiple pixels. Each pixel has a blue sub-pixel, a green sub-pixel, and a red sub-pixel. In the fabrication stage of the organic light emitting display of an active matrix organic light emitting display device, evaporation deposition process is used to fabricate the pixel array. A fine metal mask including vertical stripe openings is used for manufacturing the conventional organic light emitting diode display through an evaporation process of organic light emitting materials. The blue, green, and red sub-pixels are formed on a substrate by the evaporation process sequentially through the masks for each sub-pixel. This type of mask will form pixels composed of a blue sub-pixel, a green sub-pixel, and a red sub-pixel disposed adjacently along a horizontal direction. The evaporation process with conventional masks requires high precision. This is so-called a stripe type pixel arrangement.

Furthermore, in this conventional pixel array, a specific distance between the stripe openings is required for maintaining sufficient structural strength of the mask to avoid yield loss of the pixel array caused by process variations and low aligning precision of the manufacturing process. However, the distance between the stripe openings has to be shrunk for higher resolution demand about the pixel array. Therefore, the stripe openings in the fine metal mask (FMM) are physically limited. Problems such as complicated manufacturing process of the fine metal masks and worse stability of the organic light emitting material may become serious accordingly. In addition, the restrictions of the openings in the conventional fine metal masks will restrict the display quality of the active matrix organic light emitting diode display.

SUMMARY OF THE INVENTION

The invention is directed to a pixel array of an active matrix organic light emitting diode (OLED) display including a plurality of pixels. The pixels are arranged in an array. Each pixel is electrically connected with a scan line, a first data line, a second data line, a third data line between the first data line and the second data line, and a power source. The scan line is intersected with the first data line, the second data line and the third data line. Each pixel includes a first sub-pixel, a second sub-pixel and a pair of third sub-pixels. A first OLED of the first sub-pixel is electrically connected to the scan line, the first data line and the power source through a first driving circuit of the first sub-pixel. A second OLED of the second sub-pixel is electrically connected to the scan line, the second data line and the power source through a second driving circuit of the second sub-pixel. A third OLED of each third sub-pixel is electrically connected to the scan line, the third data line and the power source through a third driving circuit of the corresponding third sub-pixel. The first sub-pixel, the second sub-pixel, and the third sub-pixels in each pixel are arranged in a two by two array. The pair of third sub-pixels are arranged diagonally to each other, and the first sub-pixel and the second sub-pixel are arranged diagonally to each other. The first sub-pixel of each pixel and the first sub-pixels of three adjacent pixels are arranged in a two by two array, the second sub-pixel of each pixel and the second sub-pixels of three adjacent pixels are arranged in a two by two array, and one of each of the third sub-pixels of each pixel and one of the third sub-pixels of three adjacent pixels are arranged in a two by two array.

According to an embodiment of the invention, the first OLED emits a green light.

According to an embodiment of the invention, the second OLED emits a red light.

According to an embodiment of the invention, the third OLED emits a blue light.

According to an embodiment of the invention, each of the first driving circuit, the second driving circuit, and the third driving circuit includes a switch unit, a driving unit, and at least one capacitor electrically connected between the switch unit and the driving unit.

According to an embodiment of the invention, a method of driving each of the pixels in the pixel array includes writing data respectively to the first sub-pixel through the first data line, the second sub-pixel from the second data line, and the third sub-pixel through the third data line when an enabling signal is applied to the scan line.

The invention is directed to another pixel array of an active matrix organic light emitting diode (OLED) display including a plurality of pixels. The pixels are arranged in an array. Each pixel is electrically connected with a scan line, a first data line, a second data line, a third data line between the first data line and the second data line, and two power lines. The scan line is intersected with the first data line, the second data line and the third data line. The power lines and the data lines are parallel and alternately arranged. Each pixel includes a plurality of sub-pixels respectively as a first sub-pixel, a second sub-pixel, and a pair of third sub-pixels. The scan line is connected to a switch unit of each of the sub-pixels, the switch unit of the first sub-pixel is connected to the first data line, the switch unit of the second sub-pixel is connected to the second data line, and the switch units of the pair of third sub-pixels are connected to the third data line. Each power line is connected to the driving units of two sub-pixels in a same column of each pixel, and an OLED of each of the sub-pixels are electrically connected to the driving unit of each of the sub-pixels. The first sub-pixel, the second sub-pixel, and the third sub-pixels in each pixel are arranged in a two by two array, the pair of third sub-pixels are arranged diagonally to each other, and the first sub-pixel and the second sub-pixel are arranged diagonally to each other. The first sub-pixel of each pixel and the first sub-pixels of the three adjacent pixels are arranged in a two by two array, the second sub-pixel of each pixel and the second sub-pixels of the three adjacent pixels are arranged in a two by two may, and one of each of the third sub-pixels of each pixel and one of the third sub-pixels of the three adjacent pixels are arranged in a two by two array.

According to an embodiment of the invention, the OLED of the first sub-pixel emits a green light.

According to an embodiment of the invention, the OLED of the second sub-pixel emits a red light.

According to an embodiment of the invention, the OLED of the third sub-pixel emits a blue light.

According to an embodiment of the invention, each pixel further includes a capacitor electrically connected between the switch unit and the driving unit.

According to an embodiment of the invention, a method of driving each of the pixels in the pixel array includes writing data respectively to the first sub-pixel through the first data line, the second sub-pixel through the second data line, and the third sub-pixels through the third data line when an enabling signal is applied to the scan line.

The invention also provides a method of driving a dual pixel of an active matrix organic light emitting diode display. The dual pixel includes a first sub-pixel, a second sub-pixel, and a pair of third sub-pixels arranged in a two by two array. The dual pixel is electrically connected to a first scan line, a second scan line, a first data line, and a second data line. The dual pixel serves as two pixels, and each pixel includes the first sub-pixel, the second sub-pixel, and one of the third sub-pixels, and the first sub-pixel and the second sub-pixel are shared between the two pixels. When an enabling signal is applied to the first scan line, data is respectively written to the first sub-pixel in a first row of the dual pixel through the first data line and one of the third sub-pixels in the first row through the second data line. When an enabling signal is applied to the second scan line, data is respectively written to the other one of the third sub-pixels in a second row of the dual pixel through the first data line and the second sub-pixel in the second row through the second data line. When data is written into the first sub-pixel and the second sub-pixel, the first sub-pixel and the second sub-pixel act as sub-pixels for two independent pixels.

In summary, the pixels form a two by two array with a first sub-pixel, a second sub-pixel and a pair of third sub-pixels. The pixel array is formed through an arrangement of the same sub-pixels in a two by two array. In such a way, masks used to fabricate the pixel array can have large openings. This improves the fabrication yield and stability of the masks, and the resolution of the fabricated active matrix organic light emitting diode display can be high.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings are included to provide a further understanding of the invention, and are incorporated in and constitute a part of this specification. The drawings illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention.

FIG. **1** is a schematic diagram of a pixel array of an active matrix organic light emitting diode display according to an embodiment of the invention.

FIGS. **2-4** are schematic diagrams of masks utilized to fabricate the pixel array of FIG. **1**.

FIG. **5** is a schematic diagram of a pixel of the pixel array of FIG. **1**.

FIG. **6** is a schematic diagram of a pixel array of an active matrix organic light emitting diode display according to another embodiment of the invention.

FIG. **7** is a schematic diagram of a dual pixel of the pixel array of FIG. **6**.

DESCRIPTION OF THE EMBODIMENTS

Reference will now be made in detail to the present preferred embodiments of the invention, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers are used in the drawings and the description to refer to the same or like parts.

FIG. **1** is a schematic diagram of a pixel array of an active matrix organic light emitting diode display according to an embodiment of the invention. FIGS. **2-4** are schematic diagrams of masks utilized to fabricate the pixel array of FIG. **1**. Referring to FIG. **1**, the pixel array **100** includes a plurality of pixels **110** arranged in an array. Each of the pixels **110** includes a first sub-pixel **110**G, a second sub-pixel **110**R, and a pair of third sub-pixels **110**B.

The first sub-pixel **110**G, the second sub-pixel **110**R, and the third sub-pixels **110**B in each pixel **110** are arranged in a two by two may. The pair of third sub-pixels **110**B are arranged diagonally to each other, and the first sub-pixel **110**G and the second sub-pixel **110**R are arranged diagonally to each other. The first sub-pixel **110**G of each pixel **110** is adjacent to the first sub-pixels **110**G of three adjacent pixels **110**. The second sub-pixel **110**R of each pixel **110** is adjacent to the second sub-pixels **110**R of three adjacent pixels **110**, and each third sub-pixel **110**B of each pixel **110** is adjacent to one of the third sub-pixels **110**B of three adjacent pixels **110**.

The first sub-pixel **110**G of each pixel **110** and the first sub-pixels **110**G of the three adjacent pixels **110** are arranged in a two by two array. The second sub-pixel **110**R of each pixel **110** and the second sub-pixels **110**R of the three adjacent pixels **110** are arranged in a two by two array. One of each of the third sub-pixels **110**B of each pixel **110** and one of the third sub-pixels **110**B of the three adjacent pixels **110** are arranged in a two by two array.

FIGS. **2-4** are schematic diagrams of masks utilized to fabricate the pixel array of FIG. **1**. The pixel array **100** of the active matrix organic light emitting diode display utilizes an evaporation deposition process with the masks having different opening patterns to fabricate the first sub-pixels **110**G, the second sub-pixels **110**R, and the third sub-pixels **110**B, respectively. The pixel array **100** of FIG. **2** shows a first mask **112** with a plurality of first openings **112**G corresponding to the first sub-pixels **110**G. FIG. **3** shows a second mask **114** with a plurality of second openings **114**R corresponding to the second sub-pixels **114**R. FIG. **4** shows a third mask **116** with a plurality of third openings **116**B corresponding to the third sub-pixels **110**B.

Arrangements of openings in the first mask **112**, the second mask **114**, and the third mask **116** are similar, a difference being that the arrangement of openings in each mask is offset from the arrangement of openings in each other mask. In addition, the size of the openings can be adjusted and varied according to need. By utilizing the first mask **112**, the second mask **114**, and the third mask **116** in order in the evaporation deposition process, the pixel array shown in FIG. **1** can be fabricated. Each opening of each mask utilizes the evaporation deposition process to fabricate four of the same sub-pixels. That is to say, each of the first openings **112**G form four first sub-pixels **110**G, each of the second openings **114**R form four second sub-pixels **110**R, and each of the third openings **116**B form four third sub-pixels **110**B.

In such a way, the masks can have large openings. Thus, the precision required during the fabrication process is not as demanding. Even with low precision during the fabrication process, the resolution of the fabricated active matrix organic light emitting diode display can be high. This improves the fabrication yield and stability of the masks.

FIG. **5** is a schematic diagram of a pixel of the pixel array of FIG. **1**. Referring to FIG. **5**, each of the sub-pixels **110**G, **110**R, **110**B in the pixel **110** includes a driving circuit (a first driving circuit **152**, a second driving circuit **162**, a third driving circuit **172**), and an organic light emitting diode (OLED) (a first OLED **180**, a second OLED **182**, a third OLED **184**). The first OLED **180** of the first sub-pixel **110**G emits a green light. Thereby, the first sub-pixel **110**G is a green sub-pixel. The second OLED **182** of the second sub-pixel **110**R emits a red light. Thereby, the second sub-pixel **110**R is a red sub-pixel. The third OLED **184** of the third sub-pixel **110**B emits a blue light. Thereby, the third sub-pixel **110**B is a blue sub-pixel. Each of the driving circuits **152**, **162**, **172** includes at least two transistors. In the embodiment, each of the driving circuits **152**, **162**, **172** include a switch unit **150** and a driving unit **160**.

The pixels **110** are electrically connected with a scan line **120**, a first data line **132**, a second data line **136**, a third data line **134** between the first data line **132** and the second data line **136**, a first power line **142**, and a second power line **144**. The power lines (the first power line **142**, the second power line **144**) of the pixel array **100** can be connected to a power source, and serve as a power source. The scan line **120** is intersected with the first data line **132**, the second data line **136** and the third data line **134** to form a two by two array of each pixel **110**.

Specifically, the scan line **120** is connected to the switch unit **150** of each of the sub-pixels **110**G, **110**R, **110**B in the pixel **110**. The switch unit **150** of the first driving circuit **152** of the first sub-pixel **110**G is electrically connected to the first data line **132**. The switch unit **150** of the second driving circuit **162** of the second sub-pixel **110**R is electrically connected to the second data line **136**. The switch units **150** of the third driving circuits **172** of the pair of third sub-pixels **110**B are electrically connected to the third data line **134**. The first power line **142** is connected to the driving unit **160** of two sub-pixels in the same column of the pixel **110**. In the embodiment, for example, the first power line **142** is electrically connected to the driving units **160** of the driving circuit **152** of the first sub-pixel **110**G and the driving circuit **172** of one of the third sub-pixels **110**B that are in the same column as the first sub-pixel **110**G. The second power line **144** is connected to the driving unit **160** of two sub-pixels in the same column of the pixel **110** different from the two sub-pixels connected to the first power line **142**. In the embodiment, for example, the second power line **144** is electrically connected to the driving units **160** of the second driving circuit **162** of the second sub-pixel **110**R and the third driving circuit **172** of the other one of the third sub-pixels **110**B that are in the same column as the second sub-pixel **110**R.

The first OLED **180** of the first sub-pixel **110**G is electrically connected to the scan line **120**, the first data line **132** and the first power line **142** through the first driving circuit **152** of the first sub-pixel **110**G. The second OLED **182** of the second sub-pixel **110**R is electrically connected to the scan line **120**, the second data line **136** and the second power line **144** through the second driving circuit **162** of the second sub-pixel **110**R. The third OLED **184** of each third sub-pixel **110**B is electrically connected to the scan line **120** and the third data line **134** through the third driving circuit **172** of the corresponding third sub-pixel **110**B. The OLEDs **180**, **182**, **184** of each sub-pixel **110**G, **110**R, **110**B are electrically connected to the corresponding driving units **160** of the driving circuits **152**, **162**, **172**.

Furthermore, each driving circuit **152**, **162**, **172** further includes at least one capacitor C**1** electrically connected between the switch unit **150** and the driving unit **160**. Thus, each driving circuit **152**, **162**, **172** has, for example, a two transistor one capacitor structure. However, the invention is not limited thereto. Each driving circuit may include additional transistors and capacitors, and have an m transistor n capacitor structure, wherein m is greater than 2, and n is greater than one.

The configuration shown in FIG. **5** is an example of one of the pixels **110** in the pixel array **100**. The configuration of other pixels **110** in the pixel array **100** are similar except the positions of the sub-pixels **110**G, **110**R, **110**B may not be exactly the same as the positions of the sub-pixels **110**G, **110**R, **110**B shown in FIG. **5**. For example, a pixel below the pixel **110** in the pixel array **100** of FIG. **1** has the first sub-pixel **110**G in the bottom left corner, and the second sub-pixel **110**R in the top right corner. In the pixel to the right of the pixel **110** in the pixel array **100** of FIG. **1** has the first sub-pixel **110**G in the top right corner, and the second sub-pixel **110**R in the bottom left corner. The arrangements of the sub-pixels are not limited thereto. However, it should be noted that the two third sub-pixels **110**B are diagonal to each other, and the first sub-pixel **110**G and the second sub-pixel **110**R are diagonal to each other in any configuration. The number of data lines, scan lines, and power lines are not limited to the above description. The number of data lines, scan lines, and power lines depend on the number of pixels **110** in the pixel array **100**, and electrically connect the pixels **110** in the pixel array **100** as described above. That is to say, the scan lines connect to the pixels **110** in the same row of the pixel array **100**. The data lines and the power lines connect to the pixels **110** in the same column of the pixel array.

With this configuration, it can be seen that the pair of third sub-pixels **110**B in the pixel **110** share the third data line **134**. The three types of sub-pixels **110**G, **110**R, **110**B have OLEDs **180**, **182**, **184** of different organic materials. Therefore, the luminous efficiency of the types of sub-pixels **110**G, **110**R, **110**B are different. Sub-pixels with low luminous efficiency require a larger driving unit, and vice versa. Conventionally, the sub-pixels with low luminous efficiency are compensated by increasing the dimensions of the driving unit. The different sizes of the driving units will require a specific ratio for the pixel to achieve white balance. However, in the embodiment, since the luminous efficiency of the third sub-pixel **110**B is low, using a same data line for two third sub-pixels **110**B that is each powered by a power line in the same pixel **110** can allow the third sub-pixels **110**B to not have to increase the dimensions of the driving unit **160**. Having two third sub-pixels **110**B doubles the amount of light emitted from the third sub-pixels **110**B, which can better control white balance without having to increase the size of the driving unit of the third sub-pixels **110**B with low luminous efficiency.

To drive the pixel **110**, when an enabling signal is applied to the scan line **120**, data is written respectively to the first sub-pixel **110**G through the first data line **132**, the second sub-pixel **110**R through the second data line **136**, and the third sub-pixels **110**B through the third data line **134**. This method completes the writing of data into the pixel **110**, and achieves a balanced luminous efficiency between the sub-pixels **110**G, **110**R, **110**B in the pixel **110**. Also, by adapting a suitable algorithm for driving the pixel array **100**, the pixels **110** can achieve high resolution.

FIG. **6** is a schematic diagram of a pixel array according to another embodiment of the invention. Referring to FIG. **6**, the pixel array includes a plurality of dual pixels **210**. Each dual pixel **210** includes a first sub-pixel **210**G, a second sub-pixel **210**R, and a pair of third sub-pixels **210**B arranged in a two by two array. The dual pixel **210** serves as two pixels. Each pixel includes the first sub-pixel **210**G, the second sub-pixel **210**R, and one of the third sub-pixels **210**B. The first sub-pixel **210**G and the second sub-pixel **210**R are shared between the two pixels in the dual pixel **210**. Thus, each pixel in the dual pixel **210** has an "L" shape, which combines through the sharing of the first sub-pixel **210**G and the second sub-pixel **210**R to form the two by two array of the dual pixel **210**.

The method of fabricating the pixel array of FIG. **6** is through the masks in FIGS. **2**-**4**. Therefore, the layout and method of fabricating the pixel array in FIG. **6** is similar to the pixel array **100** in FIG. **1**. Detailed description will not be repeated.

FIG. **7** is a schematic diagram of a dual pixel of the pixel array of FIG. **6**. Referring to FIG. **7**, each of the sub-pixels **210**G, **210**R, **210**B in the dual pixel **210** includes a driving circuit (a first driving circuit **252**, a second driving circuit **262**, a third driving circuit **272**), and an organic light emitting diode (OLED) (a first OLED **280**, a second OLED **282**, a third OLED **284**). The first OLED **280** of the first sub-pixel **210**G emits a green light. Thereby, the first sub-pixel **210**G is a green sub-pixel. The second OLED **282** of the second sub-pixel **210**R emits a red light. Thereby, the second sub-pixel **210**R is a red sub-pixel. The third OLED **284** of the third sub-pixel **210**B emits a blue light. Thereby, the third sub-pixel **210**B is a blue sub-pixel. Each of the driving circuits **252**, **262**, **272** includes at least two transistors. In the embodiment, each of the driving circuits **252**, **262**, **272** include a switch unit **250** and a driving unit **260**.

Referring to FIG. **7**, it can be seen that the dual pixels **210** are electrically connected to a first scan line **220**, a second scan line **222**, a first data line **232**, a second data line **234**, a first power line **242**, and a second power line **244**. The two power lines (the first power line **242**, the second power line **244**) of the pixel array **200** can be connected to a power source, and serve as a power source. The first scan line **220** and the second scan line **222** are intersected with the first data line **232** and the second data line **234** to form a two by two array of each dual pixel **210**.

Specifically, the first scan line **220** is electrically connected to the switch unit **250** of the driving circuit **252** of the first sub-pixel **210**G and the switch unit **250** of the third driving circuit **272** of the third sub-pixel **210**B in the same row as the first sub-pixel **210**G. The second scan line **222** is electrically connected to the switch unit **250** of the second driving circuit **262** of the second sub-pixel **210**R and the switch unit **250** of the third driving circuit **272** of the third sub-pixel **210**B in the same row as the second sub-pixel **210**R. The first data line **232** is electrically connected to the switch unit **250** of the first driving circuit **252** of the first sub-pixel **210**G and the switch unit **250** of the third driving circuit **272** of the third sub-pixel **210**B in the same column as the first sub-pixel **210**G. The second data line **234** is electrically connected to the switch unit **250** of the second driving circuit **262** of the second sub-pixel **210**R and the switch unit **250** of the third driving circuit **272** of the third sub-pixel **210**B in the same column as the second sub-pixel **210**R. The first power line **242** is connected to the driving unit **260** of the driving circuits of two sub-pixels in the same column of the dual pixel **210**. In the embodiment, for example, the first power line **242** is electrically connected to the driving units **260** of the first driving circuit **252** of the first sub-pixel **210**G and the third driving circuit **272** of one of the third sub-pixels **210**B that are in the same column as the first sub-pixel **210**G. The second power line **244** is connected to the driving unit **260** of the driving circuits of two sub-pixels in the same column of the dual pixel **210** different from the two sub-pixels connected to the first power line **242**. In the embodiment, for example, the second power line **244** is electrically connected to the driving units **260** of the second driving circuit **262** of the second sub-pixel **210**R and the third driving circuit **272** of the other one of the third sub-pixels **210**B that are in the same column as the second sub-pixel **210**R.

In the embodiment, the first OLED **280** of the first sub-pixel **210**G is electrically connected to the first scan line **220**, the first data line **232** and the first power line **242** through the first driving circuit **252** of the first sub-pixel **210**G. The second OLED **282** of the second sub-pixel **210**R is electrically connected to the second scan line **222**, the second data line **234** and the second power line **244** through the second driving circuit **262** of the second sub-pixel **210**R. The third OLED **284** of one of the third sub-pixels **110**B is electrically connected to the first scan line **220**, the second data line **234**, and the second power line **244** through the third driving circuit **272** of the third sub-pixel **210**B in the same row as the first sub-pixel **210**G. The third OLED **284** of the other one of the third sub-pixels **210**B is electrically connected to the second scan line **222**, the first data line **232**, and the first power line **242** through the third driving circuit **272** of the third sub-pixel **210**B in the same row as the second sub-pixel **210**R. The OLEDs **280**, **282**, **284** of each sub-pixel **210**G, **210**R, **210**B are electrically connected to the corresponding driving units **260** of the driving circuits **252**, **262**, **272**. The configuration described above changes as the location of the sub-pixels **210**G, **210**B, **210**R are varied for different dual pixels **210**.

Furthermore, each driving circuit **252**, **262**, **272** further includes at least one capacitor C2 electrically connected between the switch unit **250** and the driving unit **260**. Thus, each driving circuit **252**, **262**, **272** has, for example, a two transistor one capacitor structure. However, the invention is not limited thereto. Each driving circuit may include additional transistors and capacitors, and have an m transistor n capacitor structure, wherein m is greater than 2, and n is greater than one.

The configuration shown in FIG. **7** is an example of one of the dual pixels **210** in the pixel array **200**. The configuration of other dual pixels **210** in the pixel array **200** are similar except the positions of the sub-pixels **210**G, **210**R, **210**B may not be exactly the same as the positions of the sub-pixels **210**G, **210**R, **210**B shown in FIG. **7**. For example, a dual pixel below the dual pixel **210** in the pixel array **200** of FIG. **7** has the first sub-pixel **210**G in the bottom left corner, and the second sub-pixel **210**R in the top right corner. In the pixel to the right of the pixel **110** in the pixel array **200** of FIG. **7** has the first sub-pixel **210**G in the top right corner, and the second sub-pixel **210**R in the bottom left corner. The arrangements of the sub-pixels are not limited thereto. However, it should be noted that the two third sub-pixels **210**B are diagonal to each other, and the first sub-pixel **210**G and the second sub-pixel **210**R are diagonal to each other in any configuration. The number of data lines, scan lines, and power lines are not limited to the above description. The number of data lines, scan lines, and power lines depend on the number of dual pixels **210** in the pixel array **200**, and electrically connect the dual pixels **210** in the pixel array **200** as described above. That is to say, the scan lines connect to the dual pixels **210** in the same row of the pixel array **200**. The data lines and the power lines connect to the dual pixels **210** in the same column of the pixel array **200**.

To drive the dual pixel **210**, when an enabling signal is applied to the first scan line **220**, data is written respectively to the first sub-pixel **210**G in a first row of the dual pixel **210** through the first data line **232** and one of the third sub-pixels **210**B in the first row through the second data line **234**. When an enabling signal is applied to the second scan line **222**, data is written respectively to the other one of the third sub-pixels **210**B in a second row of the dual pixel **210** through the first data line **232** and the second sub-pixel **210**R in the second row through the second data line **234**. When data is written into the first sub-pixel **210**G and the second sub-pixel **210**R, the first sub-pixel **210**G and the second sub-pixel **210**R act as sub-pixels for two independent pixels. Each independent pixel is, for example, the first sub-pixel **210**G, the second sub-pixel **210**R, and one of the third sub-pixels **210**B. The other independent pixel is, for example, the first sub-pixel **210**G, the second sub-pixel **210**R, and the other one of the third sub-pixels **210**B. The dual pixel **210** can achieve the effects of two independent pixels. By adapting a suitable algorithm for driving the pixel array **200**, the dual pixels **210** can achieve high resolution comparable to the resolution of two independent pixels. The dual pixels **210** can also display the display data of two independent pixels. In particular, the suitable algorithm calculates the data that is to be written into the first sub-pixel **210**G and the second sub-pixel **210**R. The data may be, for example, a driving voltage representing the grayscale of one of the sub-pixels. The suitable algorithm calculates, for example, the grayscales of the first sub-pixel **210**G and the second sub-pixel **210**R according to the two independent pixels simulated by the dual pixel **210**. That is to say, the first sub-pixel **210**G acts as, for example, two green sub-pixels for two independent pixels, and the second sub-pixel **210**R acts as, for example, two red sub-pixels for two independent pixels. Thus, the suitable algorithm must calculate the data written into each of the first sub-pixel **210**G and the second sub-pixel **210**R in order for the dual pixel **210** to effectively simulate the effects of two independent pixels.

This way, after the dual pixel **210** is driven, the visual effects of the dual pixel **210** will be similar to the visual effects of two independent pixels. For example, the visual effect to the naked eye of the dual pixel **210** will be similar to the visual effect to the naked eye of two independent pixels adjacent to each other. The resolution of the dual pixel **210** will also be similar to the resolution of two independent pixels. In addition, since a conventional independent has three sub-pixels, two conventional independent pixels have six sub-pixels. However, the dual pixel **210** has four sub-pixels, and can achieve similar resolution and visual effects as two conventional independent pixels with six sub-pixels. Therefore, a display panel with the dual pixel **210** of the embodiment can achieve similar resolution and visual effects with smaller dimensions than a display panel with conventional pixels.

In summary, the pixels form a two by two array with a first sub-pixel, a second sub-pixel and a pair of third sub-pixels. The pixel array is formed through an arrangement of the same sub-pixels in a two by two array. In such a way, the masks for fabricating the pixel array can have large openings. Thus, the precision required during the fabrication process is not as demanding. Even with low precision during the fabrication process, the resolution of the fabricated an active matrix organic light emitting diode display can be high. This improves the fabrication yield and stability of the masks. That is to say, the arrangement of the pixel array allows the mask to have large openings. Therefore, the display quality of the active matrix organic light emitting diode display can have higher resolution compared with conventional fine metal masks (FMM). In addition, by adapting a suitable algorithm for driving the pixel array, high resolution can be achieved.

It will be apparent to those skilled in the art that various modifications and variations can be made to the structure of the present invention without departing from the scope or spirit of the invention. In view of the foregoing, it is intended that the present invention cover modifications and variations of this invention provided they fall within the scope of the following claims and their equivalents.

What is claimed is:

1. A method of driving a dual pixel of an active matrix organic light emitting diode (OLED) display, wherein the dual pixel comprises a first sub-pixel, a second sub-pixel, and a pair of third sub-pixels arranged in a two by two array, wherein the dual pixel is electrically connected to a first scan line, a second scan line, a first data line, and a second data line, wherein the dual pixel serves as two pixels, and each pixel comprises the first sub-pixel, the second sub-pixel, and one of the third sub-pixels, and the first sub-pixel and the second sub-pixel are shared between the two pixels, the method comprising:

writing data respectively to the first sub-pixel in a first row of the dual pixel through the first data line and one of the third sub-pixels in the first row through the second data line when an enabling signal is applied to the first scan line; and

writing data respectively to the other one of the third sub-pixels in a second row of the dual pixel through the first data line and the second sub-pixel in the second row through the second data line when an enabling signal is applied to the second scan line, wherein when data is written into the first sub-pixel and the second sub-pixel, the first sub-pixel and the second sub-pixel act as sub-pixels for two independent pixels.

2. The method of driving a dual pixel of an active matrix organic light emitting diode (OLED) display as claimed in claim **1**, wherein a first OLED of the first sub-pixel emits a green light.

3. The method of driving a dual pixel of an active matrix organic light emitting diode (OLED) display as claimed in claim **1**, wherein a second OLED of the second sub-pixel emits a red light.

4. The method of driving a dual pixel of an active matrix organic light emitting diode (OLED) display as claimed in claim **1**, wherein a third OLED of each of the third sub-pixel emits a blue light.

5. The method of driving a dual pixel of an active matrix organic light emitting diode (OLED) display as claimed in claim **1**, wherein each of the first sub-pixel, the second sub-pixel and the pair of third sub-pixels comprises a switch unit, a driving unit, and at least one capacitor electrically connected between the switch unit and the driving unit.

6. The method of driving a dual pixel of an active matrix organic light emitting diode (OLED) display as claimed in claim **1**, wherein the pair of third sub-pixels are diagonal to each other, and the first sub-pixel and the second sub-pixel are diagonal to each other in any configuration.

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摘要(译)

像素阵列包括多个像素。每个像素具有第一子像素，第二子像素和一对第三子像素。每个像素的第一子像素和三个相邻像素的第一子像素以二乘二阵列排列，每个像素的第二子像素和三个相邻像素的第二子像素排列成两个通过两个阵列，每个像素的每个第三子像素中的一个和三个相邻像素的第三子像素中的一个以二乘二阵列排列。扫描线连接到像素中的每个子像素的开关单元。