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DISPLAY APPARATUS WITH SOLAR CELL
AND METHOD OF MANUFACTURING THE
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LTD.**, Gyeonggi-do (KR)(21) Appl. No.: **14/176,770**(22) Filed: **Feb. 10, 2014**(30) **Foreign Application Priority Data**

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(57) **ABSTRACT**

An Organic Light Emitting Diode (OLED) display apparatus with a solar cell is provided. The OLED display apparatus includes an OLED display unit which includes a pixel region formed of an OLED and a pixel boundary region partitioning the pixel region, and provided with a touch panel through which light emitted from the OLED is transmitted and at least one glass; and a solar cell for converting incident light into electricity, which is formed adjacent to the OLED display unit.

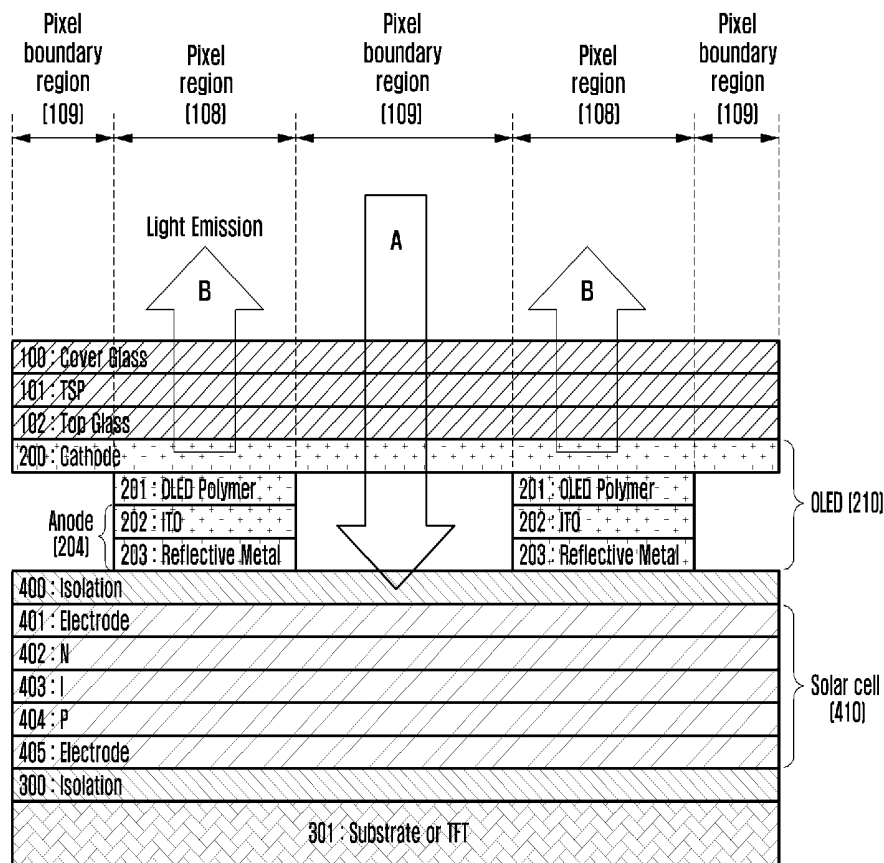


FIG. 1

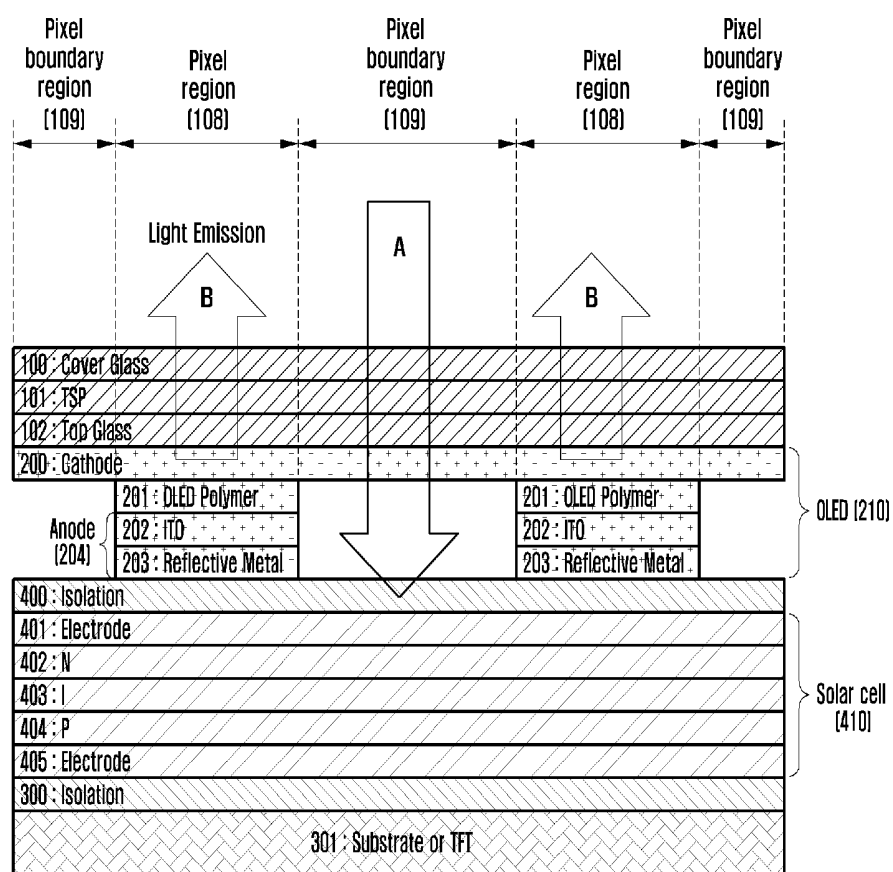


FIG. 2

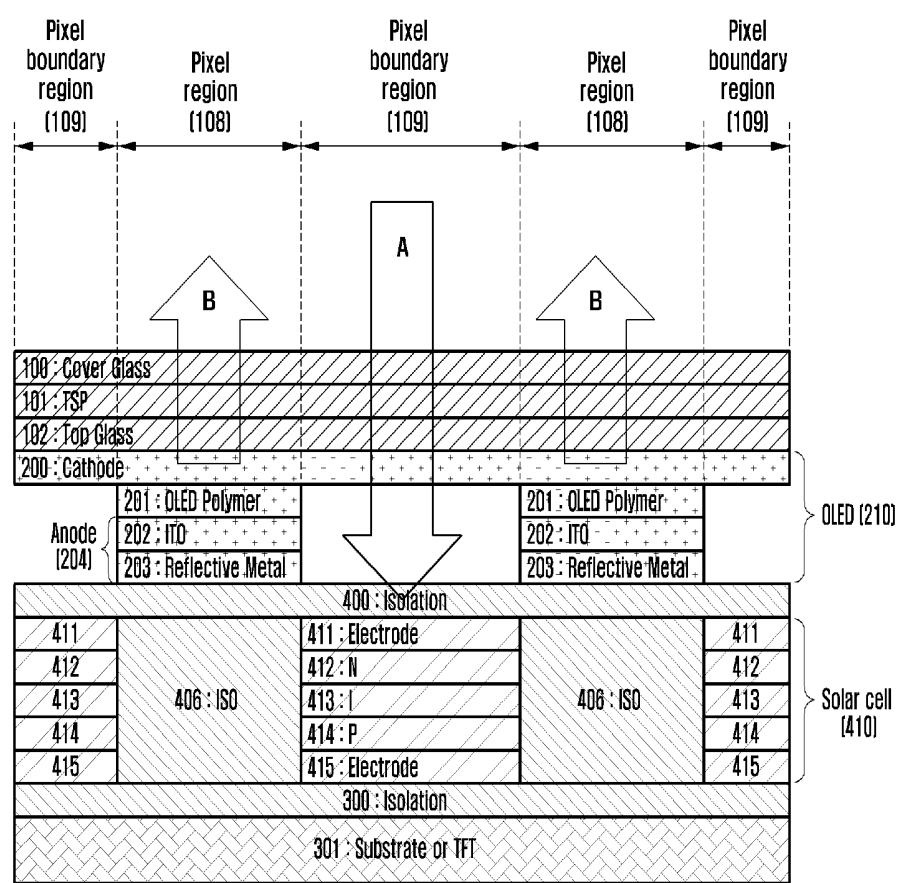


FIG. 3

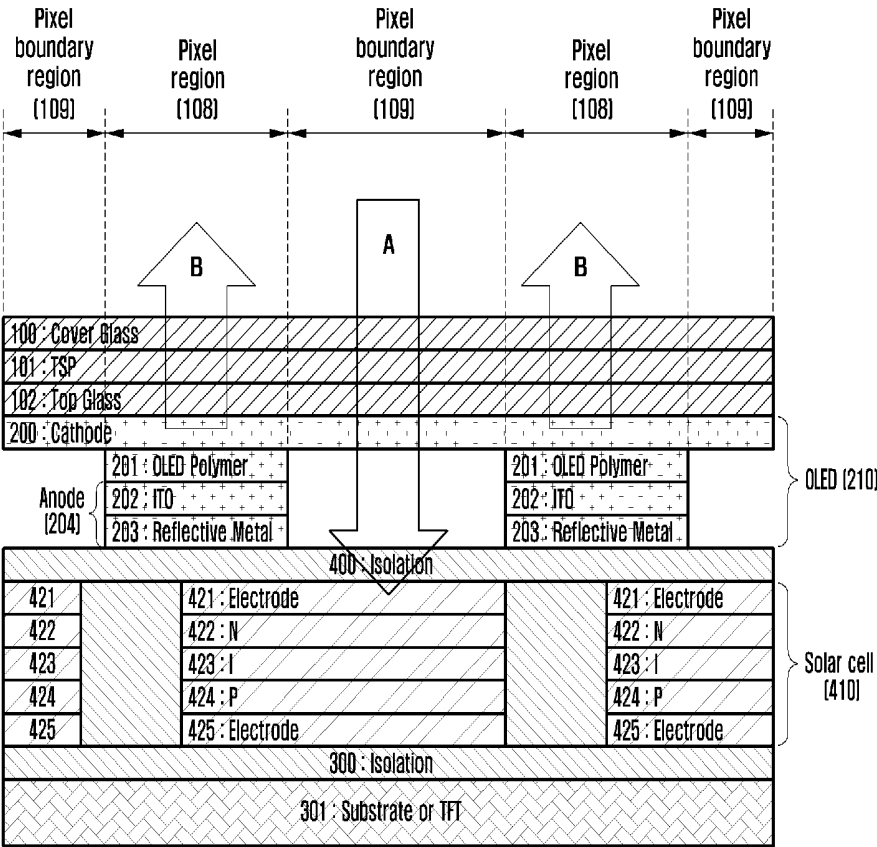


FIG. 4

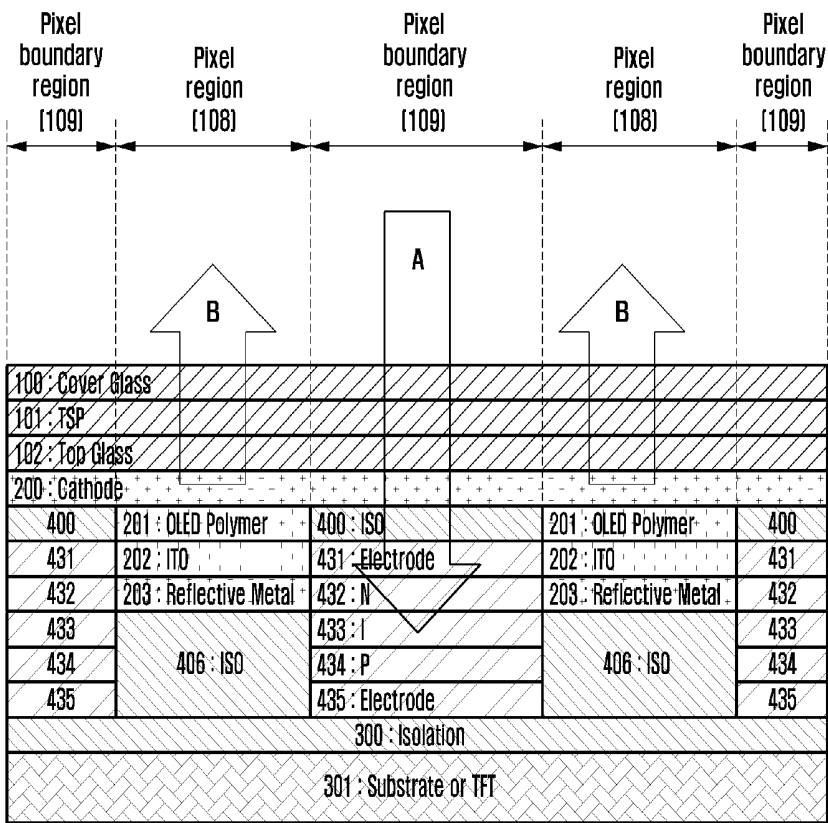


FIG. 5

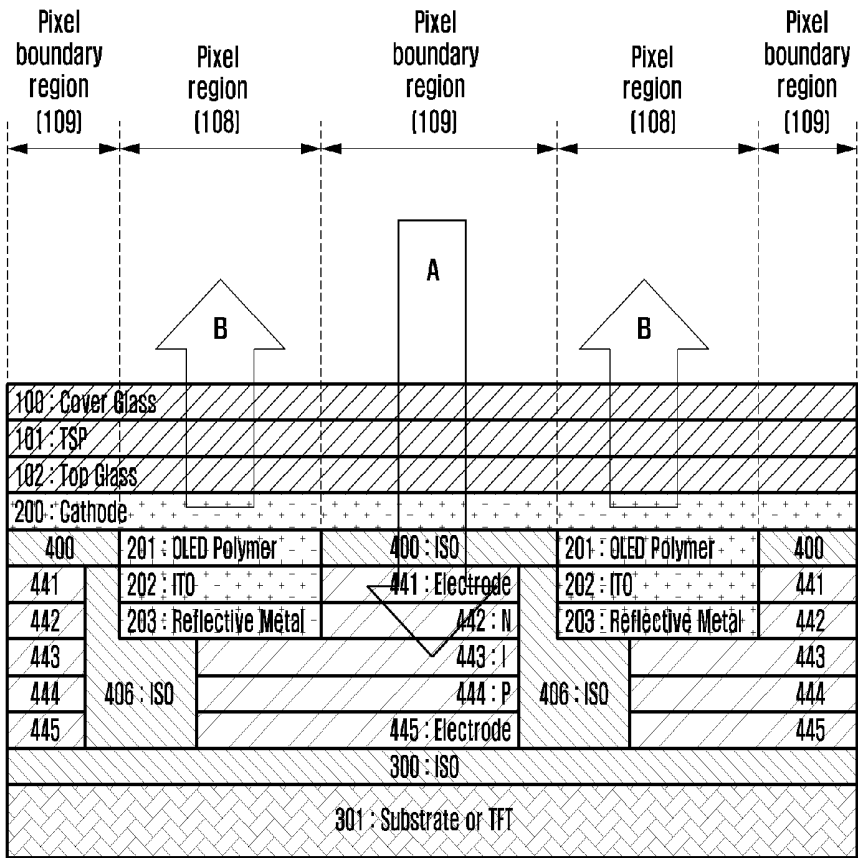


FIG. 6

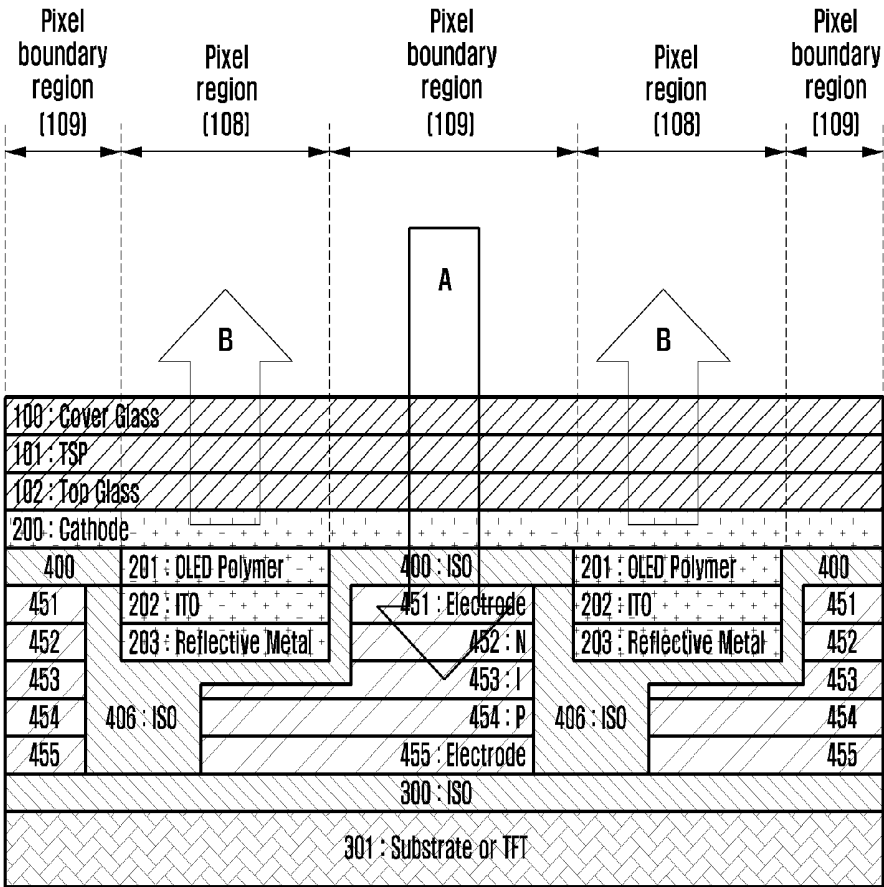


FIG. 7

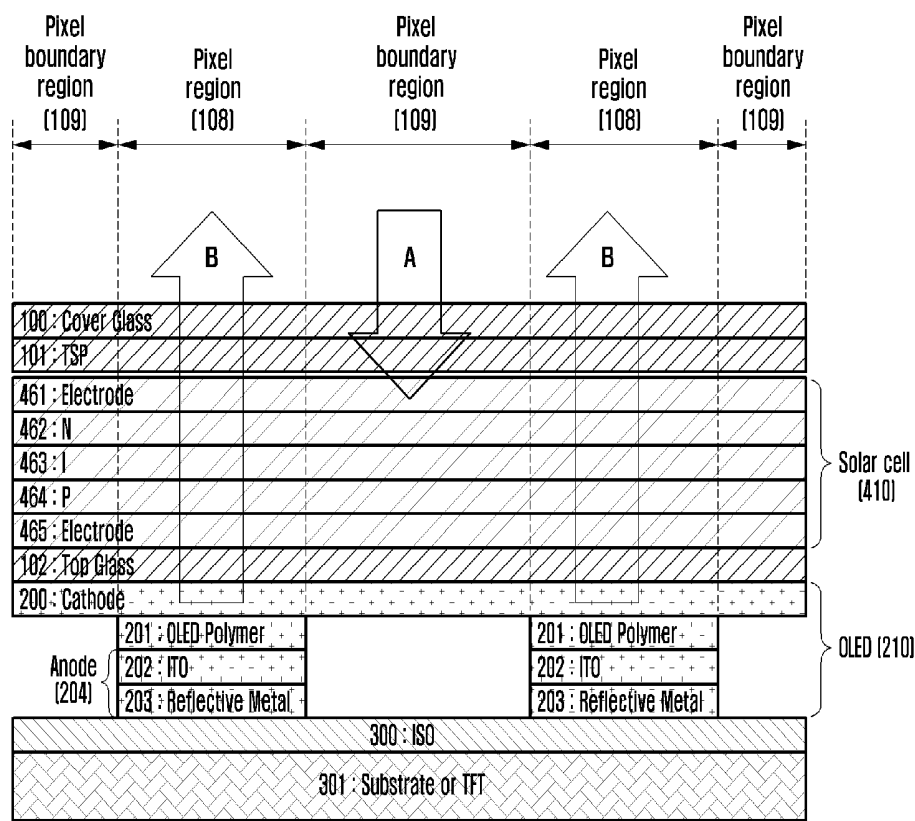


FIG. 8

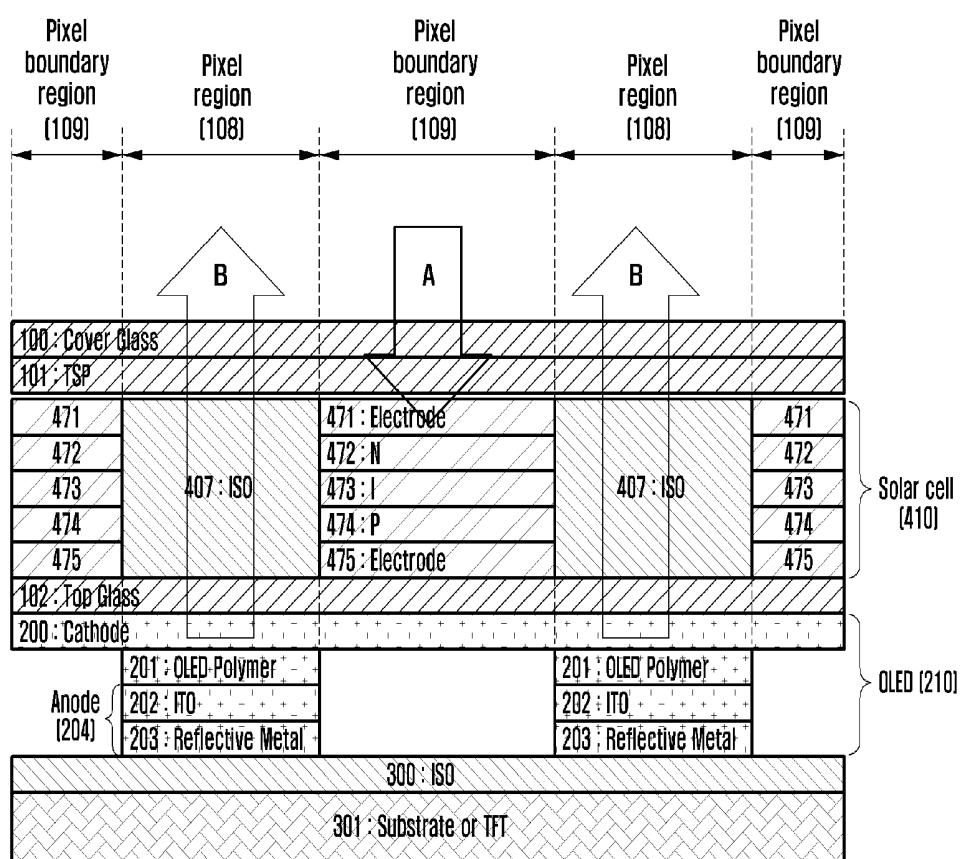


FIG. 9

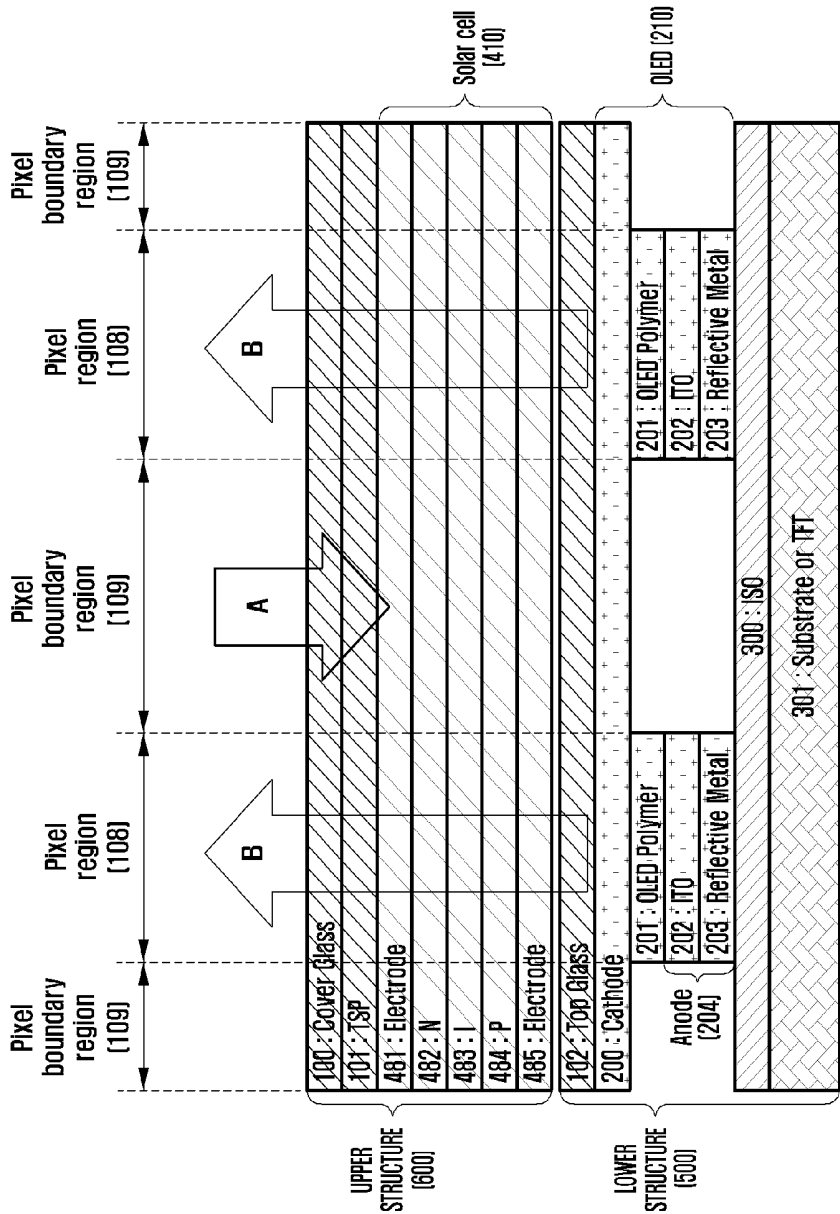
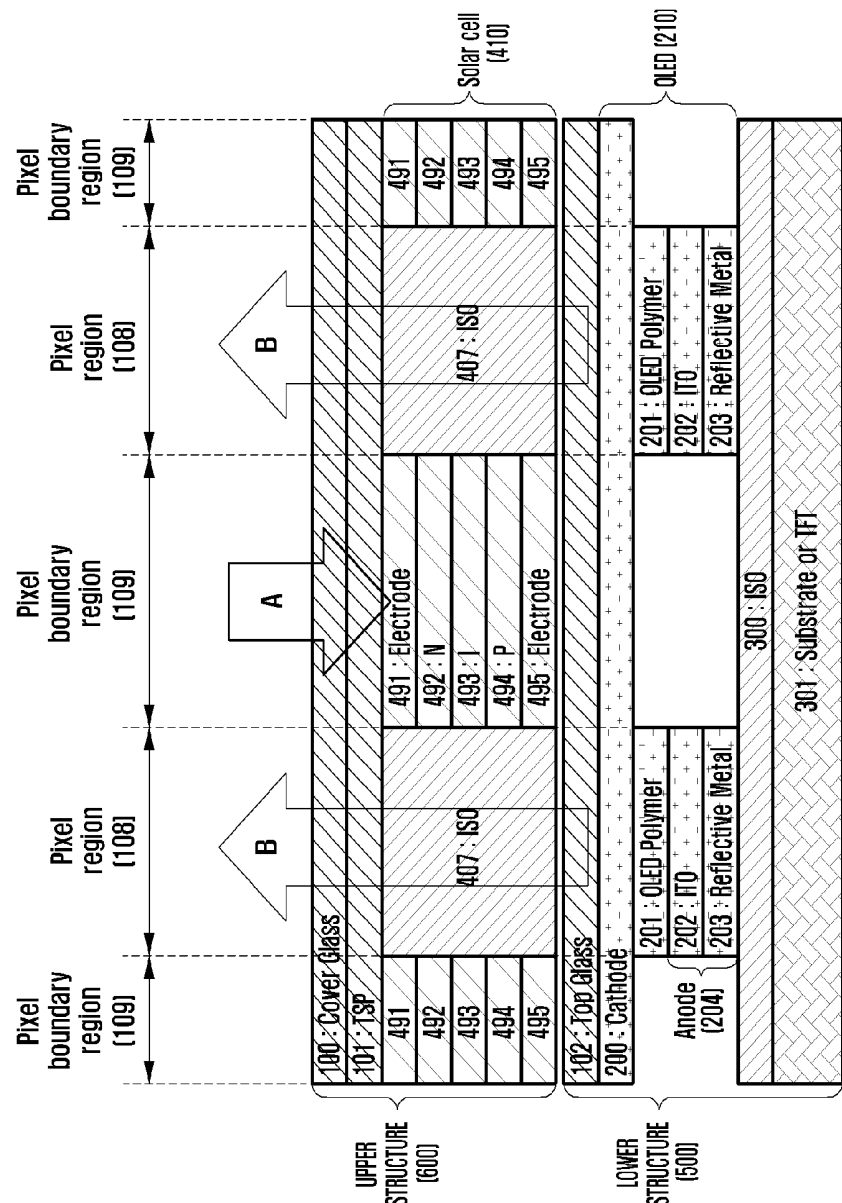


FIG. 10



**ORGANIC LIGHT EMITTING DIODE
DISPLAY APPARATUS WITH SOLAR CELL
AND METHOD OF MANUFACTURING THE
SAME**

PRIORITY

[0001] This application claims priority under 35 U.S.C. §119(a) to Korean Patent Application Serial No. 10-2013-0014307, which was filed in the Korean Intellectual Property Office on Feb. 8, 2013, the entire content of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention generally relates to an Organic Light Emitting Diode (OLED) display apparatus with a solar cell and a method of manufacturing the same, and more particularly to an OLED display apparatus with solar cells in which the solar cell is formed in a pixel boundary region or on an upper portion of an OLED so as to improve light absorbing efficiency of the solar cell prepared for the OLED display apparatus and to assist electric power of the OLED display apparatus, thereby increasing use time of electric power.

[0004] 2. Description of the Related Art

[0005] With the development of technologies relating to portable multimedia devices, a display apparatus using an OLED has been developed, which has an advantage of a wide viewing angle, a high response rate, self-light emission, low energy consumption and the like.

[0006] Such an OLED display apparatus has been applied to laptop computers, portable phones, MP3 players, Portable Multimedia Players (PMP) and the like, which are supplied with electric power from a rechargeable battery. The use time of the electronic device is determined by a charging capacity of a battery. Therefore, development of a technology for increasing battery capacity to enable longer use time of the electronic device has been required. Conventionally, research has focused on developing a technology for operating a display apparatus at low electric power and to develop an algorithm for saving electric power. Basically, there is a problem in extending the limited charging capacity of the battery.

[0007] Recently, a method of supplying electric power to a portable device or for charging a battery for the portable device by using solar light has been developed, in which a solar cell is attached to a surface of the portable device.

[0008] In the prior art, Korean Patent Application No. 2005-0035595 discloses a technology for forming a solar cell and an Organic Light Emitting Diode (OLED) on an identical substrate, in which the technology a solar cell is made of amorphous silicon. However, there is a problem in that separate spaces for the solar cell and a display unit are required. Practical use of space and practicality of the electronic device are decreased.

SUMMARY OF THE INVENTION

[0009] The present invention has been made to solve the above-mentioned problems in the prior art, and to provide at least the advantages described below. Accordingly, an aspect of the present invention is to provide an Organic Light Emitting Diode (OLED) display apparatus with a solar cell and a method of manufacturing the same, in which the solar cell assists electric power of the display apparatus.

[0010] Another aspect of the present invention is to provide an Organic Light Emitting Diode (OLED) display apparatus with a solar cell and a method of manufacturing the same, in which the display apparatus has a reduced thickness, and the solar cell has improved light absorbing efficiency.

[0011] In accordance with an aspect of the present invention, an Organic Light Emitting Diode (OLED) display apparatus with a solar cell is provided. The OLED display apparatus includes an OLED display unit which includes a pixel region formed of an OLED and a pixel boundary region partitioning the pixel region, and a touch panel through which light emitted from the OLED is transmitted, and at least one glass; and a solar cell for converting incident light into electricity, formed adjacent to the OLED display unit.

[0012] In accordance with another aspect of the present invention, a method of manufacturing an OLED display apparatus with a solar cell is provided. The method includes forming a solar cell on a substrate; forming an OLED on the solar cell; and forming at least one glass and a touch panel through which light emitted from the OLED is transmitted, on the OLED.

[0013] In accordance with still another aspect of the present invention, a method of manufacturing an OLED display apparatus with a solar cell is provided. The method includes forming a solar cell on a substrate; etching a part of the solar cell; forming an isolation layer on the etched part of the solar cell and an OLED on the isolation layer; and forming at least one glass and a touch panel through which light emitted from the OLED is transmitted, on the OLED.

[0014] In accordance with still another aspect of the present invention, a method of manufacturing an OLED display apparatus with a solar cell is provided. The method includes forming an OLED in a pixel region on a substrate, except for a pixel boundary region; forming a top glass on the pixel region and the pixel boundary region; forming a solar cell on the top glass; and forming a touch panel and a cover glass on the solar cell.

[0015] In accordance with still another aspect of the present invention, a method of manufacturing an OLED display apparatus with a solar cell is provided. The method includes preparing a lower structure by forming an OLED in a pixel region on a substrate, except for a pixel boundary region, and forming a top glass on the pixel region and the pixel boundary region; preparing an upper structure in which a cover glass, a touch panel and a solar cell are sequentially formed, separately from the lower structure; and enabling the upper structure to cohere on the lower structure by turning the upper structure upside-down.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The above and other aspects, features, and advantages of the present invention will be more apparent from the following detailed description taken in conjunction with the accompanying drawings, in which:

[0017] FIGS. 1-6 are sectional views illustrating an OLED display apparatus including a solar cell according to an embodiment of the present invention; and

[0018] FIGS. 7-10 are sectional views illustrating an OLED display apparatus including a solar cell according to another embodiment of the present invention.

DETAILED DESCRIPTION OF EMBODIMENTS
OF THE PRESENT INVENTION

[0019] In the following description of the present invention, a detailed description of related well-known functions or structures incorporated herein will be omitted when it may make the subject matter of the present invention unclear. In the description of the present invention, terms or words used hereinafter should be interpreted not as general or having general dictionary meanings, but according to the meanings and concepts suitable for the technical spirit of the present invention. Thus, since the following description and the accompanying drawings do not represent all technical aspects of the present invention, but merely indicate embodiments of the present invention, it should be understood that there may be various equivalents and modifications which can be substituted for the embodiments at a time of filing this application. Furthermore, in the accompanying drawings, some structural elements may be exaggeratingly or schematically shown, or may be omitted.

[0020] In an embodiment of the present invention, the OLED display apparatus with a solar cell may be applied to all portable electronic information and communication devices, multimedia devices and applications thereof, such as a portable phone, a television receiver (TV), a tablet Personal Computer (PC), a mobile communication terminal, a mobile phone, a laptop PC, a Personal Digital Assistant (PDA), a smart phone, an International Mobile Telecommunication 2000 (IMT-2000) terminal, a Code Division Multiple Access (CDMA) terminal, a Wideband Code Division Multiple Access (WCDMA) terminal, a Global System for Mobile communication (GSM) terminal, a General Packet Radio Service (GPRS) terminal, an Enhanced Data rates for GSM Evolution (EDGE) terminal, an Universal Mobile Telecommunication Service (UMTS) terminal, a digital broadcasting terminal and an Automated Teller Machine (ATM).

[0021] FIG. 1 is a sectional view illustrating an OLED display apparatus with a solar cell according to an embodiment of the present invention.

[0022] Referring to FIG. 1, the OLED display apparatus with the solar cell according to an embodiment of the present invention includes a cover glass 100, a touch panel 101, a top glass 102, an Organic Light Emitting Diode (OLED) 210, a solar cell 410, a first isolation layer 400, a second isolation layer 300 and a circuit board 301.

[0023] The top glass 102, the touch panel 101 and the cover glass 100 may be sequentially arranged on a cathode 200 constituting the OLED 210.

[0024] The OLED 210 is a device which is supplied with electric power from a battery or an external electric power supplying unit and emits light depending on a flow of electric current so as to display desired image information.

[0025] The OLED 210 includes a cathode region 200 comprising a transparent Indium Tin Oxide (ITO) electrode or a semitransparent ITO electrode, a polymer region 201 for emitting light, and anode region 204 comprising a transparent ITO electrode or a reflective metal. Here, the transparent ITO electrode 202 of the anode region 204 may be omitted.

[0026] The anode region 204 may be formed of a transparent conductive material. The transparent conductive material includes Indium Tin Oxide (ITO), Tin Oxide (TO), Indium Zinc Oxide (IZO), Indium Tin Zinc Oxide (ITZO), or a combination thereof.

[0027] The OLED 210 may include a Hole Injection Layer (HIL), a Hole Transporting Layer (HTL), an Emission Layer (EML), an Electron Transporting Layer (ETL), and an Electron Injection Layer (EIL).

[0028] The cathode region 200 is formed of a transparent conductive material on the polymer region 201. The transparent conductive material includes Indium Tin Oxide (ITO), Tin Oxide (TO), Indium Zinc Oxide (IZO), Indium Tin Zinc Oxide (ITZO), or a combination thereof.

[0029] An encapsulation layer or a passivation layer may be further formed on the cathode region 200 in order to protect the OLED 210.

[0030] The OLED 210 constructed as described above is supplied with electric power from a rechargeable battery in which electric energy generated by the solar cell 410 is stored, or an external electric power supply unit, and emits light B in the polymer region 201 between the anode region 204 and the cathode region 200.

[0031] The OLED 210 is a light emitting layer, in which electric currents with voltages of different polarities are applied to the anode region 204 and the cathode region 200 respectively, so as to enable a hole and an electron injected into the anode region 210 and the cathode region 200, respectively, to be coupled with each other to form an exciton, and the exciton is in a ground state to emit the light B.

[0032] The first isolation layer 400 is interposed between the OLED 210 and the solar cell 410 to isolate the OLED 210 and the solar cell 410.

[0033] The first isolation layer 400 may be formed of acrylic, silicon oxide, or the like.

[0034] The solar cell 410 is formed under the first isolation layer 400 in the form of a multilayer structure in order to improve efficiency of the solar cell. The solar cell is provided in the form of a multilayer structure in order to improve the efficiency of the solar cell, and may be formed with two-sided structure in order to absorb both external light and internal light emitted from the OLED 210.

[0035] The solar cell 410 is formed under the OLED 210, and receives light A introduced into the solar cell through a pixel boundary region adjacent to a pixel region in which the OLED 210 is provided, so as to convert the light A into electricity, to result in providing additional electric power of the electronic device.

[0036] Further, the solar cell 410 absorbs external light A introduced through a circuit board 301 made of a transparent material, and causes a potential difference between an n-type electrode and a p-type electrode to generate electric energy, thereby supplying the electric energy to an external electric power supply unit (not shown) or a rechargeable battery connected to the external electric power supply unit.

[0037] That is, the solar cell 410 generally is a semiconductor device for converting solar energy into electric energy, which is made by a junction of a p-type semiconductor and an n-type semiconductor and basically has the same structure as a diode. The solar cell 410 may be formed on a circuit board 301.

[0038] The first isolator 400 is preferably made of a transparent isolation film because incident light is made to be transmitted through the first isolator and to be introduced into the solar cell 410.

[0039] Particularly, the solar cell 410 may be formed by sequentially layering a positive electrode 405, a p-type region

404, an intrinsic region **403**, an n-type region **402**, and a negative electrode **401** between isolator **300** on circuit board **301** and isolator **400**.

[0040] A selection of material for the solar cell **410** is not limited because the solar cell **410** is electrically disconnected with the OLED **210**. The solar cell includes at least one of a crystalline silicon solar cell, an amorphous silicon solar cell, a solar cell made of groups 3-5 including GaAs, a solar cell made of a compound of Cu, In, Ga and Se (CIGS), a dye-sensitized solar cell, a solar cell based on organic compound, and a combination thereof.

[0041] In the solar cell **410**, electrons must be asymmetrically present in a structure of a p-n junction semiconductor layer for a photovoltaic energy conversion. That is, in the p-n junction semiconductor layer, an n-type semiconductor layer has a high electron density and a low hole density, and a p-type semiconductor layer has a low electron density and a high hole density.

[0042] Accordingly, in a thermal equilibrium state, an imbalance of an electric charge is generated by diffusion of a carrier due to a concentration gradient in the p-n junction semiconductor layer, and thereby an electric field is formed so that the diffusion of the carrier does not continue to occur.

[0043] At this time, when light having a higher energy than a band gap energy (which is an energy difference between a conduction band and a valence band of a material forming the p-n junction semiconductor layer) is emitted into the p-n junction semiconductor layer, electrons receiving the light energy are excited from the valence band to the conduction band. Accordingly, the electrons excited to the conduction band freely move, and holes are generated in a space of the valence band from which the electrons are slipped. The free electrons and the holes are referred to as excess carriers, and the excess carriers are diffused due to the concentration gradient in the conduction band or the valence band. At this time, the excess carriers, i.e., electrons excited in the p-type semiconductor and holes generated in the n-type semiconductor, are defined as a minority carrier, while carriers in the p-type or n-type semiconductor before the junction, i.e., p-type hole and n-type electron, are defined as a majority carrier and distinguished from the minority carrier.

[0044] Although a flow of the plural carriers is interrupted because of an energy barrier due to the electric field, the electrons which are the p-type minority carrier can move toward the n-type minority carrier. A potential drop occurs due to the diffusion of the minority carrier in the p-n junction semiconductor layer, and the p-n junction semiconductor layer functions as a battery when both electrodes thereof are connected to an external circuit to supply an electromotive force generated by the p-n junction semiconductor layer to the external circuit. Therefore, the electromotive force generated in such a manner is supplied to a battery (not shown) for operating the OLED **210** and a circuit for charging the battery, so that the battery can be automatically charged.

[0045] Solar cells **410** according to the embodiment of the present invention as shown in FIG. 1 are formed in correspondence to a lower end of the pixel region and the pixel boundary region

[0046] Alternatively, referring to FIG. 2, solar cell **410** may be formed to correspond to the lower end of the pixel boundary region. That is, the solar cell **410** is formed under the lower end of the pixel boundary region, and the isolator **406** may be formed under a lower end of the pixel region. The isolators **406** may be a partitioning region interposed between

the solar cells **410** formed like pixels. The isolator **406** may be formed of acryl, silicon oxide, or the like.

[0047] The reason for arranging the solar cells at the lower end of the pixel boundary region is because an absorbing ratio of light introduced from an outside is relatively lower than in the pixel boundary region as the OLED **210** is formed in the pixel region. Accordingly, in view of energy efficiency and cost, the solar cells **410** are preferably formed under the lower end of the pixel boundary region which has a high absorbing ratio of the light.

[0048] Further, since the solar cells **410** are formed under the lower end of the pixel boundary region, it is possible to prevent deterioration in brightness of light D emitted from the OLED **210**.

[0049] Referring to FIG. 3, the solar cells **410** according to the present invention may have a structure in which they are formed to correspond to a portion of the pixel region and a portion of the pixel boundary region and under the lower end of the pixel boundary region and the pixel region. That is, some of the solar cells **410** may be formed just under the OLED **210**, and the remaining solar cells **410** may be formed just under the pixel boundary region.

[0050] Referring to FIG. 4, the solar cells **410** according to the embodiment of the present invention are formed in the pixel boundary region. That is, the solar cells **410** may be formed at both sides of the OLED **210** which is a pixel region. In such a structure, as the solar cells **410** are formed in the pixel boundary region, the solar cells **410** are arranged nearer to an upper side of the OLED display apparatus in comparison with the solar cells **410** previously illustrated in FIGS. 1 to 3. Therefore, there is an effect in that efficiency of the solar cells **410** is improved.

[0051] Further, since the solar cells **410** according to this embodiment are arranged in the pixel boundary region which is an empty space in comparison to the previously illustrated solar cells **410** arranged in correspondence to a lower end of the OLED **210**, there are advantages in that an overall thickness of the OLED display apparatus can be reduced, and also the thickness of the OLED display apparatus with the solar cells can be reduced.

[0052] Referring to FIG. 5, the solar cell **410** may be formed under the pixel boundary region and the pixel region, i.e., formed just under the pixel region simultaneously when it is formed under the pixel boundary region. That is, some of the solar cells **410** may be formed just under the OLED **210**, and the remaining solar cells **410** may be formed under the pixel boundary region. The isolators **406** may be a partitioning region interposed between the solar cells **410** formed like pixels. As shown in FIG. 6, the isolator **406** may be formed between the solar cell **401** and the OLED **210**. That is, the isolator **406** functions to isolate the solar cell **401** and the OLED **210**, and is arranged to surround a periphery of the solar cell **401**. Referring to FIG. 7, the solar cell **410** according to an embodiment of the present invention is formed on the OLED **210**. Particularly, the solar cell **410** is formed on a substrate **301**, the OLED **210** and a top glass **102**, and a touch panel **101** and a cover glass **100** may be formed on the solar cell **410**.

[0053] At this time, the top glass between the solar cell **410** and the OLED **210** functions as a substrate for the solar cell **410**.

[0054] FIG. 8 shows a structure of the solar cell **410** which is partially formed and which has been shown in FIG. 7, in which a partitioning region **407** is formed between the solar

cells **410** formed like the pixels. The partitioning region **407** is formed of an isolation material such as silicon oxide, silicon nitride, acrylic based resin, or the like. The solar cell **410** is formed in a region corresponding to an upper portion of the pixel boundary region, and the partitioning region **407** may be formed in a region corresponding to an upper portion of the pixel region. Here, the partitioning region **407** corresponding to an upper portion of the OLED **210** may be formed of a transparent isolator, so as to transmit the light B emitted from the OLED **210**. As shown in FIGS. 7 and 8, when the solar cell **410** is formed on the upper portion of the OLED **210**, it is possible to increase an amount of light A incident to the solar cells **410**. Hereinafter, a process of manufacturing the OLED display apparatus with the solar cell according to an embodiment of the present invention will be described with reference to FIGS. 1 to 6.

[0055] Referring to FIGS. 1 to 6, in the process of manufacturing the OLED display apparatus with the solar cells, the solar cells **410** which convert the light into electricity to assist electric power of the OLED display are formed on a substrate.

[0056] Although electrodes comprising the solar cell **410** may be formed of a single thin-film, the electrodes may be formed of a multi-layered thin-film having a transparent isolation layer/a transparent electrode/a transparent isolation layer. Since the solar cell is formed of the transparent electrode and the transparent isolation layer, it is possible to further absorb light incident through a lower portion of the OLED display apparatus and to improve light absorbing capability.

[0057] After the solar cells **410** are deposited, a part of the solar cell **410** is etched in order to form pixel structures, and then the isolator **406** is deposited on the etched part of the solar cell. At this time, the part of the solar cell corresponding to the pixel region is etched and a semitransparent or transparent isolator **406** is deposited on the etched part of the solar cell, thereby forming the solar cell **410** only under the pixel boundary region which has an excellent light absorbing ratio in view of energy efficiency and cost. As shown in FIG. 6, the isolator **406** may be formed between the solar cell **410** and the OLED **210**.

[0058] Further, the isolator **300** may be further deposited between the solar cell **410** and the substrate **301**.

[0059] When the solar cell **410** is formed, an isolator **400** is deposited on the solar cell **410** and the OLED **210** is deposited in the pixel region on the isolator **400**, except for the pixel boundary region.

[0060] The OLED **210** is formed by sequentially depositing an anode region **204** comprising an ITO transparent electrode **202** and/or a reflective metal **203**, a polymer region **201** for emitting light, and a cathode region **200** comprising a transparent electrode or a semitransparent electrode. At this time, the uppermost cathode region **200** may be formed on an upper portion of the OLED display apparatus including the pixel region and the pixel boundary region.

[0061] When the OLED **210** is formed, a display unit including a top glass **102**, a touch panel **101** and a cover glass **100** are formed on the pixel region and the pixel boundary region.

[0062] Hereinafter, a process of manufacturing the OLED display apparatus with the solar cell according to another embodiment of the present invention will be described with reference to FIGS. 7 to 8.

[0063] Referring to FIG. 7, in the process of manufacturing the OLED display apparatus with the solar cell, the OLED

210 is formed in the pixel region except for the pixel boundary region on the substrate **301**. Here, an isolator **300** may be formed between the substrate **301** and the OLED **210**.

[0064] A top glass **102** is formed on a cathode **200** of the OLED **210**. In turn, the solar cell **410** may be formed on the top glass **102**, and a touch panel **101** and a cover glass **100** may be formed on the solar cell **410**. Here, the top glass **102** may function as the substrate for the solar cell **410**.

[0065] Particularly, the solar cell **410** may be prepared in such a manner that a positive electrode **465**, a p-type region **464**, an intrinsic region **463**, an n-type region **462**, and a negative electrode **461** are sequentially formed on the top glass **102**.

[0066] Referring to FIG. 8, here, a process of etching a part of the solar cell **410** shown in FIG. 7 in order to form a pixel structure and depositing an isolator **407** in the etched region may be further included. Particularly, the part of the solar cell **410** corresponding to the pixel region is etched and the semitransparent or transparent isolator **407** is deposited in the etched region, thereby facilitating transmission of the light emitted from the OLED **210** through the isolator **407**.

[0067] Hereinafter, a process of manufacturing the OLED display apparatus with the solar cell according to another embodiment of the present invention will be described with reference to FIGS. 9 to 10.

[0068] Referring to FIG. 9, in the process of manufacturing the OLED display apparatus with the solar cell according to another embodiment of the present invention, the OLED **210** may be formed in the pixel region except for the pixel boundary region on the substrate **301**. Here, an isolator **300** may be further formed between the substrate **301** and the OLED **210**. A top glass **102** is formed on the pixel boundary region and the pixel region including the OLED **210**, so as to form a lower structure of the OLED display apparatus.

[0069] After an upper structure **600** and the lower structure **500** are provided by preparing the upper structure **600** separately from the lower structure **500**, the upper structure **600** may be made to cohere on the lower structure **500** through an upside-down process. Here, the coherence of the upper structure **600** to the lower structure **500** may be performed by using an adhesive or thermal compression method.

[0070] The upper structure **600** is separated from the substrate **310** on which the OLED **210** is formed, and is prepared by sequentially forming a cover glass **100**, a touch panel **101**, and the solar cell **410**.

[0071] Referring to FIG. 10, here, a process of etching a part of the solar cell **410** shown in FIG. 9 and depositing an isolator **407** in the etched region, in order to form a pixel structure may be further included. Particularly, the part of the solar cell **410** corresponding to the pixel region is etched and the semitransparent or transparent isolator **407** is deposited in the etched region, thereby facilitating transmission of the light emitted from the OLED **210** through the isolator **407**.

[0072] While certain embodiments of the present invention shown and described in this specification and the drawings correspond to specific examples present in order to easily explain technical contents of the present invention, and to help an understanding of the present invention, they are not intended to limit the scope of the present invention. That is, it will be obvious to those skilled in the art to which the present invention belongs that different modifications can be achieved based on the technical spirit of the present invention.

What is claimed is:

1. An Organic Light Emitting Diode (OLED) display apparatus with a solar cell, the OLED display apparatus comprising:

an OLED display unit which includes a pixel region formed of an OLED and a pixel boundary region partitioning the pixel region, a touch panel through which light emitted from the OLED is transmitted, and at least one glass; and
a solar cell for converting incident light into electricity, which is formed adjacent to the OLED display unit.

2. The OLED display apparatus as claimed in claim 1, wherein the solar cell is provided under a lower portion of the OLED display unit.

3. The OLED display apparatus as claimed in claim 2, further comprising a transparent isolation layer interposed between the solar cell and the OLED display unit.

4. The OLED display apparatus as claimed in claim 2, wherein the solar cell is provided in a location corresponding to a lower portion of the pixel boundary region of the OLED display unit, and comprises an isolation layer under the pixel region.

5. The OLED display apparatus as claimed in claim 2, wherein the solar cell is provided in a location corresponding to a lower portion of the pixel boundary region and the pixel region of the OLED display unit, and comprises an isolation layer interposed between solar cells spaced apart from each other.

6. The OLED display apparatus as claimed in claim 1, wherein the solar cell is partially formed on a same horizontal plane as the OLED display unit.

7. The OLED display apparatus as claimed in claim 6, further comprising an isolation layer interposed between the solar cell and the OLED display unit.

8. The OLED display apparatus as claimed in claim 1, wherein the solar cell is provided on the OLED display unit.

9. The OLED display apparatus as claimed in claim 8, wherein a top glass, the solar cell, a touch panel, and a cover glass are sequentially formed on the OLED display unit.

10. The OLED display apparatus as claimed in claim 9, wherein the solar cell is provided on the pixel boundary region.

11. The OLED display apparatus as claimed in claim 8, wherein the solar cell comprises an isolation layer interposed between the solar cells spaced from each other on the pixel region.

12. A method of manufacturing an Organic Light Emitting Diode (OLED) display apparatus with a solar cell, the method comprising:

forming a solar cell on a substrate;
forming an Organic Light Emitting Diode (OLED) on the solar cell; and
forming at least one glass and a touch panel through which light emitted from the OLED is transmitted, on the OLED.

13. The method as claimed in claim 12, wherein forming the solar cell further comprises etching a part of the solar cell

and depositing a semitransparent or transparent isolator in the etched region of the solar cell.

14. The method as claimed in claim 13, wherein in the etching of a part of the solar cell, the part of the solar cell corresponding to a lower portion of the OLED is etched.

15. A method of manufacturing an Organic Light Emitting Diode (OLED) display apparatus with a solar cell, the method comprising:

forming a solar cell on a substrate;

etching a part of the solar cell, and forming an isolation layer on the etched part of the solar cell and an Organic Light Emitting Diode (OLED) on the isolation layer; and

forming at least one glass and a touch panel through which light emitted from the OLED is transmitted, on the OLED.

16. A method of manufacturing an Organic Light Emitting Diode (OLED) display apparatus with a solar cell, the method comprising:

forming an Organic Light Emitting Diode (OLED) in a pixel region on a substrate, except for a pixel boundary region;

forming a top glass on the pixel region and the pixel boundary region;

forming a solar cell on the top glass; and

forming a touch panel and a cover glass on the solar cell.

17. The method as claimed in claim 16, wherein forming the solar cell comprises etching a part of the solar cell corresponding to the pixel boundary region;

and depositing an isolator in the etched region of the solar cell.

18. A method of manufacturing an Organic Light Emitting Diode (OLED) display apparatus with a solar cell, the method comprising:

preparing a lower structure by forming an Organic Light Emitting Diode (OLED) in a pixel region on a substrate, except for a pixel boundary region, and forming a top glass on the pixel region and the pixel boundary region;

preparing an upper structure in which a cover glass, a touch panel and a solar cell are sequentially formed, separately from the lower structure; and

enabling the upper structure to cohere on the lower structure by turning the upper structure upside-down.

19. The method as claimed in claim 18, wherein enabling the upper structure to cohere on the lower structure is performed by adhering or thermal compressing the upper structure to the lower structure facing the upper structure.

20. The method as claimed in claim 18, wherein the forming of the solar cell comprises etching a part of the solar cell corresponding to the pixel boundary region, and depositing an isolator in the etched region of the solar cell.

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专利名称(译)	具有太阳能电池的有机发光二极管显示装置及其制造方法		
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摘要(译)

提供一种具有太阳能电池的有机发光二极管 (OLED) 显示装置。 OLED 显示装置包括OLED显示单元, 该OLED显示单元包括由OLED形成的像素区域和分隔像素区域的像素边界区域, 并且设置有触摸面板, 从OLED发射的光通过该触摸面板传输, 并且至少一个玻璃;以及用于将入射光转换成电的太阳能电池, 其形成在OLED显示单元附近。

