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(54) **LIGHT EMITTING DIODE DISPLAY**

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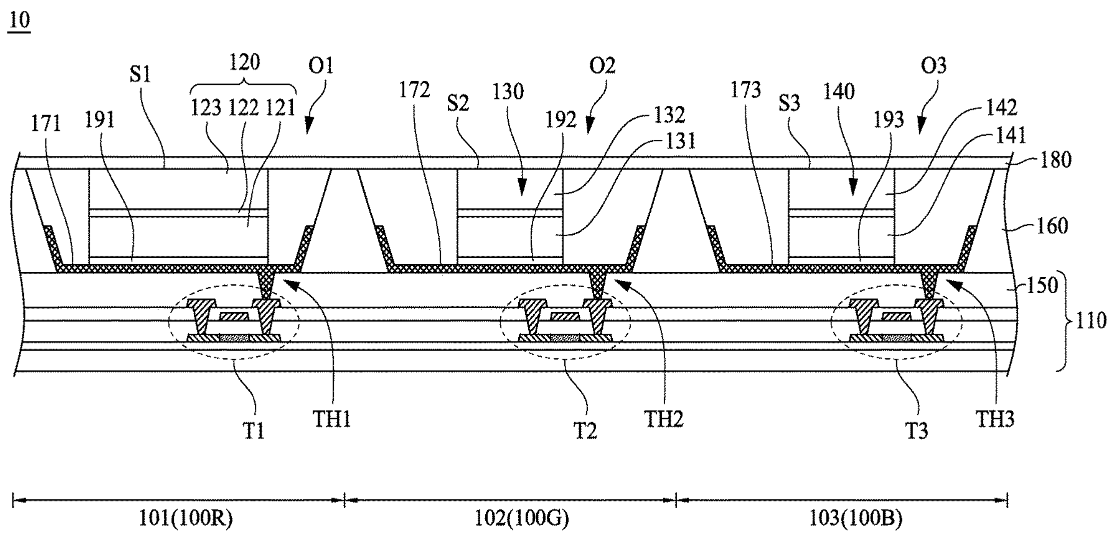
(57) **ABSTRACT**

A light emitting diode (LED) display includes a substrate, a pixel define layer, at least one first color micro LED, and at least one second color micro LED. The pixel define layer is disposed on the substrate and has a first opening and a second opening separated from each other. Contours of the first and second openings on a surface of the pixel define layer facing away from the substrate respectively define areas which are the same as each other. The first color micro LED is disposed in the first opening and has a first vertical projection projected on the substrate. The second color micro LED is disposed in the second opening and has a second vertical projection projected on the substrate. An area of the first vertical projection is different from an area of the second vertical projection.



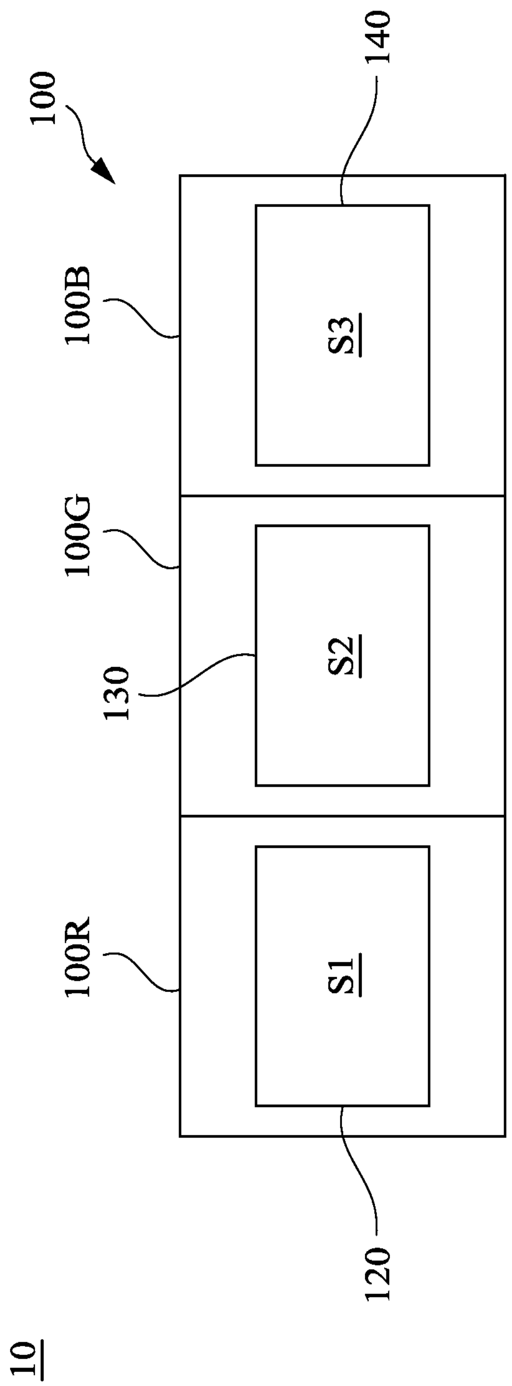
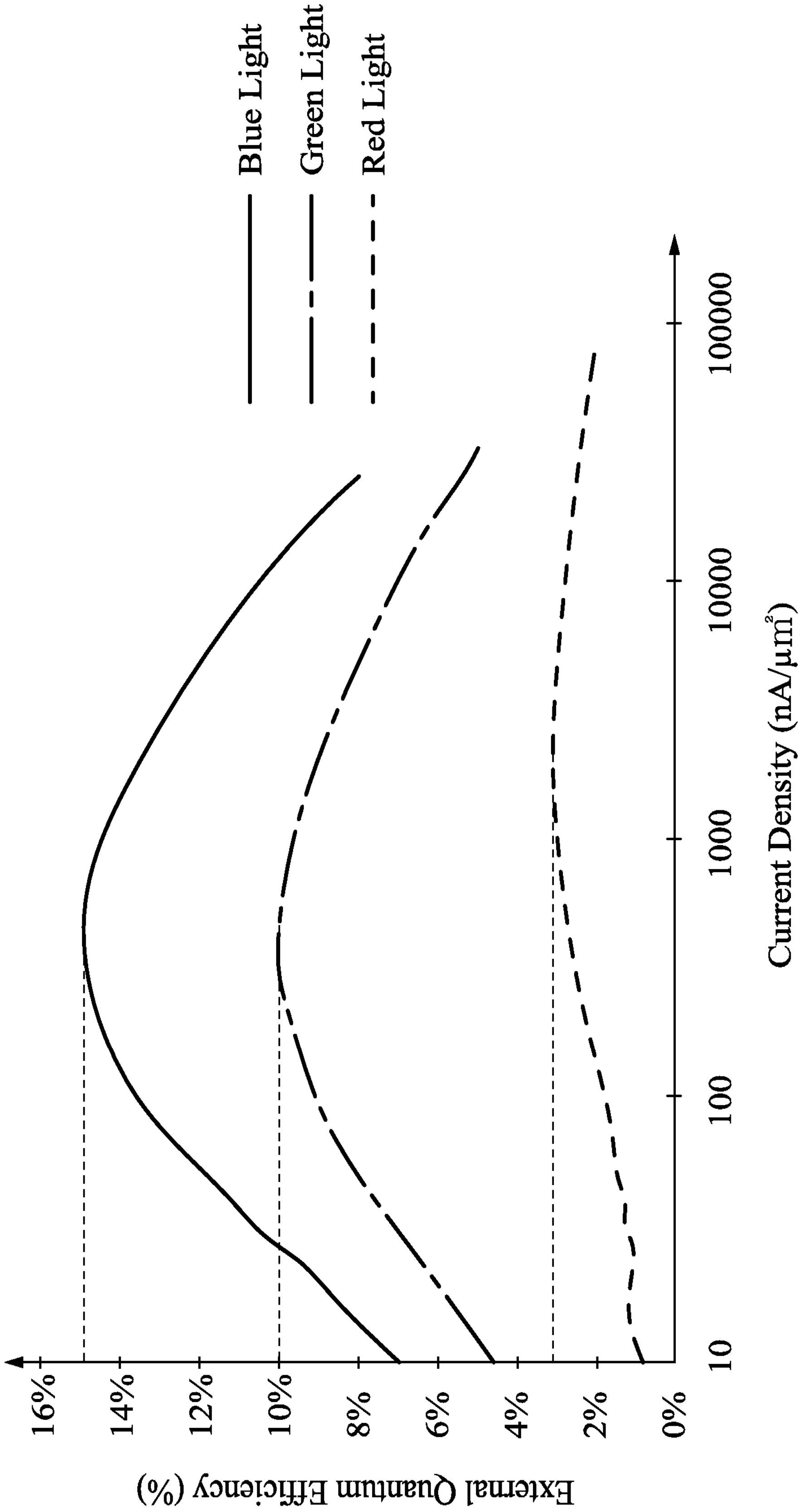


Fig. 1



Blue Light
Green Light
Red Light
External Quantum Efficiency (%)
16%
14%
12%
10%
8%
6%
4%
2%
0%
10
100
1000
10000
100000
Current Density (nA/μm²)

Fig. 2

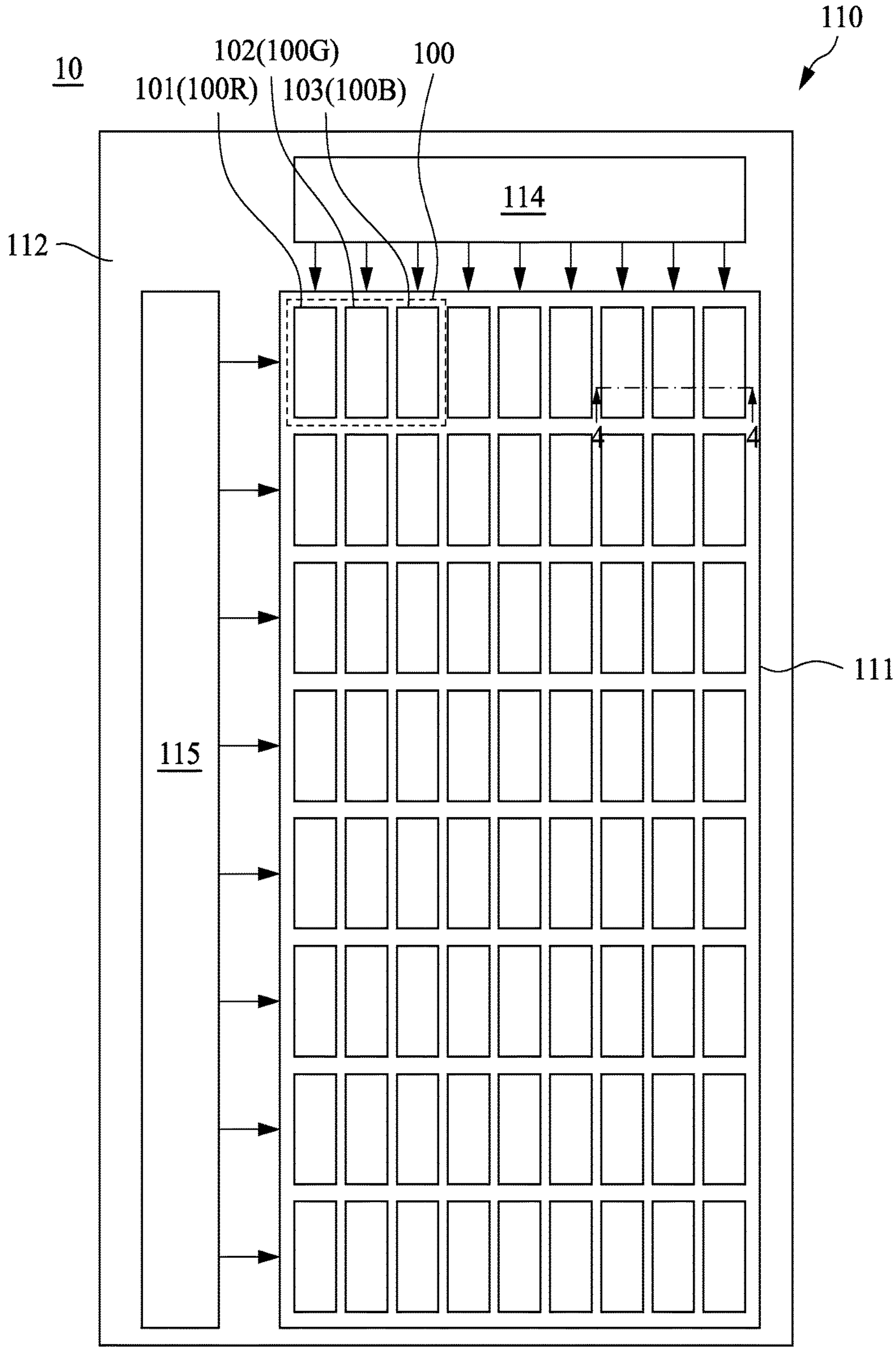


Fig. 3

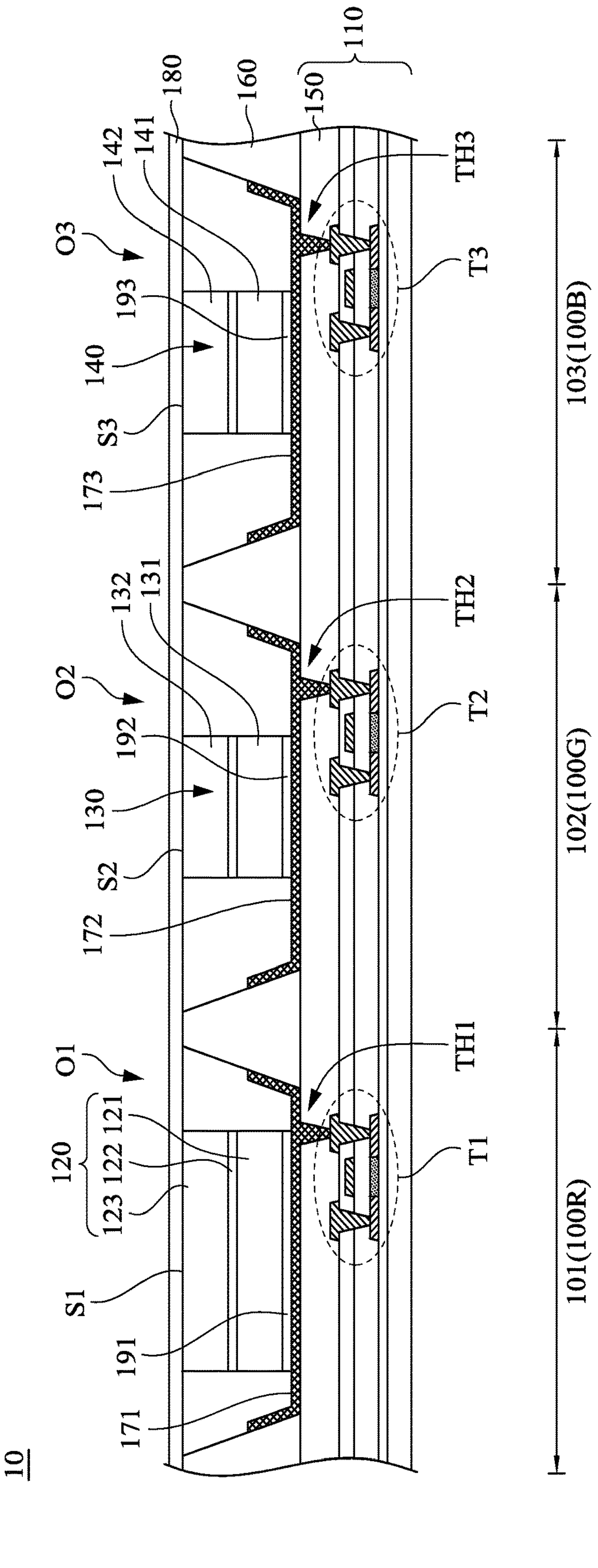

10
110
180
160
150
142
141
O3
193
140
S3
173
132
131
O2
192
130
S2
172
O1
120
121
122
123
S1
191
171
TH3
T3
TH2
T2
TH1
T1
103(100B)
102(100G)
101(100R)

Fig. 4

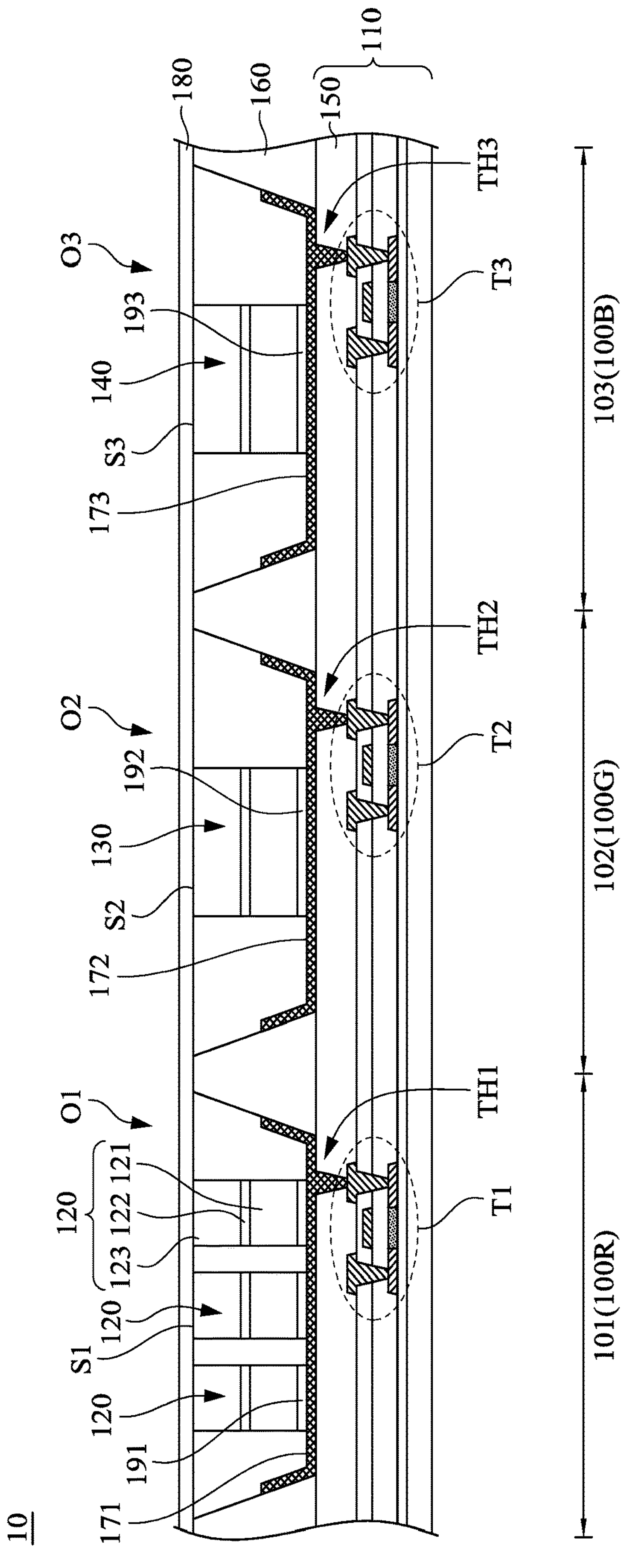

10
171
191
120
S1
120
123
122
121
120
O1
TH1
T1
101(100R)
172
S2
130
192
O2
TH2
T2
102(100G)
173
S3
140
193
O3
TH3
T3
103(100B)
180
160
150
110

Fig. 5

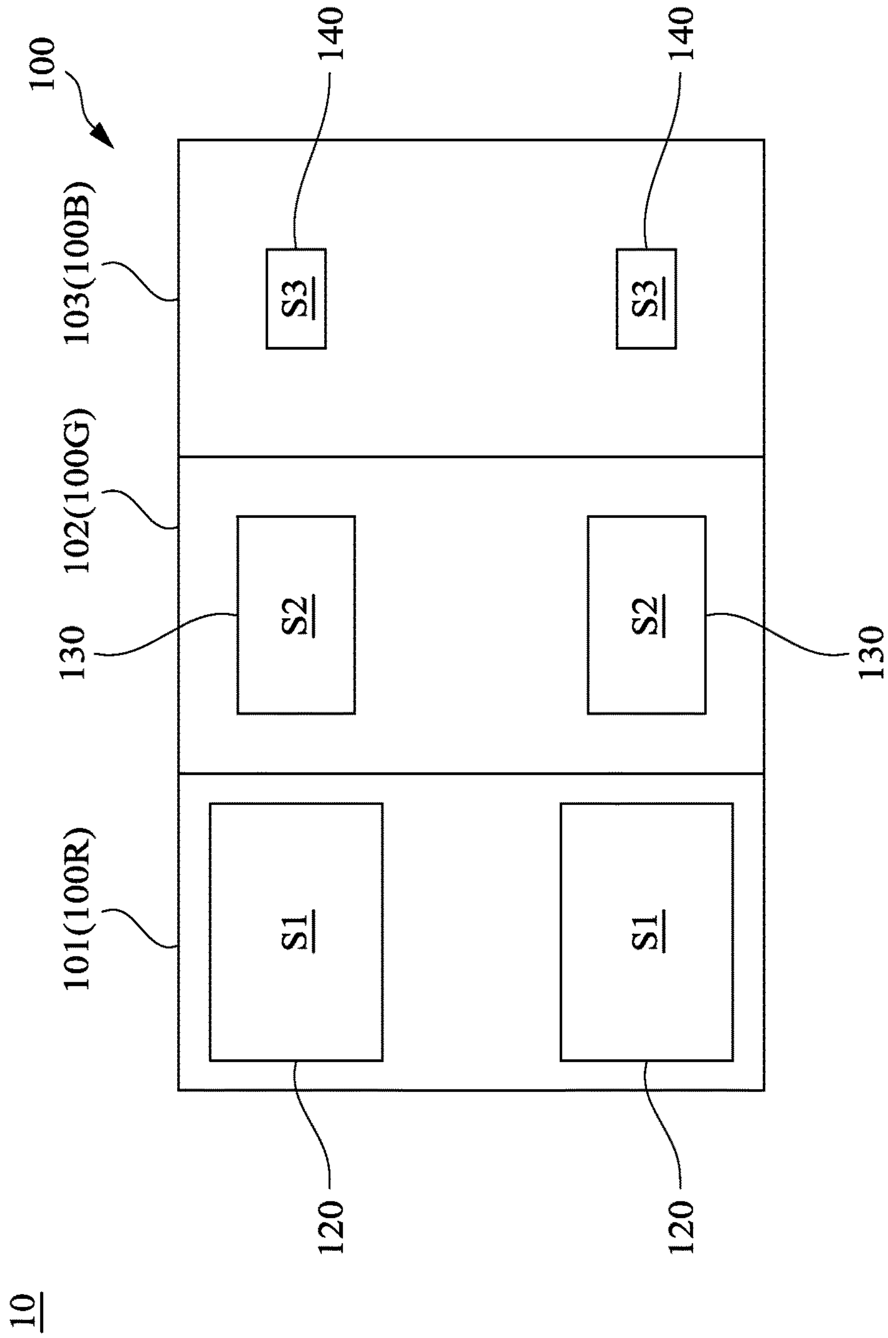

100
103(100B)
102(100G)
101(100R)
140
140
S3
S3
130
S2
S2
130
S1
S1
120
120
10

Fig. 6

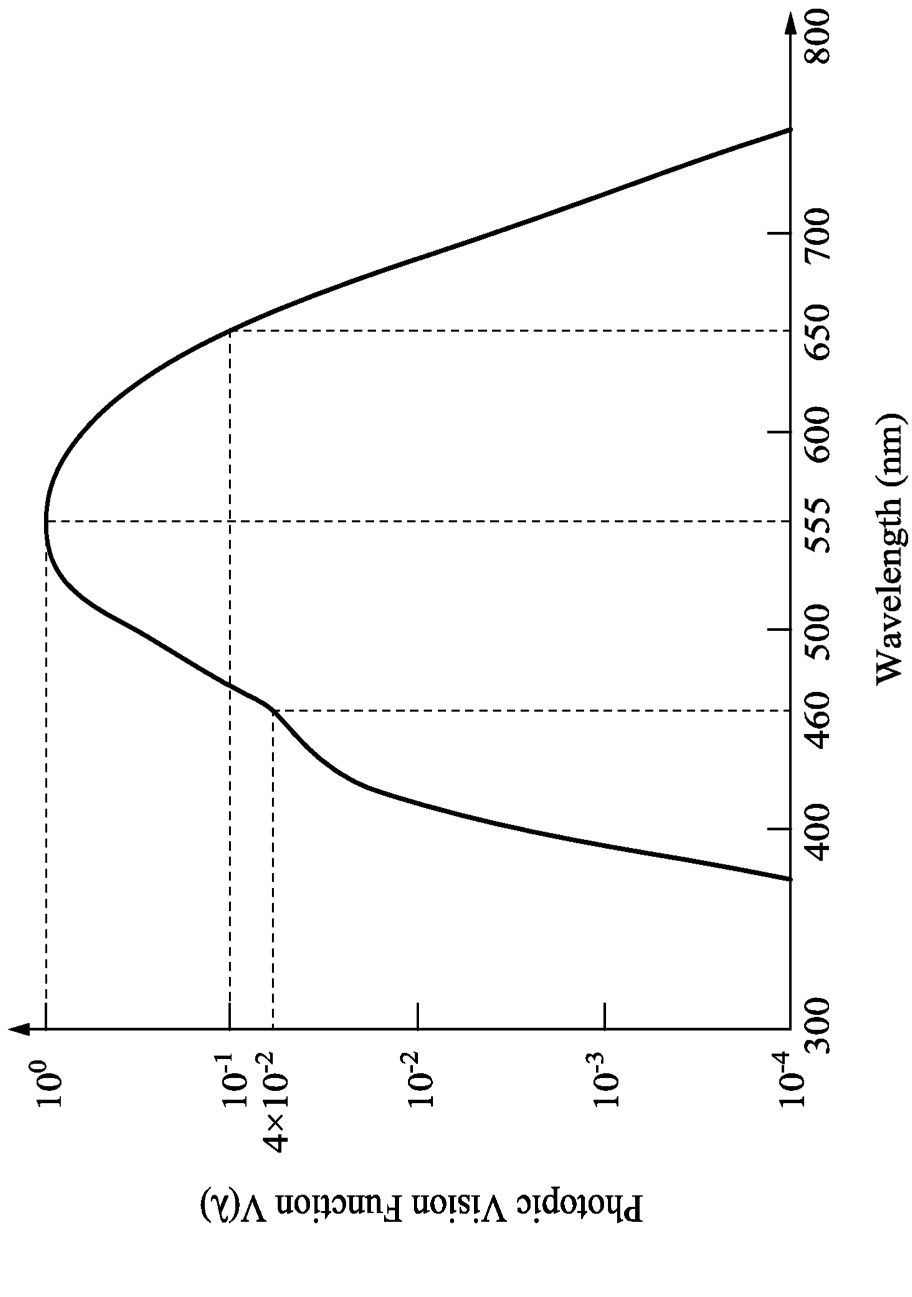

Photopic Vision Function V(λ)
10^0
10^-1
4×10^-2
10^-2
10^-3
10^-4
300
400
460
500
555
600
650
700
800
Wavelength (nm)

Fig. 7

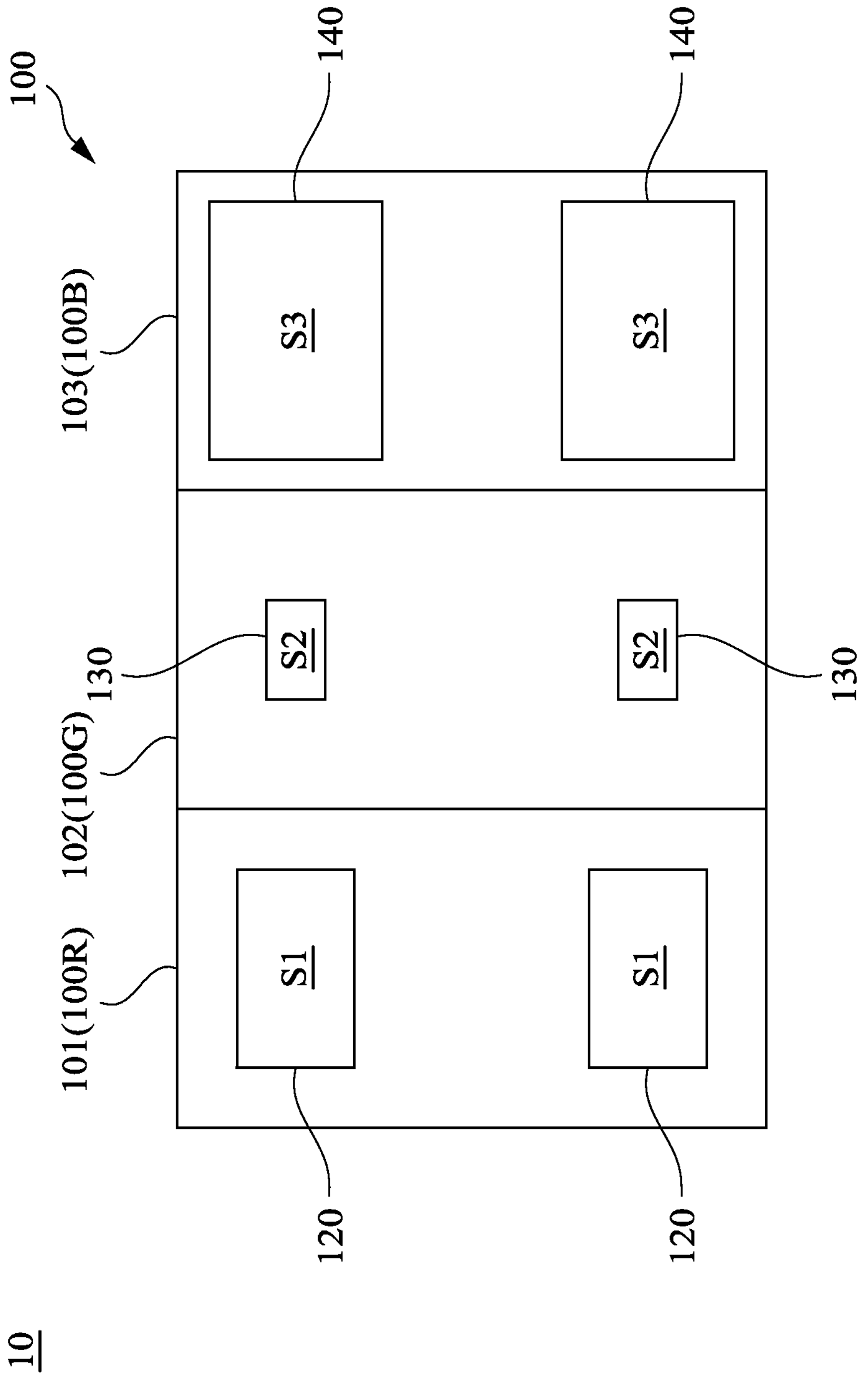
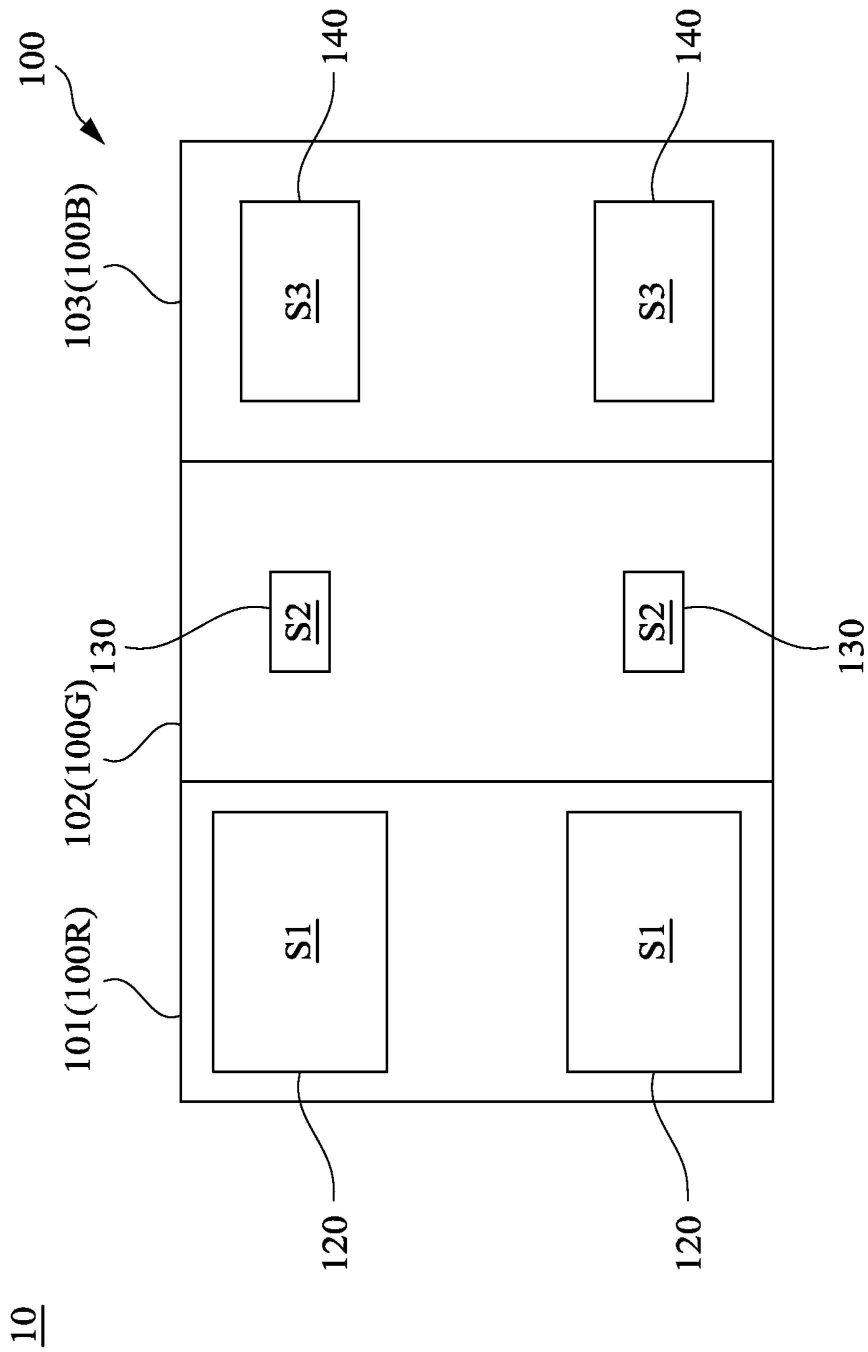

100
140
140
103(100B)
S3
S3
S2
S2
130
130
102(100G)
101(100R)
S1
S1
120
120
10

Fig. 8



10
100
101(100R)
102(100G)
103(100B)
S1
S1
S2
S2
S3
S3
120
120
130
130
140
140

Fig. 9

LIGHT EMITTING DIODE DISPLAY

RELATED APPLICATIONS

[0001] The present application is a continuation of U.S. application Ser. No. 15/158,725, filed May 19, 2016, and the application claims priority to Taiwan Application Serial Number 104119432, filed Jun. 16, 2015, which are incorporated herein by reference in its entirety.

BACKGROUND

Field of Disclosure

[0002] The present disclosure relates to a display. More particularly, the disclosure relates to a light emitting diode (LED) display and a manufacturing method thereof.

Background of the Disclosure

[0003] With the progress of technology, displays have gradually changed from the bulky cathode ray tube (CRT) displays to the flat, lightweight and slim liquid crystal displays (LCDs), plasma display panels (PDPs), or organic light emitting diode (OLED) displays, etc.

[0004] The OLED displays, as compared with the LCDs, do not need color filters as required by traditional LCD displays, thus having a simpler structure and smaller volume. In addition to that, OLEDs can be fabricated on flexible substrates, such that the OLED displays are not only lightweight and slim but also bendable. Therefore, the development and research of OLED displays have become one of the important subjects in the market. However, the OLED displays have a low blue luminous efficiency, and the organic light emitting materials have the stability problem which are the major problems faced in mass production.

SUMMARY

[0005] The disclosure relates to a light emitting diode (LED) widely applied to lighting equipment. A side length of the LED is shrunk to 3 micrometers to 150 micrometers so as to be fabricated on a substrate, or 3 micrometers to 100 micrometers so as to form an LED display.

[0006] Full-color LED displays can utilize shrunk LEDs to constitute red sub-pixel, green sub-pixels, and blue sub-pixels without disposing color filters required by traditional LCD displays. However, after LEDs are shrunk down to a micrometer scale, the luminous efficiencies of the LEDs of different colors are not consistent. In addition, human eyes have different perception to light in different wave bands. Hence, users may find that light in some wave band is too bright and light in some other wave band is too dark, thus hindering the development of LED displays.

[0007] One aspect of the disclosure is to provide an LED display.

[0008] The LED display comprises at least one pixel unit. The pixel unit has a plurality of sub-pixels disposed on a substrate. The plurality of sub-pixels comprises a red sub-pixel, a green sub-pixel, and a blue sub-pixel. The red sub-pixel comprises at least one red micro LED. The green sub-pixel comprises at least one green micro LED. The blue sub-pixel comprises at least one blue micro LED. The red sub-pixel, the green sub-pixel, and the blue sub-pixel are located in the pixel unit. In an independent pixel unit, each of the red micro LED, the green micro LED, and the blue micro LED comprises a first type semiconductor layer, a second type semiconductor layer, an active layer disposed between the first type semiconductor layer and the second type semiconductor layer, and two electrodes. Each of the at least one red micro LED, the at least one green micro LED, and the at least one blue micro LED has a light-exiting surface. A total area of the light-exiting surface of the at least one red micro LED is larger than a total area of the light-exiting surface of the at least one green micro LED. The two electrodes are disposed in each of the red sub-pixel, the green sub-pixel, and the blue sub-pixel. One of the two electrodes is electrically connected with the corresponding first type semiconductor layer. The other one of the two electrodes is electrically connected with the second type semiconductor layer. At least one of the two electrodes is electronically connected with a corresponding thin film transistor.

[0009] The disclosure further provides an LED display. The LED display comprises a pixel unit, a first sub-pixel, and a second sub-pixel. The pixel unit is disposed on a substrate. The first sub-pixel comprises at least one first micro LED. The second sub-pixel comprises at least one second micro LED. The first sub-pixel and the second sub-pixel are located in the pixel unit. The first micro LED has a first light-exiting surface corresponding to the first micro LED. The second micro LED has a second light-exiting surface corresponding to the second micro LED. An area of the first light-exiting surface is not equal to an area of the second light-exiting surface.

[0010] The disclosure further provides a manufacturing method of an LED display.

[0011] The manufacturing method of the LED display comprises the following steps: providing a substrate, wherein the substrate comprises at least one pixel unit; transferring at least one red micro LED from an another substrate to the substrate, and disposing the at least one red micro LED in the pixel unit to form a red sub-pixel; transferring at least one green micro LED from the another substrate to the substrate, and disposing the at least one green micro LED in the pixel unit to form a green sub-pixel; and transferring at least one blue micro LED from the another substrate to the substrate, and disposing the at least one blue micro LED in the pixel unit to form a blue sub-pixel. The red sub-pixel, the green sub-pixel, and the blue sub-pixel are located in the pixel unit. A total area of a light-exiting surface of the red micro LED is larger than a total area of a light-exiting surface of the green micro LED.

[0012] Since the red micro LED has an inferior luminous efficiency to the green micro LED, the total area of the light-exiting surfaces of the red micro LEDs is larger than the total area of the light-exiting surfaces of the green micro LEDs to improve the inferior luminous efficiency of the red micro LED according to the embodiments of the disclosure. In addition, as compared with green light, human eyes are less sensitive to red light. Hence, when the total area of the light-exiting surfaces of the red micro LEDs are larger, the problem that human eyes are not easy to perceive red light can be improved so as to improve the inconsistent luminous efficiencies of sub-pixels of different colors.

[0013] It is to be understood that both the foregoing general description and the following detailed description are by examples, and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] 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. In the drawings,

[0015] FIG. **1** depicts a schematic diagram of a red sub-pixel, a green sub-pixel, and a blue sub-pixel in an individual pixel unit of an LED display;

[0016] FIG. **2** depicts a relational graph between external quantum efficiencies of a red micro LED, a green micro LED, and a blue micro LED and current densities;

[0017] FIG. **3** depicts a schematic diagram of an LED display according to one embodiment of this disclosure;

[0018] FIG. **4** depicts a cross-sectional view taken along line **4** in FIG. **3**;

[0019] FIG. **5** depicts a cross-sectional view of an LED display according to another embodiment of this disclosure;

[0020] FIG. **6** depicts an enlarged view of a pixel unit of an LED display according to one embodiment of this disclosure;

[0021] FIG. **7** depicts a curve illustrating human eye perception to light in different wave bands;

[0022] FIG. **8** depicts an enlarged view of a pixel unit of an LED display according to another embodiment of this disclosure; and

[0023] FIG. **9** depicts an enlarged view of a pixel unit of an LED display according to still another embodiment of this disclosure.

DESCRIPTION OF THE EMBODIMENTS

[0024] In the following detailed description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the disclosed embodiments. It will be apparent, however, that one or more embodiments may be practiced without these specific details. In addition, drawings are only for the purpose of illustration and not plotted according to the original size. Wherever possible, the same reference numbers are used in the drawings and the description to refer to the same or like parts.

[0025] As used herein, "substantially", "around," "about" or "approximately" shall generally mean within 20 percent, preferably within 10 percent, and more preferably within 5 percent of a given value or range. Numerical quantities given herein are approximate, meaning that the term "substantially", "around," "about" or "approximately" can be inferred if not expressly stated.

[0026] In the following embodiments, a light emitting diode (LED) display comprises a plurality of pixel units. A single pixel unit may comprise a plurality of sub-pixels (such as a red sub-pixel, a green sub-pixel, and a blue sub-pixel, or a first sub-pixel, a second sub-pixel, and a third sub-pixel). A single sub-pixel may comprise one or more single color micro LEDs (for example: the red sub-pixel may comprise one or more red micro LEDs, and so do the green sub-pixel and the blue sub-pixel. A size of micro LEDs is on a scale of micrometers. In greater detail, a side length of micro LEDs is from 3 micrometers to 150 micrometers, but the disclosure is not limited in this regard. In addition, in the following embodiments, a "total area" of light-exiting surfaces of micro LEDs refers to a sum of areas of light-exiting surfaces of one or more micro LEDs in each sub-pixel. That is, if the sub-pixel only has a single micro LED, the "total area" refers to an area of the light-exiting surface of the single micro LED in the sub-pixel. If the sub-pixel has a plurality of micro LEDs, the "total area" refers to the sum of the areas of the light-exiting surfaces of all the micro LEDs in the sub-pixel.

[0027] It is noted that luminous efficiencies of the red micro LED in the red sub-pixel, the green micro LED in the green sub-pixel, and the blue micro LED in the blue sub-pixel are not the same. Preferably, the micro LEDs are inorganic LEDs having a scale less than or substantially equal to micrometers. A description is provided with reference to FIG. **1**. FIG. **1** depicts a schematic diagram of a red sub-pixel **100**R, a green sub-pixel **100**G, and a blue sub-pixel **100**B in an individual pixel unit **100** of an LED display **10**. In greater detail, a total area of a light-exiting surface **S1** of a red micro LED **120**, a total area of a light-exiting surface S2 of a green micro LED **130**, and a total area of a light-exiting surface **S3** of a blue micro LED **140** are substantially the same as shown in FIG. **1**. Under the circumstances, if luminous efficiencies of the red micro LED **120**, the green micro LED **130**, and the blue micro LED **140** are not consistent, color performance of the LED display **10** will be impacted.

[0028] In greater detail, a description is provided with reference to FIG. **1** and FIG. **2**. FIG. **2** depicts a relational graph between external quantum efficiencies of the red micro LED **120**, the green micro LED **130**, and the blue micro LED **140** and current densities, where the horizontal axis represents current density with the unit $nA/\mu m^2$, the vertical axis represents external quantum efficiency (EQE). As shown in FIG. **2**, if an area of the light-exiting surface of the red micro LED **120**, an area of the light-exiting surface of the green micro LED **130**, and an area of the light-exiting surface of the blue micro LED are all 100 μm^2, highest EQEs of the red micro LED **120**, the green micro LED **130**, and the blue micro LED **140** are approximately 3%, 10%, and 15%, respectively, when the red micro LED **120**, the green micro LED **130**, and the blue micro LED **140** have different current densities. Under the circumstances, even though the red micro LED **120**, the green micro LED **130**, and the blue micro LED **140** can respectively receive currents having different magnitudes, the inferior luminous efficiency of the red sub-pixel **100**R is difficult to improve.

[0029] In view of this, the embodiments according to the disclosure provide an LED display that is able to improve the inferior luminous efficiency of the red sub-pixel **100**R. In greater detail, by adjusting magnitude relationships between the total area of the light-exiting surface of the red micro LED **120** in the red sub-pixel **100**R and total areas of light-exiting surfaces of micro LEDs in sub-pixels of the other colors, the inconsistent luminous efficiencies of micro LEDs of different colors in the LED display are thus improved. A detailed description is provided as follows.

[0030] First, a description is provided with reference to FIG. **3** and FIG. **4**. FIG. **3** depicts a schematic diagram of the LED display **10** according to one embodiment of this invention. FIG. **4** depicts a cross-sectional view taken along line **4** in FIG. **3**. As shown in FIG. **3**, the LED display **10** comprises the plurality of pixel units **100**, first sub-pixels **101**, second sub-pixels **102**, and third sub-pixels **103**. The pixel units **100** are disposed on a substrate **110**. The substrate **110** comprises a display area **111** and a non-display area **112**.

The pixel units **100** are located in the display area **111**, and the first sub-pixels **101**, the second sub-pixels **102**, and the third sub-pixels **103** are located in the pixel units **100**. Each of the pixel units **100** occupies approximately a same area as an example. That is, each of the pixel units **100** in the display area **111** has approximately the same area. In addition, the first sub-pixel **101**, the second sub-pixel **102**, and the third sub-pixel **103** comprised in each of the pixel units **100** may, for example, respectively be the red sub-pixel **100**R, the green sub-pixel **100**G, and the blue sub-pixel **100**B, but the disclosure is not limited in this regard. Additionally, each of the sub-pixels may comprise at least one micro LED. For example, the first sub-pixel **101** may comprise at least one first micro LED (such as the red micro LED **120**), the second sub-pixel **102** may comprise at least one second micro LED (such as the green micro LED **130**), the third sub-pixel **103** may comprise at least one third micro LED (such as the blue micro LED **140**).

[0031] For example, the red micro LED **120** may be configured to from the red sub-pixel **100**R, the green micro LED **130** may be configured to from the green sub-pixel **100**G, and the blue micro LED **140** may be configured to from the blue sub-pixel **100**B. The red sub-pixel **100**R, the green sub-pixel **100**G, and the blue sub-pixel **100**B are located in the pixel unit **100**. The non-display area **112** may comprise a data line driving circuit **114** and a scan line driving circuit **115**. The data line driving circuit **114** is connected to data lines of the red sub-pixels **100**R, the green sub-pixels **100**G, and the blue sub-pixels **100**B so as to transmit data signals to each of the sub-pixels. The scan line driving circuit **115** is connected to scan lines of the red sub-pixels **100**R, the green sub-pixels **100**G, and the blue sub-pixels **100**B so as to transmit scan signals to each of the sub-pixel.

[0032] In the embodiment shown in FIG. **4**, the first sub-pixel **101** (that is, the red sub-pixel **100**R) may comprise the red micro LED **120**, the second sub-pixel **102** (that is, the green sub-pixel **100**G) may comprise the green micro LED **130**, and the third sub-pixel **103** (that is, the blue sub-pixel **100**B) may comprise the blue micro LED **140** in the pixel unit **100**. Through combining lights emitted from the red sub-pixel, the green sub-pixel, and the blue sub-pixel, the LED display **10** is allowed to emit full-color images.

[0033] With additional reference to FIG. **3** and FIG. **4**, the substrate **110** of the LED display **10** may be an active device array substrate. Two electrodes (at least one first electrode **171**, **172**, **173** and at least one second electrode **180**) are disposed in each of the red sub-pixel **100**R, the green sub-pixel **100**G, and the blue sub-pixel **100**B, wherein one of the two electrodes is electrically connected with the corresponding first type semiconductor layer **121**, the other one of the two electrodes is electrically connected with the second type semiconductor layer **123**, and at least one of the two electrodes is electronically connected with a corresponding thin film transistor. In greater detail, the substrate **110** comprises a plurality of pixel circuits T**1**, T**2**, T**3**, an insulating layer **150**, a pixel define layer **160**, at least one first electrode **171**, **172**, **173** and at least one second electrode **180**. The plurality of pixel circuits T**1**, T**2**, T**3** are respectively located in the red sub-pixel **100**R, the green sub-pixel **100**G, and the blue sub-pixel **100**B corresponding to the plurality of pixel circuits T**1**, T**2**, T**3**, and configured to respectively drive the red micro LED **120**, the green micro LED **130**, and the blue micro LED **140**. In one embodiment, each of the pixel circuits T**1**, T**2**, T**3** may further comprise at least one thin film transistor. The insulating layer **150** covers the pixel circuits T**1**, T**2**, T**3**. The pixel define layer **160** is on top of the insulating layer **150**, and the pixel define layer **160** comprises a plurality of openings O**1**, O**2**, and O**3** in it. In the present embodiment, the red micro LED **120** is located in the opening O**1**, the green micro LED **130** is located in the opening O**2**, and the blue micro LED **140** is located in the opening O**3**. The first electrodes **171**, **172**, **173** may be respectively located in the openings O**1**, O**2**, O**3**, and the three first electrodes **171**, **172**, **173** are electrically connected to the pixel circuits T**1**, T**2**, T**3**, respectively. In one embodiment, each of the first electrodes **171**, **172**, **173** may comprise a non-transparent conductive material, such as silver, aluminum, copper, magnesium, or molybdenum, a transparent conductive material, such as indium tin oxide, indium zinc oxide, or zinc aluminum oxide, a composite layer thereof, or an alloy thereof, but the disclosure is not limited in this regard. Not only do the first electrodes **171**, **172**, **173** have a good electrical conductivity, but the first electrodes **171**, **172**, **173** are also light reflective.

[0034] In greater detail, the insulating layer **150** may have a plurality of through holes TH**1**, TH**2**, TH**3** in it to expose part of the pixel circuits T**1**, T**2**, T**3**. The openings O**1**, O**2**, O**3** in the pixel define layer **160** can respectively expose the through holes TH**1**, TH**2**, TH**3**. When the first electrodes **171**, **172**, **173** are formed in the openings O**1**, O**2**, O**3**, the first electrodes **171**, **172**, **173** may be electrically connected to the pixel circuits T**1**, T**2**, T**3** via the through holes TH**1**, TH**2**, TH**3**. Additionally, the three first electrodes **171**, **172**, **173** may be electrically connected to one terminal of the red micro LED **120**, one terminal of the green micro LED **130**, and one terminal of the blue micro LED **140**, respectively. The second electrode **180** is electrically connected to another terminal of the red micro LED **120**, another terminal of the green micro LED **130**, and another terminal of the blue micro LED **140**. According to the present embodiment, the second electrode **180** may serve as a common electrode.

[0035] In addition, in each of the pixel units **100**, each of the red micro LED **120**, the green micro LED **130**, and the blue micro LED **140** may comprise a first type semiconductor layer **121**, an active layer **122**, and a second type semiconductor layer **123** (although in the figure only the red micro LED **120** is shown, it would be understood that the green micro LED **130** and the blue micro LED **140** have the same structure). The active layer **122** is disposed between the first type semiconductor layer **121** and the second type semiconductor layer **123**. For example, the active layer **122** is disposed on the first type semiconductor layer **121**. The second type semiconductor layer **123** is disposed on the active layer **122**. For example, a first type semiconductor layer **121** of the red micro LED **120** may be the P-type semiconductor or the N-type semiconductor. The second type semiconductor layer **123** of the red micro LED **120** may be the P-type semiconductor or the N-type semiconductor. The P-type semiconductor or the N-type semiconductor may be gallium arsenide (GaAs) or other suitable materials. First type semiconductor layers **131**, **141** of the green micro LED **130** and the blue micro LED **140** may be the P-type semiconductor or the N-type semiconductor. Second type semiconductor layers **132**, **142** of the green micro LED **130** and the blue micro LED **140** may be the P-type semiconductor or the N-type semiconductor. The P-type semiconductor and the N-type semiconductor may be gallium nitride

(GaN), zinc selenide (ZnSe), or aluminum nitride (AlN), or other suitable materials. A material of the active layer **120** may be gallium nitride or indium gallium nitride (InGaN), or other suitable materials.

[0036] In addition to that, each of the red micro LED **120**, the green micro LED **130**, and the blue micro LED **140** has the light-exiting surface S**1**, for example. The second type semiconductor layer **123** has the light-exiting surface S**1** on a surface opposite to the active layer **122**. Similarly, the second type semiconductor layers of the green micro LED **130** and the blue micro LED **140** respectively have the light-exiting surfaces S**2**, S**3** too. According to the present embodiment, the first micro LED in the first sub-pixel **101** has a first light-exiting surface corresponding to the first micro LED. The second micro LED in the second sub-pixel **102** has a second light-exiting surface corresponding to the second micro LED. An area of the first light-exiting surface is not equal to an area of the second light-exiting surface. In greater detail, the total area of the light-exiting surface S**1** of the red micro LED **120** in the red sub-pixel **100**R is larger than the total area of the light-exiting surface S**2** of the green micro LED **130** in the green sub-pixel **100**G. Since the total area of the light-exiting surface S**1** of the red micro LED **120** is larger than the total area of the light-exiting surface S**2** of the green micro LED **130**, the inferior luminous efficiency of the red sub-pixel **100**R is able to be compensated.

[0037] FIG. **5** depicts a cross-sectional view of the LED display **10** according to another embodiment of this invention. The cross-sectional position of FIG. **5** is the same as that of FIG. **4**. The difference between the present embodiment and the embodiment in FIG. **4** lies in that a number of the red micro LEDs **120** is plural in the present embodiment pixel unit **100**. In greater detail, it would be understood from the embodiment shown in FIG. **5** that those of ordinary skill in the art may select disposing the red micro LED in a larger size or select disposing the plurality of red micro LEDs in a smaller size, so that a sum of areas of the light-exiting surfaces S**1** of the red micro LEDs **120** is larger than a sum of an area of the light-exiting surface S**2** of the green micro LED **130**. For example, one micro LED having an area of a light-exiting surface of about 100 μm^2 is equivalent to ten micro LEDs having an area of a light-exiting surface of about 10 μm^2. Hence, since a total area of the light-exiting surfaces S**1** of the plurality of red micro LED **120** is larger than a total area of the light-exiting surface S**2** of the at least one green micro LED **130**, the inferior luminous efficiency of the red sub-pixel **100**R is able to be compensated. Because the sub-pixel has a plurality of micro LEDs of the same color, the current loaded by the micro LED is less than that loaded by the single LED in the sub-pixel, the damage of the micro LED caused by an overcurrent is thus avoided to elongate the lifetime of the LED display **10**. In addition, when part of the plurality of micro LEDs of the same color in the sub-pixel are damaged, dark spots in the sub-pixel are not generated in a bright state.

[0038] FIG. **6** depicts an enlarged view of the pixel unit **100** of the LED display **10** according to one embodiment of this invention. In the embodiment shown in FIG. **6**, the first sub-pixel **101** (that is, the red sub-pixel **100**R) comprises the two red micro LEDs **120**, the second sub-pixel **102** (that is, the green sub-pixel **100**G) comprises the two green micro LEDs **130**, and the third sub-pixel **103** (that is, the blue sub-pixel **100**B) comprises the two blue micro LEDs **140**. In the present embodiment, magnitude relationships between the total areas of the micro LEDs of different colors are adjusted in consideration of the different luminous efficiencies of the micro LEDs of different colors. In the pixel unit **100** according to the present embodiment, the second micro LED in the second sub-pixel **102** has the second light-exiting surface corresponding to the second micro LED, the third micro LED in the third sub-pixel **103** has the third light-exiting surface corresponding to the third micro LED, and the area of the second light-exiting surface is not equal to an area of the third light-exiting surface. In greater detail, a total area of the light-exiting surfaces S**2** of the green micro LEDs **130** in the green sub-pixel **100**G is larger than a total area of the light-exiting surfaces S**3** of the blue micro LEDs **140** in the blue sub-pixel **100**B. In greater detail, the total area of the light-exiting surfaces S**3** of the blue micro LEDs **140**, the total area of the light-exiting surfaces S**2** of the green micro LEDs **130**, and a total area of the light-exiting surfaces S**1** of the red micro LEDs **120** according to the present embodiment substantially satisfy the following relation:

$$AR \geq AG \geq AB \quad (1)$$

where AR represents the total area of the light-exiting surfaces S**1** of the red micro LEDs **120**, AG represents the total area of the light-exiting surfaces S**2** of the green micro LEDs **130**, and AB represents the total area of the light-exiting surfaces S**3** of the blue micro LEDs **140**. However, AR, AG, and AB are not the same at the same time. Therefore, since the EQE of the red micro LED **120** is lower and the EQE of the blue micro LED **140** is higher, the total area of the light-exiting surfaces S**3** of the blue micro LEDs **140** is smaller and the total area of the light-exiting surfaces S**1** of the red micro LEDs **120** is larger in the present embodiment, when only considering the luminous efficiencies of the micro LEDs, so as to compensate for the inferior luminous efficiency of the sub-pixel in a specific color (such as the red sub-pixel **100**R).

[0039] In greater detail, the total area (AR) of the light-exiting surfaces S**1** of the red micro LEDs **120**, the total area (AG) of the light-exiting surfaces S**2** of the green micro LEDs **130**, and the total area (AB) of the light-exiting surfaces S**3** of the blue micro LEDs **140** substantially satisfy the following proportions:

$$AR:AG:AB=10:3:2 \quad (2)$$

Hence, since the highest EQEs of the red micro LED **120**, the green micro LED **130**, and the blue micro LED **140** in FIG. **2** are respectively 3%, 10%, and 15%, the sub-pixel having the inferior luminous efficiency can be compensated by adjusting the proportions of the total areas of the light-exiting surfaces S**1**, S**2**, S**3** when AR:AG:AB=10:3:2 according to the present embodiment. As a result, the inconsistent luminous efficiencies of the sub-pixels of different colors can be improved.

[0040] In greater detail, a description is provided with reference to "Table 1". "Table 1" discloses EQEs of LEDs not been microminiaturized (referred to as LEDs in Table 1) and EQEs of microminiaturized LEDs (referred to as μLEDs in Table 1), and relationships of compensation proportions between total light emitting areas of the LEDs not been microminiaturized and relationships of compensation proportions between total light emitting areas of the microminiaturized LEDs when only considering the luminous efficiencies of the LEDs of different colors. The above LEDs not been microminiaturized refer to an LED having a side length outside 3 to 150 micrometers, for example, a commercially available LED which may have a side length of 1 cm.

TABLE 1

	Red	Green	Blue
External Quantum Efficiencies (EQEs) of LEDs	35%	50%	65%
Compensation Proportions of Light Emitting Areas of LEDs	2.86	2	1.54
External Quantum Efficiencies (EQEs) of μLEDs	3%	10%	15%
Compensation Proportions of Light Emitting Areas of μLEDs	10	3	2

[0041] In some embodiments, if only considering the luminous efficiencies of the LEDs, the total area of the light-exiting surfaces **S1** of the red micro LEDs **120** may be 1 to 35 times the total area of the light-exiting surfaces **S2** of the green micro LEDs **130**. The total area of the light-exiting surfaces **S3** of the blue micro LEDs **140** may be 0.5 to 1 time the total area of the light-exiting surfaces **S2** of the green micro LEDs **130**. In greater detail, it would be understood from "Table 1" that a range of AR/AG is approximately 1.43 to 3.3 and a range of AB/AG is approximately 0.67 to 0.77 when only considering the luminous efficiencies of the micro LEDs of different colors. In other words, in the embodiment shown in FIG. **6**, the total area of the light-exiting surfaces **S1** of the red micro LEDs **120** may be 1.43 to 3.3 times the total area of the light-exiting surfaces **S2** of the green micro LEDs **130**. The total area of the light-exiting surfaces **S3** of the blue micro LEDs **140** may be 0.67 to 0.77 times the total area of the light-exiting surfaces **S2** of the green micro LEDs **130**. Hence, by properly adjusting the magnitude relationships between the total areas of the light-exiting surfaces **S1**, **S2**, **S3** of the red, green, and blue micro LEDs **120**, **130**, **140**, the inconsistent luminous efficiencies of the sub-pixels of different colors can be improved.

[0042] In addition, human eyes have different perception of red light, green light, and blue light. A description is provided with reference to FIG. **7**. FIG. **7** depicts a curve illustrating human eye perception to light in different wave bands, where the horizontal axis represents wavelength with the unit nm, the vertical axis represents the photopic vision function V(λ). For example, in a bright environment, human eyes have the most acute perception to 555 nms. Hence, the photopic vision function V(λ) may be a ratio of a radiant energy flux of light having a wavelength of 555 nm to a radiant energy flux of light having any wavelength when a same brightness is generated. As shown in the figure, if the red light is evaluated at a wavelength of 650 nm, the green light is evaluated at a wavelength of 555 nm, and the blue light is evaluated at a wavelength of 460 nm, proportions of human eye perception to red light, green light, and blue light are respectively 0.1:1:0.04, under a same light intensity. In other words, human eyes are more sensitive to light in the green wave band. Hence, in an individual or the single pixel unit **100**, when considering the human eye perception to light in different wave bands, the total area of the light-exiting surfaces of the green micro LEDs **130** can be smaller, and the red micro LEDs **120** should have a larger total light emitting area than the green micro LEDs **130**. As shown in the embodiment in FIG. **6**, since the total area of the light-exiting surfaces **S1** of the red micro LEDs **120** is larger than the total area of the light-exiting surfaces **S2** of the green micro LEDs **130**, the problem that human eyes are not easy to perceive red light is improved.

[0043] FIG. **8** depicts an enlarged view of the pixel unit **100** of the LED display **10** according to another embodiment of this invention. As shown in the figure, the sub-pixels **101**(**100**R), **102**(**100**G), **103**(**100**B) in the individual pixel unit **100** respectively have the two red micro LEDs **120**, the two green micro LEDS **130**, and the two blue micro LEDs **140** according to the present embodiment. Additionally, when only considering the human eye perception to light in different wave bands, the total area of the light-exiting surface **S3** of the blue micro LEDs **140** is larger than the total area of the light-exiting surface **S1** of the red micro LEDs **120** according to the present embodiment. In greater detail, the total area of the light-exiting surfaces **S3** of the blue micro LEDs **140**, the total area of the light-exiting surfaces **S2** of the green micro LEDs **130**, and the total area of the light-exiting surfaces **S1** of the red micro LEDs **120** substantially satisfy the following relation:

$$AB \geq AR \geq AG \tag{3}$$

As a result, since human eyes are less sensitive to blue light and more sensitive to green light, in the present embodiment the total area of the light-exiting surfaces **S3** of the blue micro LEDs **140** is larger and the total area of the light-exiting surfaces **S2** of the green micro LEDs **130** is smaller. However, AR, AG, and AB are not the same at the same time. The problem that the human eyes have different perception to light in different wave bands is thus improved.

[0044] In greater detail, the total area of the light-exiting surfaces **S3** of the blue micro LEDs may be 1 to 20 times the total area of the light-exiting surfaces **S2** of the green micro LEDs **130**. In another embodiment, the total area of the light-exiting surfaces **S3** of the blue micro LEDs **140** may be 16 to 20 times the total area of the light-exiting surface **S2** of the green micro LEDs **130**. Hence, by properly adjusting the proportional relationships between the total areas of the light-exiting surfaces **S1**, **S2**, **S3** of the red, green, and blue micro LEDs **120**, **130**, **140**, the problem that human eyes have different perception to light in different wave bands is thus improved.

[0045] A description is provided with reference to Table 2. In practical applications, the total area of the light-exiting surfaces **S1** of the red micro LEDs **120**, the total area of the light-exiting surfaces **S2** of the green micro LEDs **130**, and the total area of the light-exiting surfaces **S3** of the blue micro LEDs **140** substantially satisfy the following proportions:

$$AR{:}AG{:}AB=10{:}1{:}25 \tag{4}$$

Hence, since the proportions of human eye perception to red light, green light, and blue light are respectively 0.1:1:0.04 (see FIG. **7**), the human eye perception to red light, green light, and blue light in the pixel unit **100** can be improved when AR:AG:AB=10:1:25 under approximately the same light intensity.

TABLE 2

	Red	Green	Blue
Human Eye Perception	0.1	1	0.04
Compensation Proportions for Human Eye Perception	10	1	25

[0046] FIG. **9** depicts an enlarged view of the pixel unit **100** of the LED display **10** according to still another embodiment of this invention. As shown in the figure, the sub-pixels **101**(**100**R), **102**(**100**G), **103**(**100**B) in the individual pixel unit **100** respectively have the two red micro LEDs **120**, the two green micro LEDS **130**, and the two blue micro LEDs **140** according to the present embodiment. In the present embodiment, both the luminous efficiencies of the micro LEDs and the human eye perception to light of different colors are considered to adjust magnitude relationships between the total areas of the micro LEDs of different colors. The total area of the light-exiting surfaces S**3** of the blue micro LEDs **140** is smaller than the total area of the light-exiting surfaces S**1** of the red micro LEDs **120** and larger than the total area of the light-exiting surfaces S**2** of the green micro LEDs **130** according to the present embodiment. In brief, the total area of the light-exiting surfaces S**3** of the blue micro LEDs **140**, the total area of the light-exiting surfaces S**2** of the green micro LEDs **130**, and the total area of the light-exiting surfaces S**1** of the red micro LEDs **120** according to the present embodiment substantially satisfy the following relation:

$$AR \geq AB \geq AG \tag{5}$$

As a result, since both the luminous efficiencies of the micro LEDs and the human eye perception to light of different colors are considered, the magnitude relationships between the total areas according to the present embodiment can compensate for the sub-pixel having the inferior luminous efficiency. However, AR, AG, and AB are not the same at the same time. The problem that human eyes have different perception to light in different wave bands can also be improved.

[0047] In greater detail, the total area (AR) of the light-exiting surfaces S**1** of the red micro LEDs **120**, the total area (AG) of the light-exiting surfaces S**2** of the green LEDs **130**, and the total area (AB) of the light-exiting surfaces S**3** of the blue LEDs **140** substantially satisfy:

$$AR:AG:AB=100:3:50 \tag{6}$$

Proportional relationships in (6) according to the present embodiment can be obtained by multiplying the proportional relationships in (2) and the proportional relationships in (4). Hence, in the present embodiment since the EQE of the red micro LED **120** is lower and human eyes have a poorer perception to red light, the total area of the light-exiting surfaces S**1** of the red micro LEDs **120** obtains a larger compensation. Conversely, since human eyes are more sensitive to green light and the EQE of green light is at least higher than that of red light, the total area compensation obtained by green light is smaller. As a result, the present embodiment is able to improve the inconsistent luminous efficiencies of sub-pixels of different colors and the problem that human eyes have different perception to light in different wave bands at the same time.

[0048] Next, a description is provided with reference to "Table 3". In addition to information in "Table 1", "Table 3" contains proportions of human eye perception to light of different colors in "Table 2", compensation proportions of light emitting areas of micro LEDs (referred to as μLEDs in Table 3) and LEDs not been microminiaturized (referred to as LEDs in Table 3) when only considering human eye perception, and compensation proportions of light emitting areas of the micro LEDs (referred to as μLEDs in Table 3) and the LEDs not been microminiaturized (referred to as LEDs in Table 3) when considering both the luminous efficiencies of the LEDs and human eye perception.

TABLE 3

	Red	Green	Blue
Compensation Proportions of Light Emitting Areas of LEDs (When Only Considering EQEs)	2.86	2	1.54
Compensation Proportions of Light Emitting Areas of μLEDs (When Only Considering EQEs)	10	3	2
Compensation Proportions for Human Eye Perception	10	1	25
Compensation Proportions of Light Emitting Areas of LEDs (When Considering EQEs and Human Eye Perception)	28.6	2	38.5
Compensation Proportions of Light Emitting Areas of LEDs (When Considering EQEs and Human Eye Perception)	14.3	1	19.25
Compensation Proportions of Light Emitting Areas of μLEDs (When Considering EQEs and Human Eye Perception)	100	3	50
Compensation Proportions of Light Emitting Areas of μLEDs (When Considering EQEs and Human Eye Perception)	33.33	1	16.67

[0049] In some embodiments, after considering both the luminous efficiencies of the LEDs and human eye perception, the total area of the light-exiting surfaces S**1** of the red micro LEDs **120** may be 14 to 34 times the total area of the light-exiting surfaces S**2** of the green micro LEDs **130**. The total area of the light-exiting surfaces S**3** of the blue micro LEDs **140** may be 16 to 20 times the total area of the light-exiting surfaces S**2** of the green micro LEDs **130**. In greater detail, a description is provided with reference to "Table 3". The total area of the light-exiting surfaces S**1** of the red micro LEDs **120** may be 14.3 to 33.3 times the total area of the light-exiting surfaces S**2** of the green micro LEDs **130**. The total area of the light-exiting surfaces S**3** of the blue micro LEDs **140** may be 16.67 to 19.25 times the total area of the light-exiting surfaces S**2** of the green micro LEDs **130**. Thus, by properly adjusting the magnitude relationships between the total areas of the light-exiting surfaces S**1**, S**2**, S**3** of the red, green, and blue micro LEDs **120**, **130**, **140**, the inconsistent luminous efficiencies of the sub-pixels of different colors and the problem that human eyes have different perception to light in different wave bands can be improved at the same time.

[0050] In addition, in the above one or more embodiments, the total area of the light-exiting surfaces S**1** of the red micro LEDs **120**, the total area of the light-exiting surfaces S**2** of the green micro LEDs **130**, and the total area of the light-exiting surfaces S**3** of the blue micro LEDs **140** substantially satisfy the following relation:

$$A\text{min} < A\text{max} < 35^{*}A\text{min} \tag{7}$$

Where Amin is a minimum in the total area of the light-exiting surfaces S**1** of the red micro LEDs **120**, the total area of the light-exiting surfaces S**2** of the green micro LEDs **130**, and the total area of the light-exiting surfaces S**3** of the blue LEDs **140**, Amax is a maximum in the total area of the light-exiting surfaces S**1** of the red micro LEDs **120**, the total area of the light-exiting surfaces S**2** of the green micro

LEDs **130**, and the total area of the light-exiting surfaces S3 of the blue LEDs **140**. For example, in the embodiment shown in FIG. **9**, the total area of the light-exiting surfaces S1 of the red micro LEDs **120** is smaller than 35 times the total area of the light-exiting surfaces S2 of the green micro LEDs **130**.

[0051] It would be understood that those of ordinary skill in the art may dispose different numbers of the red micro LEDs **120**, the green micro LEDs **130**, and the blue micro LEDs **140** to realize the proportional relationships or magnitude relationships between areas according to the above one or more embodiments. Additionally, in the embodiments shown in FIG. **6** to FIG. **9**, the light-exiting surfaces S1, S2, S3 of the red micro LEDs **120**, the green micro LEDs **130**, and the blue micro LEDs **140** are depicts as rectangles, but the disclosure is not limited in this regard. The light-exiting surfaces S1, S2, S3 of the red micro LEDs **120**, the green micro LEDs **130**, and the blue micro LEDs **140** may be in any shape once the proportional relationships or magnitude relationships between areas according to the above one or more embodiments are satisfied.

[0052] In addition to that, the above embodiments all discuss the magnitude relationships or proportional relationships between the total areas of the light-exiting surfaces of the micro LEDs in the sub-pixels of different colors. It would be understood that, in practical applications, an area percentage of each of the sub-pixels occupied by the total area of the light-exiting surfaces of all micro LEDs in the each of the sub-pixels should be within a predetermined range in view of the limitations of process capability. A description is provided with reference to “Table 4”. Table 4 shows area percentages of the red, green, or blue sub-pixels **100**R, **100**G, **100**B respectively occupied by the total areas of the light-exiting surfaces of the red, green, or blue micro LEDs **120**, **130**, **140** according to one embodiment. An area of individual sub-pixels in Table 4 is approximately 99 micrometers multiplied by 33 micrometers. In consideration of the upper limit of process capability, a minimum side length of the micro LEDs is approximately 3 micrometers (an area of individual micro LEDs is 3 micrometers multiplied by 3 micrometers), and a maximum side length of the micro LEDs is 20 micrometers (the area of individual micro LEDs is 20 micrometers multiplied by 20 micrometers). In addition, a number of the micro LEDs in each of the sub-pixels is 1 to 2.

TABLE 4

Area Of Sub-pixel (um^2)	Area of an Individual Micro LED	Total Area of Light-exiting surface(s)	Percentage
99*33(um^2)	3*3(um^2)	9*1(One)	0.3%
99*33(um^2)	10*10(um^2)	100*2(Two)	6.0%
99*33(um^2)	16*16(um^2)	256*2(Two)	15.7%
99*33(um^2)	20*20(um^2)	400*2(Two)	24.5%

[0053] As shown in “Table 4”, in one embodiment, the area percentage of each of the sub-pixels occupied by the total area of the light-exiting surfaces of the all micro LEDs in the each of the sub-pixels is approximately 0.3% to 24.5%, but the disclosure is not limited in this regard. In other embodiments, the area of the sub-pixels my be larger than or smaller than 99 micrometers multiplied by 33 micrometers, and the side length of the micro LEDs may be up to 150 micrometers. The number of the micro LEDs in each of the sub-pixels is not limited to 1 to 2. Hence, in other embodiments, the area percentage of the each of the sub-pixels occupied by the total area of the light-exiting surfaces of the all micro LEDs in the each of the sub-pixels may be outside 0.3% to 24.5%, such as from 0.3% to 30%.

[0054] In summary, the above embodiments can adjust the relationships between the total areas of the red, green, and blue micro LEDs **120**, **130**, **140** in the red, green, and blue sub-pixels **100**R, **100**G, **100**B to improve the inconsistent luminous efficiencies of the sub-pixels of different colors and the problem that human eyes have different perception to light in different wave bands. As a result, brightness of the red micro LEDs **120**, the green micro LEDs **130**, or the blue micro LEDs **140**, whose total area of light-exiting surfaces is the largest of the total areas of the light-exiting surfaces S1, S2, S3, is greater than or equal to brightness of the red micro LEDs **120**, the green micro LEDs **130**, or the blue micro LEDs **140**, whose total area of the light-exiting surfaces is the smallest of the total areas of the light-exiting surfaces S1, S2, S3 in each of the pixel units **100**.

[0055] A manufacturing method of the LED display **10** is further disclosed in the following embodiment to facilitate understanding. A description is provided with reference to FIG. **3** and FIG. **4**. The manufacturing method of the LED display **10** may comprise the following steps:

[0056] S**1**: providing a substrate **110**. As shown in FIG. **3**, the substrate **110** may comprise at least one pixel unit **100**, and the substrate **110** may be an active device array substrate.

[0057] S**2**: disposing at least one red micro LED **120** in the pixel unit **100** to form a red sub-pixel **100**R, disposing at least one green micro LED **130** in the pixel unit **100** to form a green sub-pixel **100**G, and disposing at least one blue micro LED **140** in the pixel unit **100** to form a blue sub-pixel **100**B. The red sub-pixel **100**R, the green sub-pixel **100**G, and the blue sub-pixel **100**B are located in the pixel unit **100**. In greater detail, the red, green, and blue micro LEDs **120**, **130**, **140** can be transposed from another substrate (not show in figure) to the pixel unit **100** of the substrate **110** by utilizing a micromechanical device. Numbers of the red, green, and blue micro LEDs **120**, **130**, **140** disposed may be one or more than one depending on a size of light-exiting surfaces S1, S2, S3 as required.

[0058] In one embodiment, the step of providing the substrate **110** further comprises:

[0059] S**1**.**1**: forming pixel circuits T**1**, T**2**, T**3**. The pixel circuits T**1**, T**2**, T**3** are located in the pixel unit **100**. Each of the pixel circuits T**1**, T**2**, T**3** may comprise a transistor, a data line, or a scan line, etc., and the pixel circuits T**1**, T**2**, T**3** may be configured to respectively drive the luminescence of the red, green, and blue micro LEDs **120**, **130**, **140**.

[0060] S**2**.**1**: forming an insulating layer **150** on the pixel circuits T**1**, T**2**, T**3**. In greater detail, the insulating layer **150** covers the pixel circuits T**1**, T**2**, T**3**, and the insulating layer **150** may have a plurality of through holes TH**1**, TH**2**, TH**3**. The red, green, and blue micro LEDs **120**, **130**, **140** can be electrically connected to the pixel circuits T**1**, T**2**, T**3** via the through holes TH**1**, TH**2**, TH**3**.

[0061] S**1**.**3**: forming a pixel define layer **160** on top of the insulating layer **150**. A plurality of openings O**1**, O**2**, O**3** may be defined in the pixel define layer **160** by utilizing lithography and etching processes.

[0062] S**1**.**4**: forming first electrodes **171**, **172**, **173** in the openings O**1**, O**2**, O**3**, respectively. The first electrodes **171**, 172, 173 may be electrically connected to the pixel circuits T1, T2, T3 via the through holes TH1, TH2, TH3, respectively. The first electrodes 171, 172, 173 are electrically connected to one terminal of the red micro LED 120, one terminal of the green micro LED 130, and one terminal of the blue micro LED 140, and the first electrodes 171, 172, 173 may be made of a high reflective metal material for reflecting light. In one embodiment, electrical adhesive layers 191, 192, 193 are respectively disposed on the first electrodes 171, 172, 173 in the openings O1, O2, O3. For example, each of the electrical adhesive layers 191, 192, 193 may be conductive adhesive or other suitable conductive materials. The conductive material may be, for example, at least one of indium (In), bismuth (Bi), tin (Sn), silver (Ag), gold (Au), copper (Cu), gallium (Ga) and antimony (Sb), but the disclosure is not limited in this regard. The electrical adhesive layers 191, 192, 193 are configured to fix the red, green, and blue micro LEDs 120, 130, 140 in the openings O1, O2, O3, and electrically connect the first electrode 171, 172, 173.

[0063] S1.5: forming a second electrode 180. The second electrode 180 may be a transparent electrode for electrically connecting another terminal of the red micro LED 120, another terminal of the green micro LED 130, and another terminal of the blue micro LED 140.

[0064] Although the present invention has been described in considerable detail with reference to certain embodiments thereof, other embodiments are possible. Therefore, the spirit and scope of the appended claims should not be limited to the description of the embodiments contained herein.

[0065] 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 light emitting diode (LED) display comprising:

a substrate;

a pixel define layer disposed on the substrate and having a first opening and a second opening separated from each other, wherein contours of the first and second openings on a surface of the pixel define layer facing away from the substrate respectively define areas which are substantially the same as each other;

at least one first color micro LED disposed in the first opening and having a first vertical projection projected on the substrate; and

at least one second color micro LED disposed in the second opening and having a second vertical projection projected on the substrate, wherein an area of the first vertical projection is different from an area of the second vertical projection.

2. The LED display of claim 1, wherein the at least one first color micro LED is at least one red micro LED, the at least one second color micro LED is at least one blue micro LED, the pixel define layer further has a third opening separated from the first and second openings, the LED display further comprises at least one third color micro LED as at least one green micro LED in the third opening, and the first, second and third openings define a pixel unit.

3. The LED display of claim 2, wherein a contour of the third opening on said surface of the pixel define layer defines an area substantially the same as each of said areas of the first and second openings, the at least one green micro LED has a third vertical projection projected on the substrate, and an area of the third vertical projection is different from at least one of said areas of the first and second vertical projections.

4. The LED display of claim 1, wherein the pixel define layer further has a third opening separated from the first and second openings, and a distance between any adjacent two of the first, second and third openings is the same.

5. The LED display of claim 1, further comprising an upper electrode extended along a direction passing through the first and second openings, and the upper electrode connected to the first and second color micro LEDs at sides thereof opposite to the substrate, wherein the at least one first color micro LED has a first quantity, the at least one second color micro LED has a second quantity, and the first quantity is different from the second quantity.

6. The LED display of claim 5, wherein a width of the first color micro LED is substantially the same as a width of the second micro LED with respect to the direction.

7. The LED display of claim 5, wherein a width of the first color micro LED is different from a width of the second micro LED with respect to the direction.

8. The LED display of claim 1, further comprising a upper electrode extended along a direction passing through the first and second openings, and the upper electrode connected to the first and second color micro LEDs at sides thereof opposite to the substrate, wherein the at least one first color micro LED has a first quantity, the at least one second color micro LED has a second quantity, the first quantity is the same as the second quantity, and a width of the first color micro LED is different from a width of the second micro LED with respect to the direction.

9. The LED display of claim 8, wherein an area of a contact interface between the at least one first color micro LED and the upper electrode is different from that between the at least one second color micro LED and the upper electrode.

10. The LED display of claim 1, further comprising at least one first electrical adhesive layer between the substrate and the at least one first color micro LED respectively, and comprising at least one second electrical adhesive layer between the substrate and the at least one second color micro LED respectively.

11. The LED display of claim 10, wherein the first and second electrical adhesive layers are free from side walls of the first and second openings respectively.

12. The LED display of claim 10, further comprising a plurality of lower electrodes between the substrate and the first and second color micro LEDs, wherein the first electrical adhesive layer is sandwiched between one of the lower electrodes and the first color micro LED, and the second electrical adhesive layer is sandwiched between another one of the lower electrodes and the second micro LED.

13. The LED display of claim 1, wherein the first color micro LED comprises:

a first type semiconductor layer;

a second type semiconductor layer on a side of the first type semiconductor opposite to the substrate; and

a first active layer between the first and second semiconductor layers, wherein a first light emitting surface of the second semiconductor layer opposite to the first active layer has a first area; and the second micro LED comprises:

another first type semiconductor layer;

another second type semiconductor layer on a side of said another first type semiconductor opposite to the substrate; and

a second active layer between said another first and second semiconductor layers, wherein a second light emitting surface of said another second semiconductor layer opposite to the second active layer has a second area different from the first area.

14. The LED display of claim **1**, wherein a number of the at least one first color micro LED is plural, and the first color micro LEDs are separated from each other.

15. The LED display of claim **1**, wherein side walls of the first and second openings are inclined with respect to the substrate respectively.

16. The LED display of claim **1**, wherein the first and second color micro LEDs are separated from side walls of the first and second openings respectively.

17. The LED display of claim **1**, wherein surfaces of the first and second color micro LEDs facing away from the substrate are flush with a surface of the pixel define layer facing away from the substrate.

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专利名称(译)	发光二极管显示器		
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[标]申请(专利权)人(译)	友达光电股份有限公司		
申请(专利权)人(译)	友达光电股份有限公司		
当前申请(专利权)人(译)	友达光电股份有限公司		
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摘要(译)

发光二极管(LED)显示器包括基板，像素限定层，至少一个第一彩色微型LED以及至少一个第二彩色微型LED。像素界定层配置于基板上且具有彼此分离的第一开口及第二开口。像素限定层远离基板的表面上的第一开口和第二开口的轮廓分别限定彼此相同的区域。第一彩色微型LED设置在第一开口中并且具有投影在基板上的第一垂直投影。第二彩色微型LED设置在第二开口中并且具有投影在基板上的第二垂直投影。第一垂直投影的区域不同于第二垂直投影的区域。