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(19) **United States**(12) **Patent Application Publication**
WU et al.(10) **Pub. No.: US 2016/0307983 A1**(43) **Pub. Date: Oct. 20, 2016**(54) **OLED PIXEL STRUCTURE**(71) Applicant: **Shenzhen China Star Optoelectronics Technology Co. Ltd.**, Shenzhen City (CN)(72) Inventors: **Yuanchun WU**, Shenzhen City (CN);
Xiaoling WU, Shenzhen City (CN);
Shipeng CHI, Shenzhen City (CN)(21) Appl. No.: **14/655,735**(22) PCT Filed: **Apr. 1, 2015**(86) PCT No.: **PCT/CN2015/075691**

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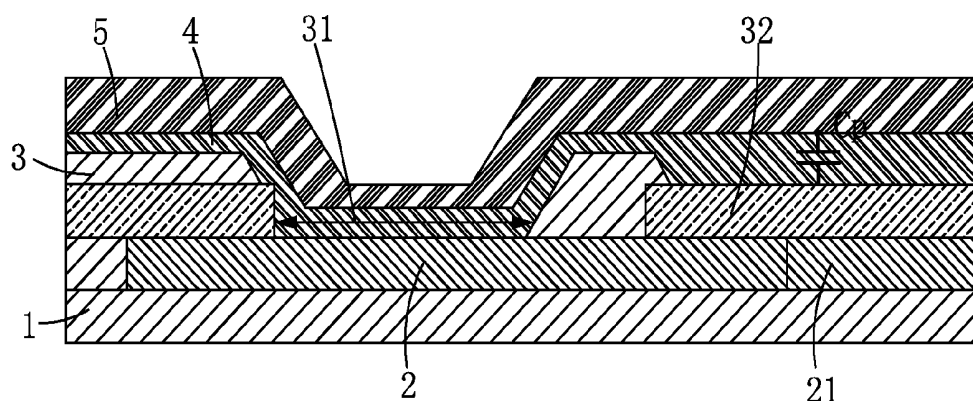
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(57)

ABSTRACT

The present invention provides an OLED pixel structure, comprising red, green, blue sub pixel areas, and the red, the green, the blue sub pixel areas respectively comprise a substrate, an anode formed on the substrate, a flat layer formed on the anode, an organic light emitting layer formed on the flat layer and a cathode formed on the organic light emitting layer, and an aperture area is formed on the flat layer, and the organic light emitting layer contacts the anode through the aperture area, and the anode comprises a positive electrode and a positive electrode compensation area coupled to the positive electrode, and the cathode, the positive electrode compensation area and a sandwiched layer between the cathode and the positive electrode compensation area constitute a compensation capacitor, and the compensation capacitor respectively makes total capacitance values of the red, green, blue sub pixel areas are equivalent to reach the capacitance value required by an drive circuit of the OLED element.



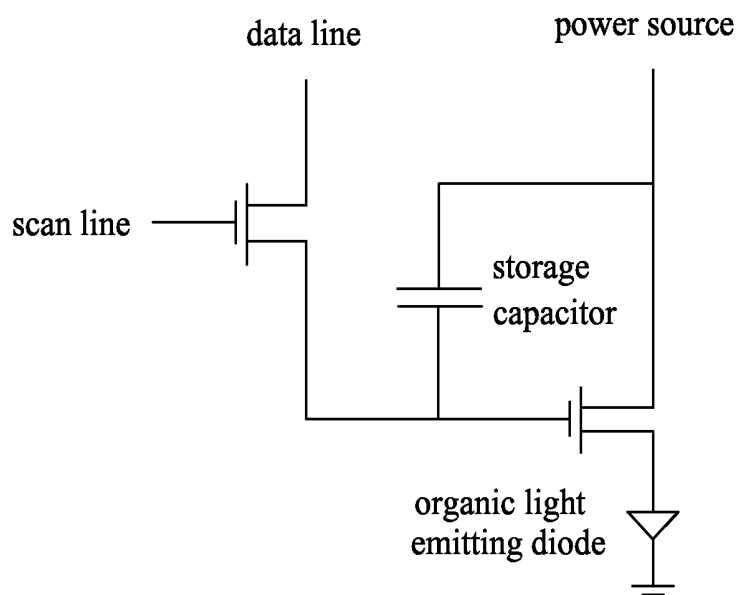


Fig. 1

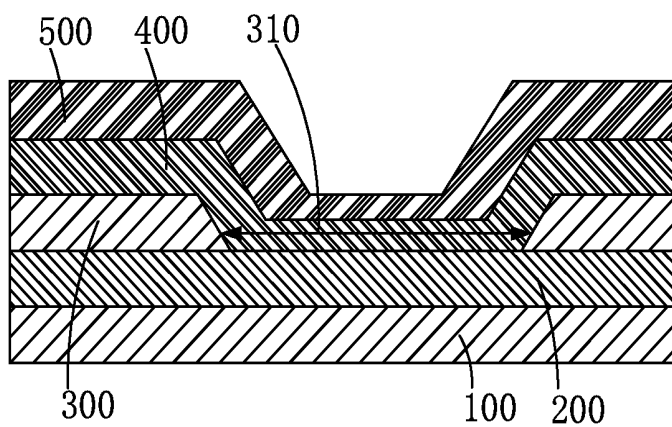


Fig. 2

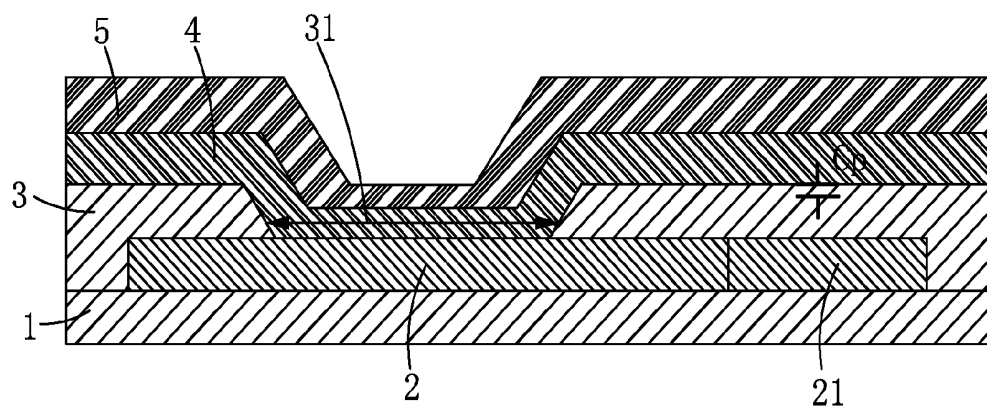


Fig. 3

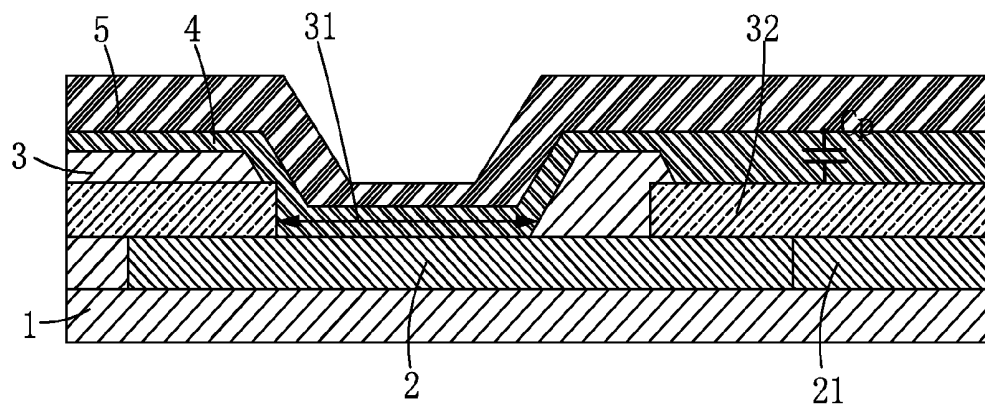


Fig. 4

OLED PIXEL STRUCTURE

FIELD OF THE INVENTION

[0001] The present invention relates to a display technology field, and more particularly to an OLED pixel structure.

BACKGROUND OF THE INVENTION

[0002] Organic Light Emitting Diode (OLED) is a flat panel display technology which has great prospects for development. It does not only possess extremely excellent display performance but also properties of self-illumination, simple structure, ultra thin, fast response speed, wide view angle, low power consumption and capability of realizing flexible display, and therefore is considered as "dream display". Meanwhile, the investment for the production equipments is far smaller than the Liquid Crystal Display (LCD). It has been favored by respective big display makers and has become the main selection of the third generation display element.

[0003] As shown in FIG. 1, it is a drive circuit diagram of an OLED according to prior art. In the OLED display device, each OLED element can be equivalent to a structure having a light emitting diode and a capacitor coupled in parallel, and the size of the capacitor coupled in parallel directly influences the voltage of two ends, the flowing through current value of the OLED, and accordingly influences the display quality of the entire OLED display device.

[0004] As shown in FIG. 2, it is a sectional diagram of an OLED pixel structure according to prior art. The OLED pixel structure comprises red, green, blue sub pixel areas, and the red, the green, the blue sub pixel areas respectively comprise a substrate 100, an anode 200 formed on the substrate 100, a flat layer 300 formed on the anode 200, an organic light emitting layer 400 formed on the flat layer 300 and a cathode 500 formed on the organic light emitting layer 400, and an aperture area 310 is formed on the flat layer 300, and the organic light emitting layer 400 contacts the anode 200 through the aperture area 310.

[0005] In the OLED pixel structure according to prior art, the light emitting materials, the aperture ratios and attenuations of the red, the green, the blue sub pixel areas are different and the total capacitance values of the red, the green, the blue sub pixel areas are different. Thus, the voltages of two ends of the OLEDs in the different sub pixel areas are different, and the brightnesses of the OLEDs in the different sub pixel areas are different, either. Accordingly, the performances of the OLED elements and the display quality of the entire display screen are influenced.

SUMMARY OF THE INVENTION

[0006] An objective of the present invention is to provide an OLED pixel structure, and the total capacitance values of the red, green, blue sub pixel areas in the OLED pixel structure are equivalent to reach the capacitance value required by the OLED drive circuit.

[0007] For realizing the aforesaid objective, the present invention provides an OLED pixel structure, comprising red, green, blue sub pixel areas, and the red, the green, the blue sub pixel areas respectively comprise a substrate, an anode formed on the substrate, a flat layer formed on the anode, an organic light emitting layer formed on the flat layer and a cathode formed on the organic light emitting layer, and an aperture area is formed on the flat layer, and the organic light

emitting layer contacts the anode through the aperture area, and the anode comprises a positive electrode and a positive electrode compensation area coupled to the positive electrode, and the cathode, the positive electrode compensation area and a sandwiched layer between the cathode and the positive electrode compensation area constitute a compensation capacitor C_p , and the compensation capacitor C_p respectively makes total capacitance values of the red/green/blue sub pixel areas are equivalent to reach the capacitance value C_{total} required by an OLED drive circuit.

[0008] The sandwiched layer is the organic light emitting layer and the flat layer, and the cathode, the positive electrode compensation area and the organic light emitting layer and the flat layer between the cathode and the positive electrode compensation area constitute the compensation capacitor C_p .

[0009] An insulative layer is located on the positive electrode compensation area, and the sandwiched layer is the organic light emitting layer and the insulative layer, and the cathode, the positive electrode compensation area and the organic light emitting layer and the insulative layer between the cathode and the positive electrode compensation area constitute the compensation capacitor C_p .

[0010] Material of the insulative layer is silicon oxide, and a thickness of the insulative layer is smaller than a thickness of the flat layer.

[0011] Material of the positive electrode is Indium Tin Oxide.

[0012] Material of the flat layer is organic material.

[0013] Proportions of the positive electrode compensation areas of the red, the green, the blue sub pixel areas are different.

[0014] With the capacitance value C_{total} required by the OLED drive circuit and the self capacitor C_r of the OLED in the red sub pixel area, the compensation capacitor $C_p = C_{total} - C_r$ is calculated, and the proportion of the positive electrode compensation area of the red sub pixel area is calculated according to a parallel plate capacitor calculation formula.

[0015] With the capacitance value C_{total} required by the OLED drive circuit and the self capacitor C_g of the OLED in the green sub pixel area, the compensation capacitor $C_p = C_{total} - C_g$ is calculated, and the proportion of the positive electrode compensation area of the green sub pixel area is calculated according to a parallel plate capacitor calculation formula.

[0016] With the capacitance value C_{total} required by the OLED drive circuit and the self capacitor C_b of the OLED in the blue sub pixel area, the compensation capacitor $C_p = C_{total} - C_b$ is calculated, and the proportion of the positive electrode compensation area of the blue sub pixel area is calculated according to a parallel plate capacitor calculation formula.

[0017] The present invention further provides an OLED pixel structure, comprising red, green, blue sub pixel areas, and the red, the green, the blue sub pixel areas respectively comprise a substrate, an anode formed on the substrate, a flat layer formed on the anode, an organic light emitting layer formed on the flat layer and a cathode formed on the organic light emitting layer, and an aperture area is formed on the flat layer, and the organic light emitting layer contacts the anode through the aperture area, and the anode comprises a positive electrode and a positive electrode compensation area coupled to the positive electrode, and the cathode, the positive electrode compensation area and a sandwiched

layer between the cathode and the positive electrode compensation area constitute a compensation capacitor C_p , and the compensation capacitor C_p respectively makes total capacitance values of the red, green, blue sub pixel areas are equivalent to reach the capacitance value C_{total} required by an OLED drive circuit;

[0018] wherein the sandwiched layer is the organic light emitting layer and the flat layer, and the cathode, the positive electrode compensation area and the organic light emitting layer and the flat layer between the cathode and the positive electrode compensation area constitute the compensation capacitor C_p ;

[0019] wherein material of the positive electrode is Indium Tin Oxide.

[0020] The benefits of the present invention are: the OLED pixel structure of the present invention respectively calculates the compensation capacitors required by the red, the green, the blue sub pixel areas according to the total capacitance values required by the drive circuit of the OLED elements and the self capacitors of the OLEDs in the red, the green, the blue sub pixel areas. Then the demanded enlarged areas of the anodes of the red, the green, the blue sub pixel areas are respectively calculated according to a parallel plate capacitor calculation formula to manufacture the positive electrode compensation area so that the positive electrode compensation area, the anode and the sandwiched layer between the cathode and the positive electrode compensation area constitute a compensation capacitor. The compensation capacitors make the total capacitance values of the red, the green, the blue sub pixel areas are equivalent. Accordingly, the issue that the light emitting materials, the aperture ratios and attenuations of the red, the green, the blue sub pixel areas are different and thus the total capacitance values of the red, the green, the blue sub pixel areas are different can be solved. Meanwhile, the structure is simple and easy for manufacture.

[0021] In order to better understand the characteristics and technical aspect of the invention, please refer to the following detailed description of the present invention is concerned with the diagrams, however, provide reference to the accompanying drawings and description only and is not intended to be limiting of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] The technical solution and the beneficial effects of the present invention are best understood from the following detailed description with reference to the accompanying figures and embodiments.

[0023] In drawings,

[0024] FIG. 1 is a drive circuit diagram of an OLED according to prior art;

[0025] FIG. 2 is a sectional diagram of an OLED pixel structure according to prior art;

[0026] FIG. 3 is a diagram of an OLED pixel structure according to the first embodiment of the present invention;

[0027] FIG. 4 is a diagram of an OLED pixel structure according to the second embodiment of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0028] For better explaining the technical solution and the effect of the present invention, the present invention will be

further described in detail with the accompanying drawings and the specific embodiments.

[0029] Please refer to FIG. 3, which is an OLED pixel structure according to the first embodiment of the present invention. The OLED pixel structure comprises red, green, blue sub pixel areas, and the red, the green, the blue sub pixel areas respectively comprise a substrate 1, an anode formed on the substrate 1, a flat layer 3 formed on the anode, an organic light emitting layer 4 formed on the flat layer 3 and a cathode 5 formed on the organic light emitting layer 4, and an aperture area 31 is formed on the flat layer 3, and the organic light emitting layer 4 contacts the anode through the aperture area 31, and the anode comprises a positive electrode 2 and a positive electrode compensation area 21 coupled to the positive electrode 2, and the cathode 5, the positive electrode compensation area 21 and a sandwiched layer between the cathode 5 and the positive electrode compensation area 21 constitute a compensation capacitor C_p , and the compensation capacitor C_p respectively makes total capacitance values of the red, green, blue sub pixel areas are equivalent to reach the capacitance value C_{total} required by an OLED drive circuit.

[0030] Specifically, material of the positive electrode 2 is Indium Tin Oxide and material of the flat layer 3 is organic material.

[0031] Specifically, as shown in FIG. 3, in the capacitor compensation area, the sandwiched layer between the cathode 5 and the positive electrode compensation area 21 is the organic light emitting layer 4 and the flat layer 3, and the cathode 5, the positive electrode compensation area 21 and the organic light emitting layer 4 and the flat layer 3 between the cathode 5 and the positive electrode compensation area 21 constitute a compensation capacitor C_p .

[0032] Specifically, the respective organic light emitting layers 4, the aperture ratios of the red, the green, the blue sub pixel areas are different, and thus, the self capacitor values of the OLEDs in the respective sub pixel areas are different, either. For making all the total capacitance values of the respective sub pixel areas reach the capacitance value C_{total} required by an OLED drive circuit, the compensation capacitor values C_p required by respective sub pixel areas are different, and proportions of the positive electrode compensation areas 21 of the red, the green, the blue sub pixel areas are different, either.

[0033] Specifically, with the capacitance value C_{total} required by the OLED drive circuit and the self capacitor C_r of the OLED in the red sub pixel area, the compensation capacitor $C_p = C_{total} - C_r$ is calculated, and the proportion of the positive electrode compensation area of the red sub pixel area is calculated according to a parallel plate capacitor calculation formula;

[0034] With the capacitance value C_{total} required by the OLED drive circuit and the self capacitor C_g of the OLED in the green sub pixel area, the compensation capacitor $C_p = C_{total} - C_g$ is calculated, and the proportion of the positive electrode compensation area of the green sub pixel area is calculated according to a parallel plate capacitor calculation formula;

[0035] With the capacitance value C_{total} required by the OLED drive circuit and the self capacitor C_b of the OLED in the blue sub pixel area, the compensation capacitor $C_p = C_{total} - C_b$ is calculated, and the proportion of the positive

electrode compensation area of the blue sub pixel area is calculated according to a parallel plate capacitor calculation formula.

[0036] Please refer to FIG. 4, which is an OLED pixel structure according to the second embodiment of the present invention. In the capacitor compensation area of the second embodiment, the sandwiched layer between the cathode 5 and the positive electrode compensation area 21 is the organic light emitting layer 4 and the insulative layer 32, and the cathode 5, the positive electrode compensation area 21 and the organic light emitting layer 4 and the insulative layer 32 between the cathode 5 and the positive electrode compensation area 21 constitute a compensation capacitor C_p ; preferably, material of the insulative layer 32 is silicon oxide, and a thickness of the insulative layer 32 is smaller than a thickness of the flat layer 3.

[0037] As comparing the second embodiment with the first embodiment, the difference is: on the positive electrode compensation area 21, the insulative layer 32 is employed to replace the flat layer 3, and the insulative property of the insulative layer 32 is larger than the insulative property of the flat layer 3. Thus, under circumstance that the compensation capacitor C_p is the same, the proportion of the positive electrode compensation area 21 in the second embodiment is smaller than the proportion of the positive electrode compensation area 21 in the second embodiment. Accordingly, the proportion of the positive electrode compensation area 21 required to manufacture is diminished, and the production cost and manufacture difficulty are lowered.

[0038] In the aforesaid pixel structure, by respectively locating the capacitor compensation areas in the red, the green, the blue sub pixel areas, the capacitor compensation area comprises the positive electrode compensation area coupled to the positive electrode, the cathode and the sandwiched layer between the cathode and the positive electrode compensation area. The aforesaid sandwiched layer structure constitutes the compensation capacitors C_p of the red, the green, the blue sub pixel areas. The compensation capacitors C_p respectively make all the total capacitance values of the red, the green, the blue sub pixel areas reach the capacitance value C_{total} required by the drive circuit of the OLED element.

[0039] In conclusion, the OLED pixel structure of the present invention respectively calculates the compensation capacitors required by the red, the green, the blue sub pixel areas according to the total capacitance values required by the drive circuit of the OLED elements and the self capacitors of the OLEDs in the red, the green, the blue sub pixel areas. Then the demanded enlarged areas of the anodes of the red, the green, the blue sub pixel areas are respectively calculated according to a parallel plate capacitor calculation formula to manufacture the positive electrode compensation area so that the positive electrode compensation area, the anode and the sandwiched layer between the cathode and the positive electrode compensation area constitute a compensation capacitor. The compensation capacitors make the total capacitance values of the red, the green, the blue sub pixel areas are equivalent. Accordingly, the issue that the light emitting materials, the aperture ratios and attenuations of the red, the green, the blue sub pixel areas are different and thus the total capacitance values of the red, the green, the blue sub pixel areas are different can be solved. Meanwhile, the structure is simple and easy for manufacture.

[0040] Above are only specific embodiments of the present invention, the scope of the present invention is not limited to this, and to any persons who are skilled in the art, change or replacement which is easily derived should be covered by the protected scope of the invention. Thus, the protected scope of the invention should go by the subject claims.

What is claimed is:

1. An OLED pixel structure, comprising red, green, blue sub pixel areas, and the red, the green, the blue sub pixel areas respectively comprise a substrate, an anode formed on the substrate, a flat layer formed on the anode, an organic light emitting layer formed on the flat layer and a cathode formed on the organic light emitting layer, and an aperture area is formed on the flat layer, and the organic light emitting layer contacts the anode through the aperture area, and the anode comprises a positive electrode and a positive electrode compensation area coupled to the positive electrode, and the cathode, the positive electrode compensation area and a sandwiched layer between the cathode and the positive electrode compensation area constitute a compensation capacitor C_p , and the compensation capacitor C_p respectively makes total capacitance values of the red, green, blue sub pixel areas are equivalent to reach the capacitance value C_{total} required by an OLED drive circuit.

2. The OLED pixel structure according to claim 1, wherein the sandwiched layer is the organic light emitting layer and the flat layer, and the cathode, the positive electrode compensation area and the organic light emitting layer and the flat layer between the cathode and the positive electrode compensation area constitute the compensation capacitor C_p .

3. The OLED pixel structure according to claim 1, wherein an insulative layer is located on the positive electrode compensation area, and the sandwiched layer is the organic light emitting layer and the insulative layer, and the cathode, the positive electrode compensation area and the organic light emitting layer and the insulative layer between the cathode and the positive electrode compensation area constitute the compensation capacitor C_p .

4. The OLED pixel structure according to claim 3, wherein material of the insulative layer is silicon oxide, and a thickness of the insulative layer is smaller than a thickness of the flat layer.

5. The OLED pixel structure according to claim 1, wherein material of the positive electrode is Indium Tin Oxide.

6. The OLED pixel structure according to claim 1, wherein material of the flat layer is organic material.

7. The OLED pixel structure according to claim 1, wherein proportions of the positive electrode compensation areas of the red, the green, the blue sub pixel areas are different.

8. The OLED pixel structure according to claim 7, wherein with the capacitance value C_{total} required by the OLED drive circuit and the self capacitor C_r of the OLED in the red sub pixel area, the compensation capacitor $C_p = C_{total} - C_r$ is calculated, and the proportion of the positive electrode compensation area of the red sub pixel area is calculated according to a parallel plate capacitor calculation formula.

9. The OLED pixel structure according to claim 7, wherein with the capacitance value C_{total} required by the OLED drive circuit and the self capacitor C_g of the OLED in the green sub pixel area, the compensation capacitor

$C_p = C_{total} - C_g$ is calculated, and the proportion of the positive electrode compensation area of the green sub pixel area is calculated according to a parallel plate capacitor calculation formula.

10. The OLED pixel structure according to claim 7, wherein with the capacitance value C_{total} required by the OLED drive circuit and the self capacitor C_b of the OLED in the blue sub pixel area, the compensation capacitor $C_p = C_{total} - C_b$ is calculated, and the proportion of the positive electrode compensation area of the blue sub pixel area is calculated according to a parallel plate capacitor calculation formula.

11. An OLED pixel structure, comprising red, green, blue sub pixel areas, and the red, the green, the blue sub pixel areas respectively comprise a substrate, an anode formed on the substrate, a flat layer formed on the anode, an organic light emitting layer formed on the flat layer and a cathode formed on the organic light emitting layer, and an aperture area is formed on the flat layer, and the organic light emitting layer contacts the anode through the aperture area, and the anode comprises a positive electrode and a positive electrode compensation area coupled to the positive electrode, and the cathode, the positive electrode compensation area and a sandwiched layer between the cathode and the positive electrode compensation area constitute a compensation capacitor C_p , and the compensation capacitor C_p respectively makes total capacitance values of the red, green, blue sub pixel areas are equivalent to reach the capacitance value C_{total} required by an OLED drive circuit;

wherein the sandwiched layer is the organic light emitting layer and the flat layer, and the cathode, the positive electrode compensation area and the organic light emitting layer and the flat layer between the cathode and the

positive electrode compensation area constitute the compensation capacitor C_p ;

wherein material of the positive electrode is Indium Tin Oxide.

12. The OLED pixel structure according to claim 11, wherein material of the flat layer is organic material.

13. The OLED pixel structure according to claim 11, wherein proportions of the positive electrode compensation areas of the red, the green, the blue sub pixel areas are different.

14. The OLED pixel structure according to claim 13, wherein with the capacitance value C_{total} required by the OLED drive circuit and the self capacitor C_r of the OLED in the red sub pixel area, the compensation capacitor $C_p = C_{total} - C_r$ is calculated, and the proportion of the positive electrode compensation area of the red sub pixel area is calculated according to a parallel plate capacitor calculation formula.

15. The OLED pixel structure according to claim 13, wherein with the capacitance value C_{total} required by the OLED drive circuit and the self capacitor C_g of the OLED in the green sub pixel area, the compensation capacitor $C_p = C_{total} - C_g$ is calculated, and the proportion of the positive electrode compensation area of the green sub pixel area is calculated according to a parallel plate capacitor calculation formula.

16. The OLED pixel structure according to claim 13, wherein with the capacitance value C_{total} required by the OLED drive circuit and the self capacitor C_b of the OLED in the blue sub pixel area, the compensation capacitor $C_p = C_{total} - C_b$ is calculated, and the proportion of the positive electrode compensation area of the blue sub pixel area is calculated according to a parallel plate capacitor calculation formula.

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专利名称(译)	OLED像素结构		
公开(公告)号	US20160307983A1	公开(公告)日	2016-10-20
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[标]申请(专利权)人(译)	深圳市华星光电技术有限公司		
申请(专利权)人(译)	深圳中星光电科技有限公司		
当前申请(专利权)人(译)	深圳市中国星光电科技有限公司.		
[标]发明人	WU YUANCHUN WU XIAOLING CHI SHIPENG		
发明人	WU, YUANCHUN WU, XIAOLING CHI, SHIPENG		
IPC分类号	H01L27/32 H01L51/52		
CPC分类号	H01L27/3265 H01L27/3211 H01L2251/308 H01L2251/303 H01L2251/558 H01L51/5212 H01L27/3216 H01L27/3246 H01L51/5209		
优先权	201510044960.2 2015-01-28 CN		
其他公开文献	US9647049		
外部链接	Espacenet USPTO		

摘要(译)

本发明提供了一种OLED像素结构，包括红，绿，蓝子像素区，所述红，绿，蓝子像素区分别包括基板，形成在所述基板上的阳极，形成在所述阳极上的平坦层，形成在平坦层上的有机发光层和形成在有机发光层上的阴极，并且在平坦层上形成开口区域，有机发光层通过开口区域与阳极接触，阳极包括正电极和与所述正电极耦合的正电极补偿区，所述正电极补偿区和所述正电极补偿区与所述正电极补偿区之间的夹层构成补偿电容，所述补偿电容分别为红色子像素区域，绿色子像素区域，蓝色子像素区域的电容值等于达到OLED元件的驱动电路所需的电容值。

