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(54) **OLED DISPLAY STRUCTURE AND OLED DISPLAY DEVICE**

OLED-ANZEIGESTRUKTUR UND OLED-ANZEIGEVORRICHTUNG

STRUCTURE D'AFFICHAGE À DIODES ÉLECTROLUMINESCENTES ORGANIQUES ET DISPOSITIF D'AFFICHAGE À DIODES ÉLECTROLUMINESCENTES ORGANIQUES

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(56) References cited:
EP-A2- 1 223 618
CN-A- 1 368 656
CN-A- 1 774 654
CN-U- 202 008 552
CN-U- 202 008 552
CN-U- 202 549 937
US-A1- 2005 194 891

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Description

TECHNICAL FIELD

[0001] Embodiments of the present invention relate to an organic light emitting diode (OLED) display structure and an OLED display device having the OLED display structure.

BACKGROUND

[0002] Organic Light-Emitting Diode (OLED) display devices are widely used in MP3 players and the like digital products due to their characteristics of light weight, thin profile, energy-saving, etc. The OLED display technology differs from the conventional LCD (Liquid Crystal Display) display technology, it does not need a backlight module and typically adopts very thin organic material films and a glass substrate, and these organic materials will emit light when a current passes through them. Moreover, an OLED display screen can be made-lighter, thinner, and capable of saving electric energy remarkably, and have wider viewing angles. However, as a display device, the OLED display screen is also affected by an external use environment. Especially in an outdoor, strong-light environment, display effect of the OLED display screen will be degraded to some extent.

[0003] In order to overcome the influence of ambient light, as shown in FIG. 1, an OLED display structure has been proposed, and it eliminates the influence of strong ambient light on the display by providing a quarter-wave plate layer 60 and a polarizer layer 70 on an OLED pixel layer 20 in sequence. Its operational principle will be described below. Ambient light 80 is incident into a display screen, and is changed to linearly polarized light after it passes through the polarizer layer 70 firstly, and then the linearly polarized light passes through the quarter-wave plate layer 60 (an optical axis of which is at an angle of ±45° with respect to the polarization direction of the linearly polarized light) to change to right-handed or left-handed circularly polarized light. That is, the polarizer layer 70 and the quarter-wave plate layer 60 work in combination as a right-handed or left-handed circular polarizer, which can convert natural light into right-handed or left-handed circularly polarized light. The right-handed or left-handed circularly polarized light is changed into left-handed or right-handed circularly polarized light, for example, after it is reflected by a substrate 10, and is further changed to linearly polarized light again after it passes through the above quarter-wave plate layer 60 for the second time, but its polarization direction is rotated by 90° to exactly coincide with the absorption axis of the polarizer layer 70. Thereby, the reflected light is absorbed by the polarizer layer 70 and cannot be transmitted therethrough. That is, right-handed circularly polarized light cannot pass through a left-handed circular polarizer, or left-handed circularly polarized light cannot pass through a right-handed circular polarizer. Therefore, with the above configuration, such objects that the influence of ambient light is eliminated, contrast is enhanced, and visual effect is improved can be achieved.

[0004] However, light emitted by the OLED pixel layer 20 have no polarization characteristics, and still does not possess polarization characteristics yet after it is transmitted through the quarter-wave plate layer 60, while their energy is absorbed in half upon passing through the polarizer layer 70. Further due to influence factors like scattering, reflection and so on, the transmittance of light is greatly reduced. This results in the consequence that, in order to obtain suitable brightness, pixel currents have to be increased in practice. In turn, this brings about waste of energy.

In the prior art light-emitting devices and light-emitting displays are known from EP 1 223 618 A2. CN 202 008 552 U discloses a polarizer and liquid crystal display adopting same.

SUMMARY

[0005] Regarding the above shortcomings, embodiments of the invention provide an OLED display structure and an OLED display device comprising the above OLED display structure, which can overcome impact of ambient light, but will not absorb or scatter too much light emitted by itself, so that light transmittance is increased and then energy is saved.

[0006] In an aspect of the invention, there is provided an OLED display structure, comprising: a substrate, and an OLED pixel layer, a beam splitting layer and a circular polarizer layer which are formed on the substrate in sequence, wherein the beam splitting layer is adapted to spatially divide a light beam into o-light and e-light, and to convert the o-light and the e-light into circularly polarized light which has the same polarization state as the circular polarizer layer; and the circular polarizer layer is adapted to allow passage of the circularly polarized light which has the same polarization state as it.

[0007] As for the display structure, for example, the beam splitting layer comprises a birefringent crystal layer, and an o-light quarter-wave plate layer and an e-light quarter-wave plate layer which are formed on the birefringent crystal layer; the o-light quarter-wave plate layer is adapted for converting the o-light into circularly polarized light which has the same polarization state as the circular polarizer layer; and the e-light quarter-wave plate layer is adapted for converting the e-light into circularly polarized light which has the same polarization state as the circular polarizer layer.

[0008] As for the display structure, for example, directions of optical axes of the o-light quarter-wave plate layer and the e-light quarter-wave plate layer are perpendicular to each other, and the optical axes of the o-light quarter-wave plate layer and the e-light quarter-wave plate layer form an angle of 45° with respect to polarization directions of the corresponding o-light and e-light, respectively.

[0009] As for the display structure, for example, the birefringent crystal layer is made from a material possessing a birefringent property such as calcite crystal, quartz, ruby, or the like.

[0010] As for the display structure, for example, the circular polarizer layer comprises a quarter-wave plate layer and a linear polarizer formed thereon; the quarter-wave plate layer is adapted to convert circularly polarized light into linearly polarized light, and the linear polarizer is adapted to allow passage of linearly polarized light which has the same polarization direction as its.

[0011] For example, the OLED display structure may further comprise a lens layer, which is located between the OLED pixel layer and the beam splitting layer, and adapted to converge light beams which are emitted from the OLED pixel layer to be parallel light beams to enter the beam splitting layer.

[0012] As for the display structure, for example, the lens layer comprises a transparent substrate, and a first convex lens and a second convex lens which are formed on two sides of the transparent substrate, respectively; focal points or focal planes of the first convex lens and the second convex lens coincide with each other.

[0013] As for the display structure, for example, the lens layer comprises a transparent substrate, and a first convex lens and a concave lens microstructure layer which are formed on two sides of the transparent substrate, respectively, wherein the first convex lens and the concave lens microstructure layer cooperate to converge light beams into parallel light beams.

[0014] As for the display structure, for example, the transparent substrate may further comprise a reflective layer, by which ambient light is reflected to the circular polarizer layer for absorption.

[0015] In another aspect of the invention, there is further provided an OLED display device, comprising an OLED display structure stated as any of the above items.

[0016] The OLED display structure and the OLED display device having the OLED display structure according to embodiments of the invention, by spatially dividing a light emitted from the OLED pixel layer into o-light and e-light, and converting the o-light and the e-light into circularly polarized light which has the same polarization state as the circular polarizer layer to pass through the circular polarizer layer totally, improve light transmittance, reduce pixel current of the OLED pixel layer, thereby saving energy.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] In order to illustrate the technical solution of the embodiments of the invention more clearly, the drawings of the embodiments will be briefly described below; it is obvious that the drawings as described below are only related to some embodiments of the invention, but not limitative of the invention.

FIG. 1 is a structurally schematic view showing an existing OLED display structure;

FIG. 2 is a schematic view showing a phenomenon of birefringence of a birefringent crystal in a space rectangular coordinate system in the relevant art;

FIG. 3 is a structurally schematic view showing an OLED display structure according to an embodiment 1 of the invention;

FIG. 4 is a structurally schematic view showing an OLED display structure according to an embodiment 2 of the invention; and

FIG. 5 is a structurally schematic view showing an OLED display structure according to an embodiment 3 of the invention.

Reference signs:

[0018] 4: a lens layer; 5: a beam splitting layer; 6: a circular polarizer layer; 10: a substrate; 20: an OLED pixel layer; 30: light beam(s); 40: a transparent substrate; 41: a first convex lens; 42: a second convex lens; 43: a concave lens microstructure layer; 50: a birefringent crystal layer; 51: an o-light quarter-wave plate layer; 52: an e-light quarter-wave plate layer; 60: a quarter-wave plate layer; 70: a polarizer; 80: ambient lights; 90: a reflective layer.

DETAILED DESCRIPTION

[0019] In order to make objects, technical details and advantages of the embodiments of the invention apparent, hereinafter, the technical solutions of the embodiments of the invention will be described in a clearly and fully understandable way in connection with the drawings related to the embodiments of the invention. It is obvious that the described embodiments are just a part but not all of the embodiments of the invention. Based on the described embodiments of the invention, those ordinarily skilled in the art can obtain other embodiment(s), without any inventive work, which should be within the scope sought for protection by the invention.

[0020] Unless otherwise defined, the technical terminology or scientific terminology used herein should have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. "First", "second" and the like used in specification and claims of the patent application of the invention do not show any order, number or importance, but are only used to distinguish different constituent parts. Likewise, a term "a," "an," "the" or the like does not indicate limitation in number, but specifies the presence of at least one. A term such as "comprises," "comprising," "comprises," "comprising", "contains" or the like means that an element or article ahead of this term encompasses element(s) or article(s) listed behind this term and its(their) equivalents, but does not preclude the presence of other elements or articles. A term such as "connection," "connected," or the like is not limited to physical or mechanical connection, but can comprise electrical connection, whether directly or indirectly. "Upper," "lower," "left," "right" or the like is only used to describe a relative positional relationship, and when an absolute position of the described object is changed, the relative positional relationship might also be changed accordingly.

[0021] According to the principle of birefringence of light, when a light beam is incident into a birefringent crystal, it turns into two beams of linearly polarized light after refraction, one beam of which follows the law of refraction and is called as ordinary light ("o-light"), and another beam of which does not follow the law of refraction and is called as extraordinary light ("e-light"). A birefringent crystal refers to a crystal which allows light to generate birefringence, such as a calcite crystal, quartz, ruby, or the like material possessing a birefringent property.

[0022] As shown in FIG. 2, if the light traveling direction of an incident, linearly polarized light beam is the positive direction of the z-axis in the space rectangular coordinate system, and it is perpendicular to the positive direction of an x-axis in the space rectangular coordinate system that is directed toward the inside of the paper plane, and perpendicular to the positive direction of the y-axis in the space rectangular coordinate system that is directed upward from the plane in which the x and z axes are located, then the vibration plane of the o-light is the x-o-z plane, and the vibration plane of the e-light is the y-o-z plane.

[0023] An OLED display structure according to an embodiment of the invention comprises: a substrate 10, and an OLED pixel layer 20, a beam splitting layer and a circular polarizer layer which are formed on the substrate 10 in sequence; the beam splitting layer is adapted to spatially divide a light beam 30 emitted from the OLED pixel layer into o-light and e-light and to convert o-light and e-light into circularly polarized light which has the same polarization state as the circular polarizer layer; and the circular polarizer layer is adapted to allow passage of circularly polarized light which has the same polarization state as its.

[0024] With respect to the above OLED display structure, light emitted from an OLED pixel layer is spatially divided into o-light and e-light, and o-light and e-light are converted into circularly polarized light which have the same polarization state as the circular polarizer layer, so that it passes through the circular polarizer layer totally and then exit for display. This enhances the light transmittance and reduces the pixel current of the OLED pixel layer, thereby saving the energy.

[0025] In some embodiments of the invention, the OLED display structure may further comprise a lens layer, and the lens layer may be located between the OLED pixel layer and the beam splitting layer, and adapted to converge light beams which are emitted from the OLED pixel layer to be parallel light beams to enter the beam splitting layer. This helps the beam splitting layer better conduct beam-splitting, avoids influence due to light components in other directions, and raises the light transmittance of the OLED display structure.

[0026] The beam splitting layer stated in the OLED display structure according to an embodiment of the invention may comprise a birefringent crystal layer 50, and may comprise an o-light quarter-wave plate layer 51 and an e-light quarter-wave plate layer 52 which are formed on the birefringent crystal layer 50. The birefringent crystal layer 50 can be made from a material possessing a birefringent property such as a calcite crystal, quartz, ruby, or the like. The directions of the optical axes of the o-light quarter-wave plate layer 51 and the e-light quarter-wave plate layer 52 are perpendicular to each other, and the optical axes of the o-light quarter-wave plate layer 51 and the e-light quarter-wave plate layer 52 forms an angle of 45° with respect to the polarization directions of the corresponding o light and e-light, respectively. The o-light quarter-wave plate layer 51 is adapted to convert the o-light into circularly polarized light which has the same polarization state as the circular polarizer layer; and the e-light quarter-wave plate layer 52 is adapted to convert the e-light into circularly polarized light which has the same polarization state as the circular polarizer layer.

[0027] The circular polarizer layer stated in the OLED display structure according to the embodiment of the invention may comprise a quarter-wave plate layer 60 and a linear polarizer 70 formed thereon; left-handed or right-handed circularly polarized light can be converted into linearly polarized light due to the polarization state of the quarter-wave plate layer 60, and the linear polarizer 70 is adapted to allow passage of linearly polarized light which has the same polarization direction as the linear polarizer.

[0028] In an embodiment of the invention, the OLED pixel layer can be formed by any available process in the art; for example, it is a stacked structure which comprises a cathode layer, an organic light emitting layer, and an anode layer. The stacked structure may further comprise auxiliary function layers such as an electron transportation layer, a hole transportation layer, etc. After a voltage is applied, in the OLED pixel layer, holes injected from the anode and electrons injected from the cathode recombine in the light emitting layer so as to emit light. The scope of the invention is not limited to the specific structure of the OLED pixel layer.

Embodiment 1

[0029] As shown in FIG. 3, an OLED display structure in the embodiment comprises: a substrate 10 and an OLED pixel layer 20, a lens layer 4, a beam splitting layer 5 and a circular polarizer layer 6 which are formed on the substrate 10 from bottom to top in sequence. The light emitted upward from the OLED pixel layer 20 passes through the lens layer 4, the beam splitting layer 5 and the circular polarizer layer 6 in sequence, and then exits for display.

[0030] The beam splitting layer 5 is adapted to spatially divide a light beam 30, which is emitted from the OLED pixel layer 20 and transmitted through this beam splitting layer 5, into o-light and e-light, and to convert the o-light and the e-light into circularly polarized light which have the same polarization state as the circular polarizer layer; and the circular polarizer layer 6 is adapted to allow passage of the circularly polarized light which has the same polarization state as its.

[0031] The beam splitting layer 5 comprises a birefringent crystal layer 50, and an o-light quarter-wave plate layer 51 and an e-light quarter-wave plate layer 52 which are formed thereon. The birefringent crystal layer 50 may be formed of a material possessing a birefringent property such as a calcite crystal, quartz, ruby, or the like. The directions of the optical axes of the o-light quarter-wave plate layer 51 and the e-light quarter-wave plate layer 52 are perpendicular to each other, and the optical axes of the o-light quarter-wave plate layer 51 and the e-light quarter-wave plate layer 52 form an angle of 45° with the polarization directions of the corresponding o-light and e-light, respectively. The o-light quarter-wave plate layer 51 is adapted to convert the o-light into circularly polarized light which has the same polarization state as the circular polarizer layer; and the e-light quarter-wave plate layer 52 is adapted to convert the e-light into circularly polarized light which has the same polarization state as the circular polarizer layer. The o-light quarter-wave plate layer 51 and the e-light quarter-wave plate layer 52 are provided on the birefringent crystal layer 50 side by side, for example, each occupies a half of the top surface of the birefringent crystal layer 50.

[0032] The circular polarizer layer 6 comprises a quarter-wave plate layer 60 and a linear polarizer 70 formed thereon. Left-handed or right-handed circularly polarized light can be converted into linearly polarized light due to the polarization state of the quarter-wave plate layer 60, and the linear polarizer 70 is adapted to allow passage of linearly polarized light which has the same polarization direction as its.

[0033] The lens layer 4 comprises a transparent substrate 40, and comprises a first convex lens 41 and a second convex lens 42 which are formed on two sides of the transparent substrate 40, respectively, and focal points or focal planes of the first convex lens 41 and the second convex lens 42 coincide with each other. The lens layer 4 is adapted to converge the light beam 30 so as to improve the display effect.

[0034] In the embodiment, for example, the substrate 10 may have a reflective property, or a reflective layer is formed on the substrate 10 for reflecting incident ambient light 80 from outside of the display device upward or for reflecting light emitted from the OLED pixel layer upward. The ambient light 80 is subjected to light extinction due to existence of the circular polarizer layer 6, and this reduces impact of the ambient light 80 greatly.

Embodiment 2

[0035] As shown in FIG. 4, the embodiment is substantially the same as Embodiment 1, and the only difference is that, a lens layer 4 comprised in an OLED display structure according to the embodiment comprises a transparent substrate 40, and a first convex lens 41 and a concave lens microstructure layer 43 which are formed on two sides of the transparent substrate 40, respectively; the first convex lens 41 and the concave lens microstructure layer 43 cooperate to converge light to be parallel light beams.

Embodiment 3

[0036] As shown in FIG. 5, the embodiment is substantially the same as Embodiment 1, and the only difference is that, the lens layer 4 further comprises a reflective layer 90 which is provided on the transparent substrate 40 and used to reflect ambient light 80 totally to the circular polarizer layer for absorption, which reduces impact of the ambient light 80 greatly.

[0037] The above embodiments can be combined with each other or replaced by each other so as to form a new embodiment. For example, the lens layer in Embodiment 2 may be used to replace the lens layer (except the reflective layer 90) in Embodiment 3, to thereby obtain a new embodiment.

[0038] In addition, according to another embodiment of the invention, there is further comprised an OLED display device which comprises the above OLED display structure.

[0039] Thus, an OLED display structure and an OLED display device comprising the OLED display device are disclosed by an embodiment of the invention. With the above OLED display structure, light emitted from the OLED pixel layer is spatially divided into o-light and e-light, and both the o-light and the e-light are converted into circularly polarized light which has the same polarization state as the circular polarizer layer so as to pass through the circular polarizer layer totally and exit. This improves the light transmittance, and reduces the pixel current of the OLED pixel layer, thereby saving energy. According to an embodiment of the invention, a reflective layer may be further provided so as to reduce impact of ambient light further. Thus, the readability in an outdoor environment is improved, and adaptability to environments becomes strong. Further, the birefringent crystal material has many kinds and an excellent performance and belongs to a mature technology, so that the production costs can be reduced.

[0040] The foregoing are merely exemplary embodiments of the invention, but are not used to limit the protection scope of the invention. The protection scope of the invention is determined by attached claims.

Claims

1. An Organic Light Emitting Diode (OLED) display structure, comprising: a substrate (10) and an OLED pixel layer (20), a beam splitting layer (5) and a circular polarizer layer (6) which are formed on the sub-

strate (10) in sequence, wherein the beam splitting layer (5) is adapted to spatially divide a light beam (30) into o-light and e-light, and to convert the o-light and the e-light into circularly polarized light which has the same polarization state as the circular polarizer layer (6); and the circular polarizer layer (6) is adapted to allow passage of the circularly polarized light which has the same polarization state as it.

2. The OLED display structure claimed as claim 1, wherein the beam splitting layer (5) comprises a birefringent crystal layer (50), and an o-light quarter-wave plate layer (51) and an e-light quarter-wave plate layer (52) which are formed on the birefringent crystal layer (50), wherein, the o-light quarter-wave plate layer (51) is adapted to convert the o-light into circularly polarized light which has the same polarization state as the circular polarizer layer (6); and the e-light quarter-wave plate layer (52) is adapted to convert the e-light into circularly polarized light which has the same polarization state as the circular polarizer layer (6).

3. The OLED display structure claimed as claim 2, wherein directions of optical axes of the o-light quarter-wave plate layer (51) and the e-light quarter-wave plate layer (52) are perpendicular to each other, and the optical axes of the o-light quarter-wave plate layer (51) and the e-light quarter-wave plate layer (52) form an angle of 45° with respect to polarization directions of the corresponding o-light and e-light, respectively.

4. The OLED display structure claimed as claim 2 or 3, wherein the birefringent crystal layer (50) is made from calcite crystal, quartz or ruby.

5. The OLED display structure claimed as any of claims 1 to 4, wherein the circular polarizer layer (6) comprises a quarter-wave plate layer (60) and a linear polarizer (70) formed on the quarter-wave plate layer (60), wherein the quarter-wave plate layer (60) is adapted to convert circularly polarized light into linearly polarized light; and the linear polarizer (70) is adapted to allow passage of linearly polarized light which has the same polarization direction as its.

6. The OLED display structure claimed as any of claims 1 to 5, further comprising a lens layer (4), which is located between the OLED pixel layer and the beam splitting layer, and adapted to converge light beams which are emitted from the OLED pixel layer to be parallel light beams to enter the beam splitting layer (5).

7. The OLED display structure claimed as claim 6, wherein the lens layer (4) comprises a transparent substrate (40), and a first convex lens (41) and a second convex lens (42) which are formed on two sides of the transparent substrate (40), respectively, wherein focal points or focal planes of the first convex lens (41) and the second convex lens (42) coincide with each other.

8. The OLED display structure claimed as claim 6, wherein the lens layer (4) comprises a transparent substrate (40), and a first convex lens (41) and a concave lens microstructure layer (43) which are formed on two sides of the transparent substrate (40), respectively, wherein the first convex lens (41) and the concave lens microstructure layer (43) cooperate to converge light beams into parallel light beams.

9. The OLED display structure claimed as claim 7 or 8, wherein the transparent substrate (40) further comprises a reflective layer (90), by which ambient light is reflected to the circular polarizer layer (6) for absorption.

10. An Organic Light Emitting Diode (OLED) display device, comprising the OLED display structure claimed as any of claims 1 to 9.

Patentansprüche

1. Organische-Licht-emittierende Diode-(OLED)-Anzeigestruktur, umfassend: ein Substrat (10) und eine OLED-Pixelschicht (20), eine Strahlenteilungsschicht (5) und eine Zirkularpolarisationsschicht (6), die der Reihe nach auf dem Substrat (10) gebildet sind, wobei die Strahlenteilungsschicht (5) geeignet ist, einen Lichtstrahl (30) räumlich in o-Licht und e-Licht aufzuteilen und um das o-Licht und das e-Licht in zirkular polarisiertes Licht zu konvertieren, welches den gleichen Polarisationszustand wie die Zirkularpolarisationsschicht (6) hat; und wobei die Zirkularpolarisationsschicht (6) geeignet ist, Durchgang des zirkular polarisierten Lichts, welches den gleichen Polarisationszustand wie sie hat, zu erlauben.

2. OLED-Anzeigestruktur gemäß Anspruch 1, wobei die Strahlenteilungsschicht (5) eine doppelbrechende Kristallschicht (50) umfasst und eine o-Licht-Viertelwellenlängenplättchenschicht (51) und eine e-Licht- Viertelwellenlängenplättchenschicht (52), die auf der doppelbrechenden Kristallschicht (50) gebildet sind, wobei die o-Licht- Viertelwellenlängenplättchenschicht (51) geeignet ist, das o-Licht in zirkular polarisiertes Licht, welches den gleichen Polarisationszustand wie die Zirkularpolarisationsschicht (6) aufweist, zu konvertieren; und wobei die e-Licht-Viertelwellenlängenplättchenschicht (52) geeignet ist, das e-Licht in zirkular polarisiertes Licht, welches den gleichen Polarisationszustand wie die Zirkularpolarisationsschicht (6) hat, zu konvertieren.

3. OLED-Anzeigestruktur gemäß Anspruch 2, wobei Richtungen von optischen Achsen der o-Licht-Viertelwellenlängenplättchenschicht (51) und der e-Licht-Viertelwellenlängenplättchenschicht (52) senkrecht zueinander sind, und wobei die optischen Achsen der o-Licht-Viertelwellenlängenplättchenschicht (51) und der e-Licht-Viertelwellenlängenplättchenschicht (52) einen Winkel von 45° in Bezug auf Polarisationsrichtungen des korrespondierenden o-Lichts bzw. e-Lichts bilden.

4. OLED-Anzeigestruktur gemäß Anspruch 2 oder 3, wobei die doppelbrechende Kristallschicht (5) aus Calcit-Kristall, Quarz oder Rubin gebildet ist.

5. OLED-Anzeigestruktur gemäß einem der Ansprüche 1 bis 4, wobei die Zirkularpolarisationsschicht (6) eine Viertelwellenlängenplättchenschicht (60) und einen linearen Polarisator (70), gebildet auf der Viertelwellenlängenplättchenschicht (60), umfasst, wobei die Viertelwellenlängenplättchenschicht (60) geeignet ist, zirkular polarisiertes Licht in linear polarisiertes Licht zu konvertieren; und wobei der lineare Polarisator (70) geeignet ist, Durchgang von linear polarisiertem Licht, welches die gleiche Polarisationsrichtung wie seine hat, zu erlauben.

6. OLED-Anzeigestruktur gemäß einem der Ansprüche 1 bis 5, außerdem umfassend eine Linsenschichtung (4), die zwischen der OLED-Pixelschicht und der Strahlenteilungsschicht lokalisiert ist, und geeignet ist, Lichtstrahlen zu konvergieren, welche von der OLED-Pixelschicht emittiert werden, um parallele Lichtstrahlen zu sein, um in die Strahlenteilungsschicht (5) einzutreten.

7. OLED-Anzeigestruktur gemäß Anspruch 6, wobei die Linsenschichtung (4) ein transparentes Substrat (40) umfasst und eine erste konvexe Linse (41) und eine zweite konvexe Linse (42), die auf zwei Seiten bezüglich des transparenten Substrats (40) gebildet sind, wobei Fokalpunkte oder Fokalebenen der ersten konvexen Linse (41) und der zweiten konvexen Linse (42) miteinander übereinstimmen.

8. OLED-Anzeigestruktur gemäß Anspruch 6, wobei die Linsenschichtung (4) ein transparentes Substrat (40) umfasst und eine erste konvexe Linse (41) und eine konkave-Linse-Mikrostruktur-Schicht (43), die auf zwei Seiten bezüglich des transparenten Substrats (40) gebildet sind, wobei die erste konvexe Linse (41) und die konkave-Linse-Mikrostruktur-Schicht (43) zusammenwirken, um Lichtstrahlen in parallele Lichtstrahlen zu konvergieren.

9. OLED-Anzeigestruktur gemäß Anspruch 7 oder 8, wobei das transparente Substrat (40) außerdem eine reflektierende Schicht (90) umfasst, mittels welcher Umgebungslicht zu der Zirkularpolarisationsschicht (6) reflektiert wird zur Absorption.

10. Organische-Licht-emittierende-Diode-(OLED)-Anzeigevorrichtung, umfassend die OLED-Anzeigestruktur gemäß einem der Ansprüche 1 bis 9.

Revendications

1. Une structure d'affichage à diodes électroluminescentes organiques (DELO), comprenant : un substrat (10) et une couche de pixels DELO (20), une couche de division de faisceau (5) et une couche de polarisation circulaire (6) qui sont formées successivement sur le substrat (10), dans lequel la couche de division de faisceau (5) est apte à diviser spatialement un faisceau lumineux (30) en lumière o et lumière e, et pour convertir la lumière o et la lumière e en lumière polarisée circulaire qui a le même état de polarisation que la couche de polarisation circulaire (6) ; et la couche de polarisation circulaire (6) est apte à permettre le passage de la lumière polarisée circulaire qui a le même état de polarisation qu'elle.

2. La structure d'affichage DELO selon la revendication 1, dans laquelle la couche de division de faisceau (5) comprend une couche cristalline biréfringente (50), et une couche de lame quart d'onde de lumière o (51) et une couche de lame quart d'onde de lumière e (52) qui sont formées sur la couche cristalline biréfringente (50), dans laquelle la couche de lame quart d'onde de lumière o (51) est apte à convertir la lumière o en lumière polarisée circulaire qui a le même état de polarisation que la couche de polarisation circulaire (6) ; et la couche de lame quart d'onde de lumière e (52) est apte à convertir la lumière e en lumière polarisée circulaire qui a le même état de polarisation que la couche de polarisation circulaire (6) .

3. La structure d'affichage DELO selon la revendication 2, dans laquelle les directions des axes optiques de la couche de lame quart d'onde de lumière o (51) et de la couche de lame quart d'onde de lumière e (52) sont perpendiculaires entre elles, et les axes optiques de la couche de lame quart d'onde de lumière o (51) et de la couche de lame quart d'onde de lumière e (52) forment, par rapport aux directions de polarisation de la lumière o et de la lumière e correspondantes, respectivement un angle de 45°.

4. La structure d'affichage DELO selon la revendication 2 ou 3, dans laquelle la couche cristalline biréfrin-

gente (50) est faite de cristal de calcite, de quartz ou de rubis.

5. La structure d'affichage DELO selon l'une quelconque des revendications 1 à 4, dans laquelle la couche de polarisation circulaire (6) comprend une couche de lame quart d'onde (60) et un polariseur linéaire (70) formé sur la couche de lame quart d'onde (60), dans laquelle la couche de lame quart d'onde (60) est apte à convertir la lumière polarisée circulaire en lumière polarisée linéaire ; et le polariseur linéaire (70) est apte à permettre le passage de la lumière polarisée linéaire qui a la même direction de polarisation que lui.

6. La structure d'affichage DELO selon l'une quelconque des revendications 1 à 5, comprenant en outre une couche formant lentille (4), qui est située entre la couche de pixels DELO et la couche de division de faisceau, et apte à faire converger des faisceaux lumineux qui sont émis par la couche de pixels DELO pour qu'ils soient des faisceaux lumineux parallèles pour pénétrer dans la couche de division de faisceau (5).

7. La structure d'affichage DELO selon la revendication 6, dans laquelle la couche formant lentille (4) comprend un substrat transparent (40), et une première lentille convexe (41) et une seconde lentille convexe (42) qui sont formées respectivement sur deux côtés du substrat transparent (40), les points focaux ou plans focaux de la première lentille convexe (41) et de la seconde lentille convexe (42) coïncidant entre eux.

8. La structure d'affichage DELO selon la revendication 6, dans laquelle la couche formant lentille (4) comprend un substrat transparent (40), et une première lentille convexe (41) et une couche de microstructure formant lentille concave (43) qui sont formées respectivement sur deux côtés du substrat transparent (40), dans laquelle la première lentille convexe (41) et la couche de microstructure formant lentille concave (43) coopèrent pour convertir des faisceaux lumineux en faisceaux lumineux parallèles.

9. La structure d'affichage DELO selon la revendication 7 ou 8, dans laquelle le substrat transparent (40) comprend en outre une couche réfléchissante (90), par laquelle la lumière ambiante est réfléchie vers la couche de polarisation circulaire (6) pour absorption.

10. Un dispositif d'affichage à diodes électroluminescentes organiques (DELO), comprenant la structure d'affichage DELO selon l'une quelconque des revendications 1 à 9.

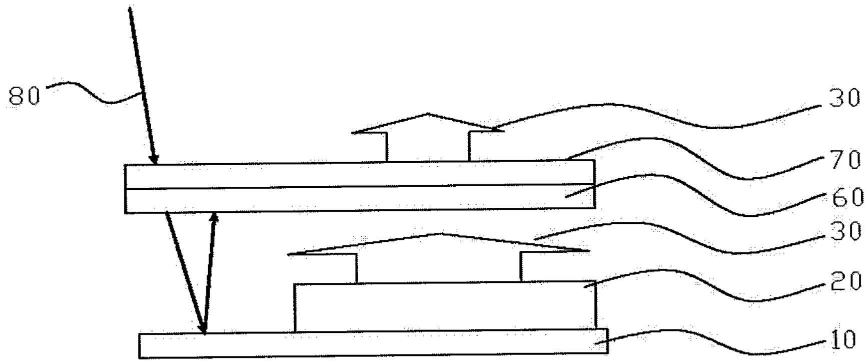
80
30
70
60
30
20
10

FIG.1

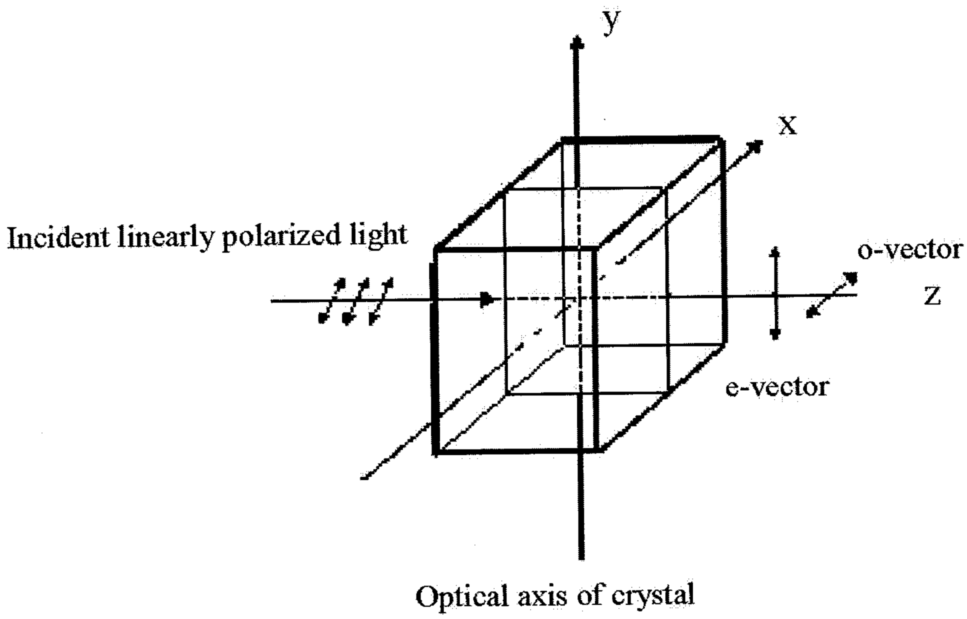
y
x
Incident linearly polarized light
o-vector
z
e-vector
Optical axis of crystal

FIG.2

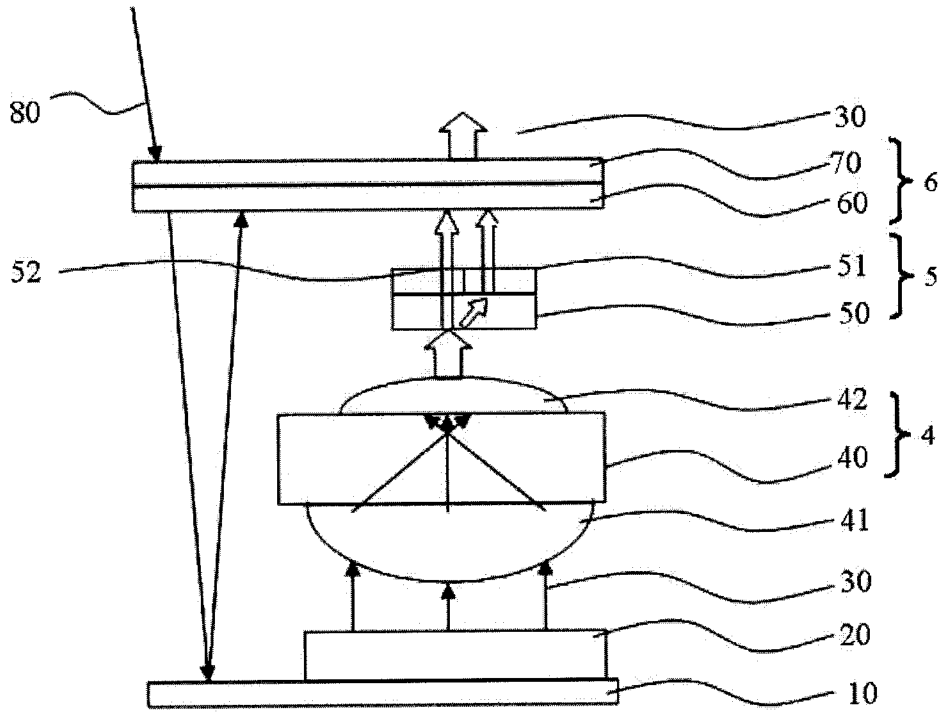
80
30
70
6
60
52
51
5
50
42
4
40
41
30
20
10

FIG.3

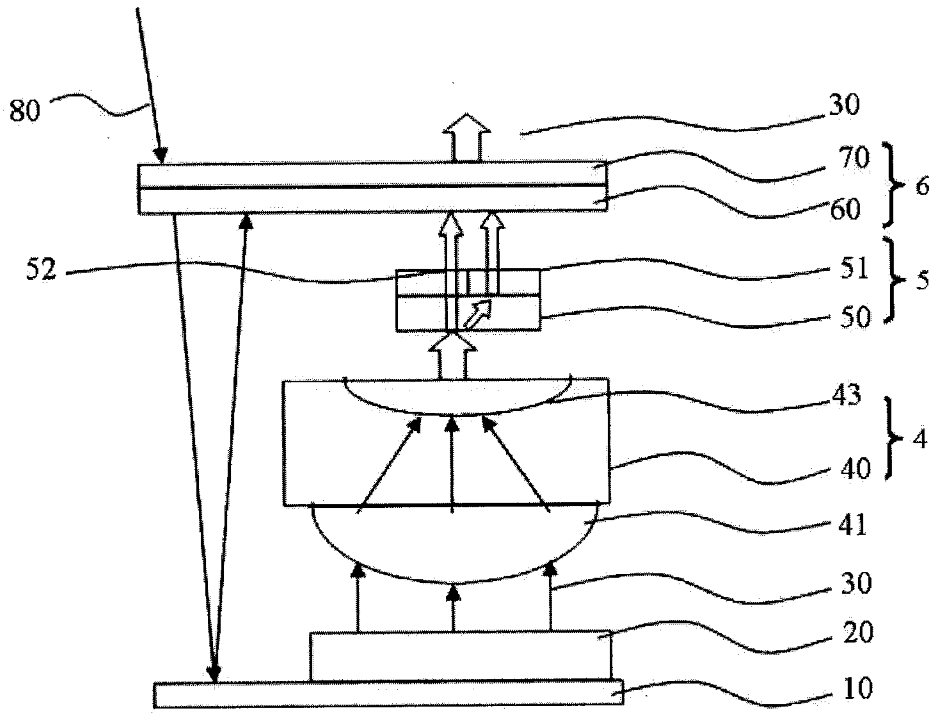
80
30
70
6
60
52
51
5
50
43
4
40
41
30
20
10

FIG.4

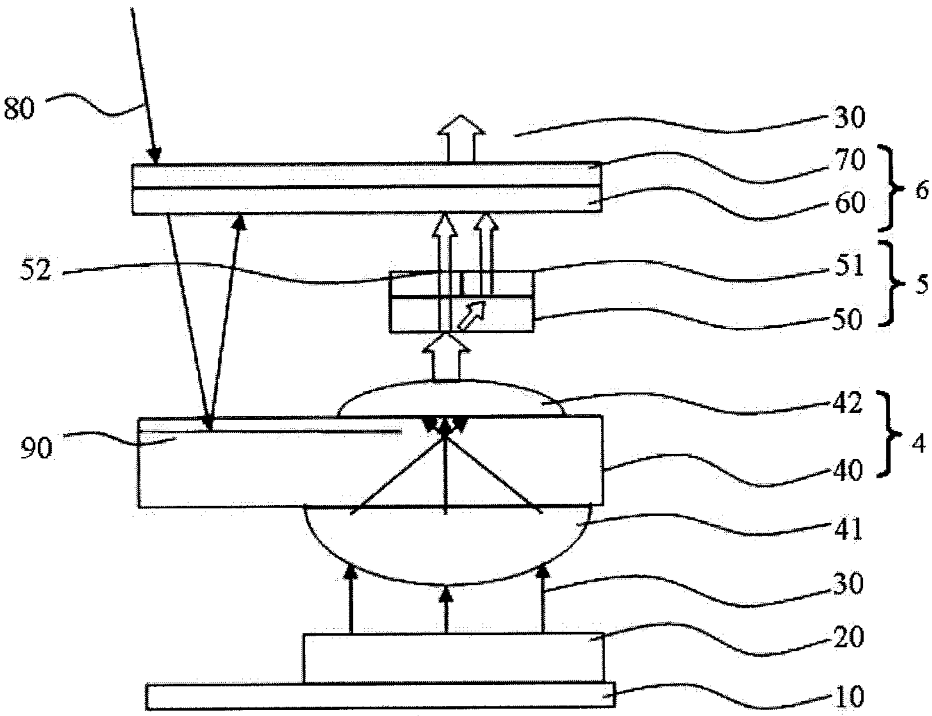

FIG.5

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 1223618 A2 **[0004]**
- CN 202008552 U **[0004]**

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申请(专利权)人(译)	京东方科技集团股份有限公司.		
当前申请(专利权)人(译)	京东方科技集团股份有限公司.		
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CPC分类号	G02B5/3083 G02B27/283 H01L51/50 H01L51/5271 H01L51/5275 H01L51/5281 H01L27/3244 H01L51/5293 H01L2251/53		
优先权	201220210411.X 2012-05-10 CN		
其他公开文献	EP2849242A1 EP2849242A4		
外部链接	Espacenet		

摘要(译)

本发明的实施例提供一种OLED显示结构以及具有该OLED显示结构的OLED显示装置。 OLED显示结构包括：基板；和依次形成在基板上的OLED像素层，分束层和圆偏振片层； 分束层，用于将光束分为o光和e光，并将o光和e光转换为与圆偏振片层具有相同偏振态的圆偏振光。 圆偏振器层适于允许具有与其相同的偏振态的圆偏振光通过。 利用该显示结构，提高了透光率，并且减小了OLED像素层的像素电流，从而节省了能量。

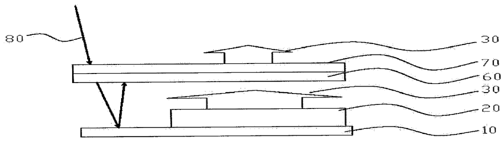

FIG.1

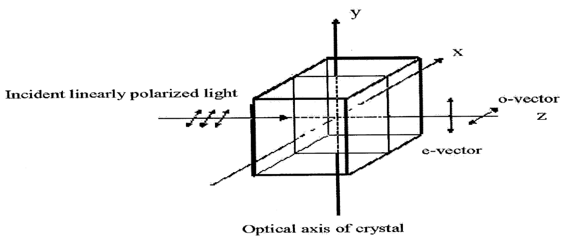

FIG.2