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Wang et al.

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- (54) **ORGANIC LIGHT EMITTING DISPLAY DEVICE**
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- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,038,373 B2 *	5/2006	Arnold	H01L 51/529
				313/503
8,368,654 B2	2/2013	Rosenblatt et al.		
8,638,030 B2	1/2014	Lee et al.		
8,730,179 B2	5/2014	Rosenblatt et al.		
2004/0135499 A1 *	7/2004	Cok	H01L 51/5284
				313/506
2006/0250064 A1 *	11/2006	Park	G02B 3/005
				313/112
2008/0029147 A1 *	2/2008	Yang	H01L 51/102
				136/244
2012/0326131 A1	12/2012	Han		
2013/0181241 A1 *	7/2013	Meulen	H01L 51/52
				257/98

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(Continued)

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FOREIGN PATENT DOCUMENTS

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JP	2011-060608	3/2011
KR	10-1997-0014503	3/1997

(Continued)

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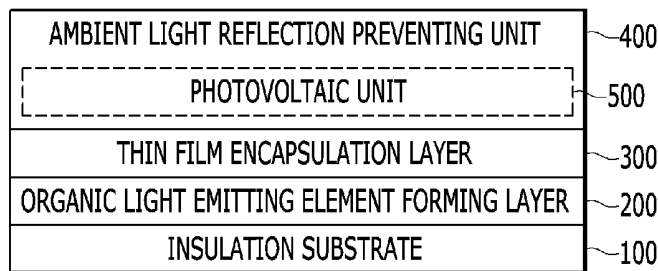
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H01L 51/44 (2006.01)
- (52) **U.S. Cl.**
CPC **H01L 27/3227** (2013.01); **H01L 27/323** (2013.01); **H01L 51/441** (2013.01); **H01L 51/5271** (2013.01); **H01L 51/5281** (2013.01); **H01L 51/5284** (2013.01)

(57) **ABSTRACT**

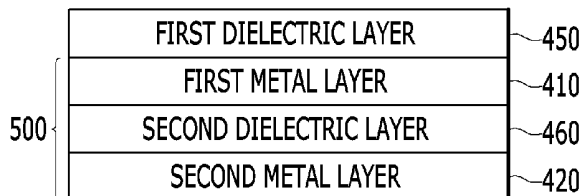
An organic light emitting display device including an organic light emitting element disposed on an insulation substrate, and an ambient light reflection preventing unit disposed on the organic light emitting element, the ambient light reflection preventing unit including a first metal layer, a first dielectric layer disposed on the first metal layer, the first metal layer and the first dielectric layer contacting each other, and a photovoltaic unit including the first metal layer as a first electrode.

(58) **Field of Classification Search**
None
See application file for complete search history.

19 Claims, 7 Drawing Sheets



400



(56)

References Cited

U.S. PATENT DOCUMENTS

2015/0293560 A1* 10/2015 Choi G06F 3/0412
345/174
2016/0149166 A1* 5/2016 Kwong H01L 51/5293
257/40

FOREIGN PATENT DOCUMENTS

KR 10-1998-077400 11/1998
KR 10-2002-0088488 11/2002
KR 10-2008-0083395 9/2008
KR 10-2009-0020726 2/2009
KR 10-2011-0049476 5/2011
KR 10-2011-0064410 6/2011
KR 10-2011-0070167 6/2011
KR 10-2012-0078959 7/2012
KR 10-2012-0119852 10/2012

* cited by examiner

FIG. 1

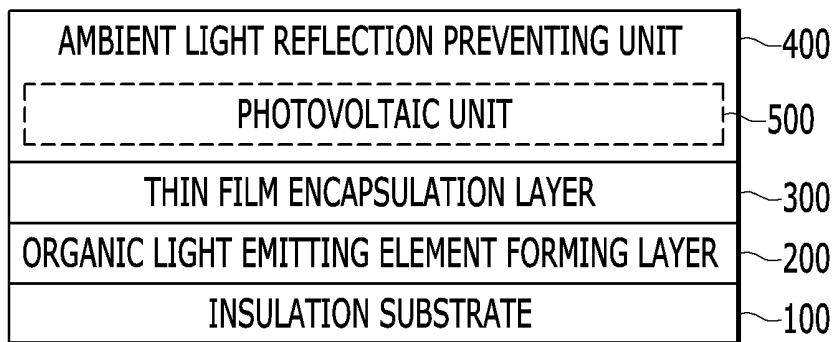


FIG. 2

400

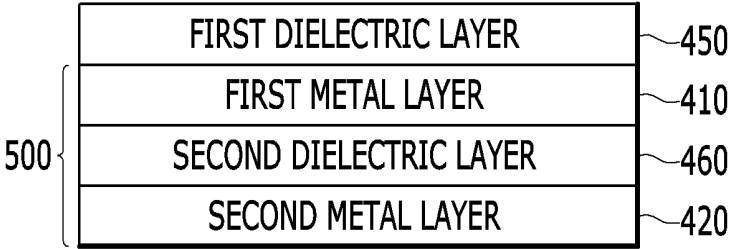


FIG. 3A

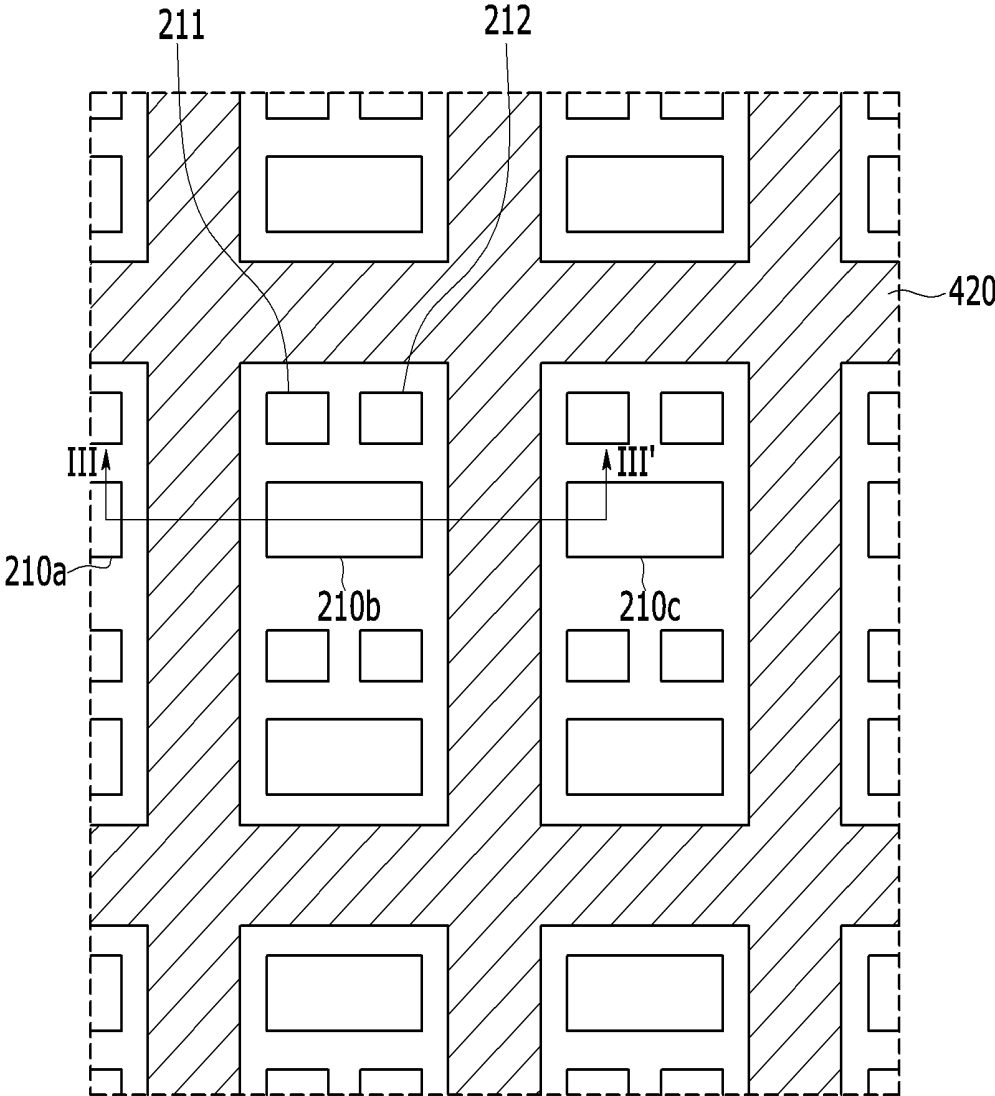


FIG. 3B

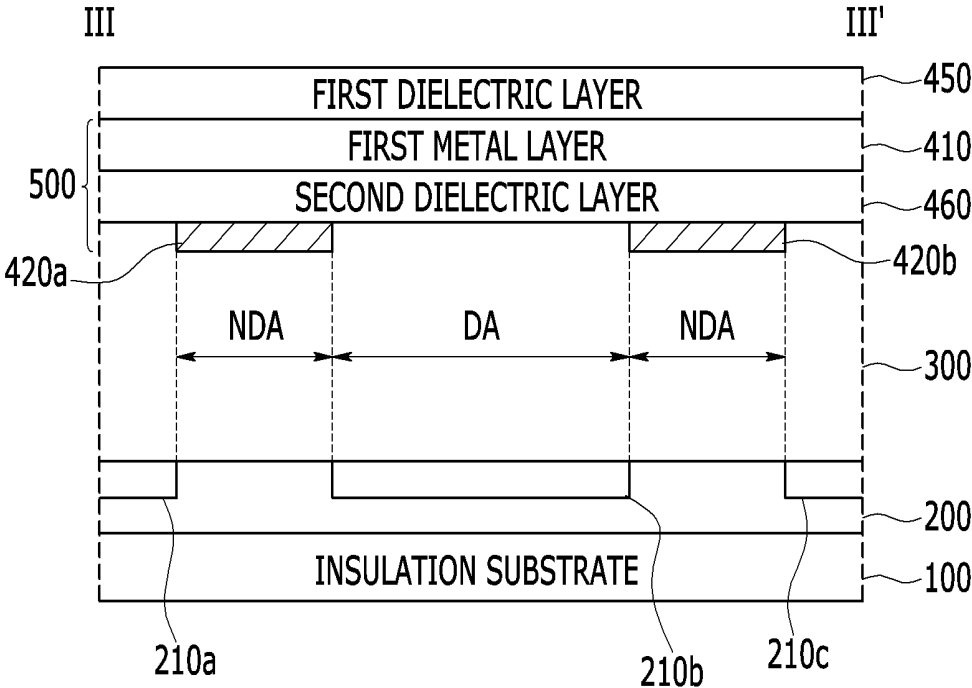


FIG. 4A

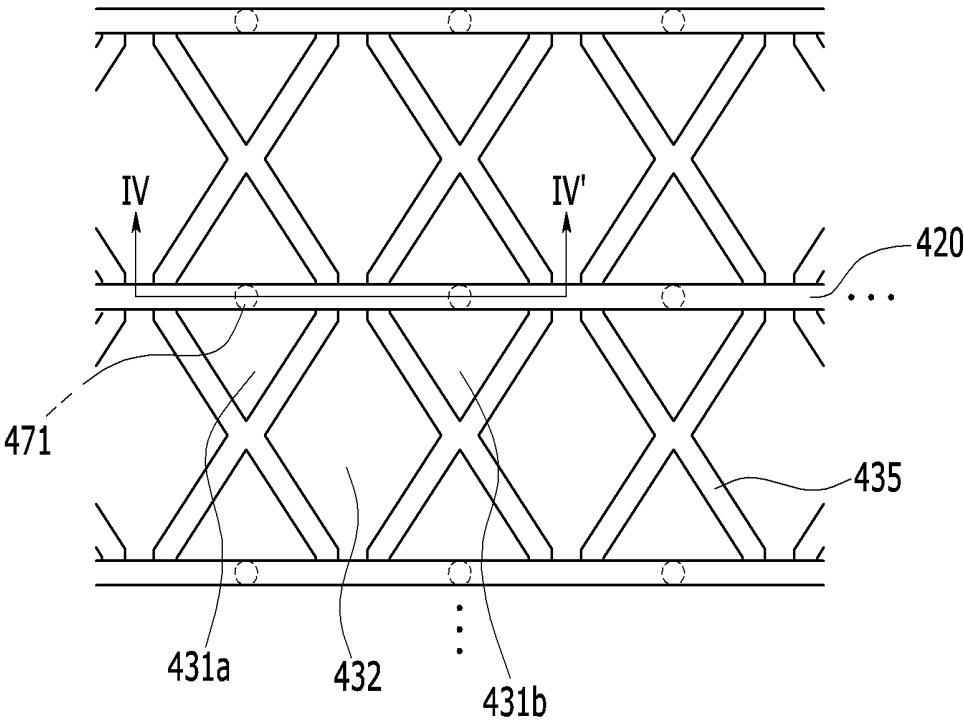


FIG. 4B

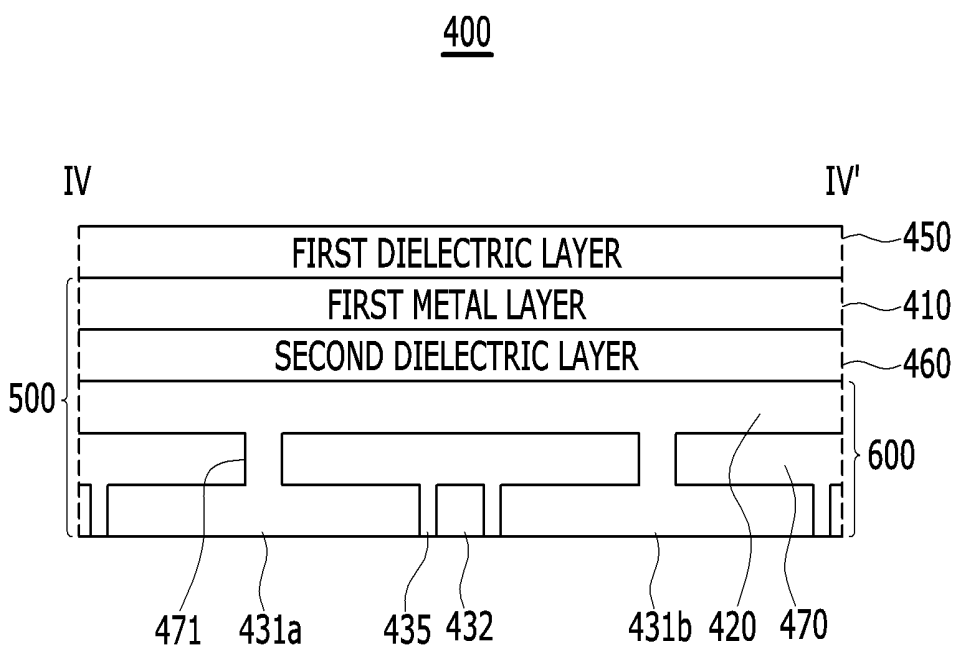
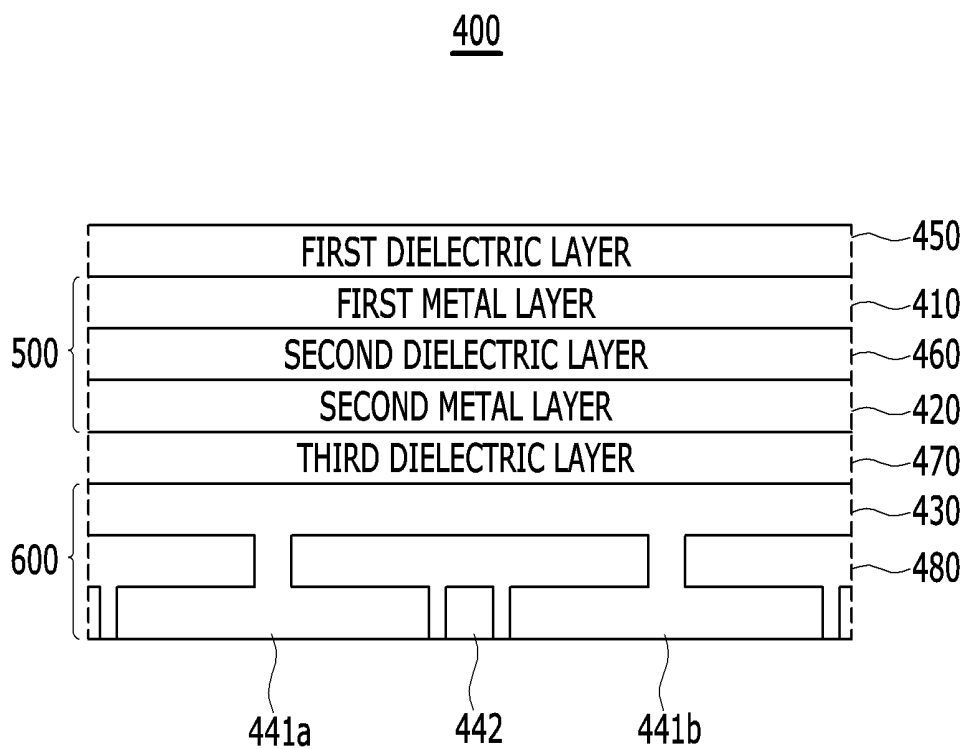


FIG. 5



ORGANIC LIGHT EMITTING DISPLAY DEVICE

CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority from and the benefit of Korean Patent Application No. 10-2015-0007002, filed on Jan. 14, 2015, which is hereby incorporated by reference for all purposes as if fully set forth herein.

BACKGROUND

Field

Exemplary embodiments of the present invention relate to an organic light emitting display device, and more particularly, to an organic light emitting display device including an ambient light reflection preventing unit integrally formed with a photovoltaic unit.

Discussion of the Background

An organic light emitting display device is a self-emissive display device including an organic light emitting diode (OLED). The organic light emitting display device may have a wide angle of view, high contrast ratio, and a fast response speed compared to liquid crystal displays (LCD). However, the organic light emitting display device may have a low visibility in outdoor environment due to reflection of ambient light by a metal layer that may form the OLED. Accordingly, the organic light emitting display device may include a polarization element such as a circular polarizer to prevent reflection of ambient light, but the polarization element may be thick, which may increase manufacturing complexity of a flexible display.

Implementing a black thin film (BTF) in which a dielectric layer and a metal layer are alternately stacked has been discussed as a technique for replacing a circular polarizer.

The above information disclosed in this Background section is only for enhancement of understanding of the background of the inventive concept, and, therefore, it may contain information that does not form the prior art that is already known in this country to a person of ordinary skill in the art.

SUMMARY

Exemplary embodiments of the present invention provide an organic light emitting display device including an ambient light reflection preventing unit capable of photovoltaic generation.

Additional aspects will be set forth in the detailed description which follows, and, in part, will be apparent from the disclosure, or may be learned by practice of the inventive concept.

According to an exemplary embodiment of the present invention, an organic light emitting display device includes an organic light emitting element disposed on an insulation substrate, and an ambient light reflection preventing unit disposed on the organic light emitting element, the ambient light reflection preventing unit including a first metal layer, a first dielectric layer disposed on the first metal layer, the first metal layer and the first dielectric layer contacting each other, and a photovoltaic unit including the first metal layer as a first electrode.

The ambient light reflection preventing unit may further include a second dielectric layer, the first metal layer may be disposed between the second dielectric layer and the first

dielectric layer, and the photovoltaic unit may include the second dielectric layer as a light receiving layer.

The ambient light reflection preventing unit may further include a second metal layer, the second dielectric layer may be disposed between the first metal layer and the second metal layer, and the photovoltaic unit may include the second metal layer as a second electrode.

The organic light emitting element may be disposed in a matrix form, and the second metal layer may be patterned to correspond to a non-display area, the non-display area not including the organic light emitting element.

The second metal layer may include a light blocking member.

The ambient light reflection preventing unit may further include a third dielectric layer, the second metal layer may be disposed between the second dielectric layer and the third dielectric layer.

The ambient light reflection preventing unit may further include a third metal layer, the third dielectric layer disposed between the second metal layer and the third metal layer, the third metal layer may include a first pattern including sensing electrodes, and the second metal layer may include a second pattern including bridge electrodes, the bridge electrodes connecting a first portion of the sensing electrodes to each other, and the second electrode of the photovoltaic unit may include the first portion of the sensing electrodes.

The third dielectric layer may include contact holes, and the bridge electrodes and the first portion of the sensing electrodes may be connected via the contact holes.

The first portion of the sensing electrodes may include one of transmitting electrodes Tx and receiving electrodes Rx, and a second portion of the sensing electrodes not comprising the first portion of the sensing electrodes may include the receiving electrodes Rx or the transmitting electrodes Tx to oppose the first portion of the sensing electrodes.

The ambient light reflection preventing unit may further include a third metal layer, the third dielectric layer may be disposed between the second metal layer and the third metal layer, a fourth metal layer, and a fourth dielectric layer may be disposed between the third metal layer and the fourth metal layer, the fourth metal layer may include a first pattern including sensing electrodes, and the third metal layer may include a second pattern including bridge electrodes connecting a first portion of the sensing electrodes to each other.

The fourth dielectric layer may include contact holes, and the bridge electrodes and the first portion of the sensing electrodes may be connected via the contact holes.

The insulation substrate may be flexible.

The third dielectric layer may be disposed between a transmitting electrode Tx and a receiving electrode Rx, the third dielectric layer insulating the transmitting and receiving electrodes Tx and Rx from each other.

According to an exemplary embodiment of the present invention, a method of forming an organic light emitting display device may include forming an organic light emitting element on an insulation substrate, forming a thin film encapsulation layer on the organic light emitting element, and forming an ambient light reflection preventing unit including a photovoltaic unit on the thin film encapsulation layer, in which forming the ambient light reflection layer includes sequentially forming a second metal layer, a second dielectric layer, a first metal layer, and a first dielectric layer on the thin film encapsulation layer, and the photovoltaic unit includes the second metal layer, the second dielectric layer, and the first metal layer.

The method may further include forming a light blocking member by patterning the second metal layer to correspond to a non-display area, the non-display area may not include the organic light element.

The method may further include forming a touch sensing unit in the photovoltaic unit, in which forming the touch sensing unit may include sequentially forming a third dielectric layer and a third metal layer between the second metal layer the second dielectric layer, patterning the third metal layer to form first sensing electrodes and second sensing electrodes, patterning the second metal layer to form bridge electrodes connecting the first sensing electrodes to each other, and patterning the third dielectric layer to form contact holes, the bridge electrodes and the first sensing electrodes may be connected via the contact holes.

The first sensing electrodes may be formed as one of transmitting electrodes Tx and receiving electrodes Rx, and the second sensing electrodes may be formed as the receiving electrodes Rx or the transmitting electrodes Tx to oppose the first sensing electrodes.

The method may further include forming a touch sensing unit, in which forming the touch sensing unit includes sequentially forming a fourth metal layer, a fourth dielectric layer, a third metal layer, and a third dielectric layer between the thin film encapsulation layer and the second metal layer, patterning the fourth metal layer to form first sensing electrodes and second sensing electrodes, patterning the third metal layer to form bridge electrodes connecting the first sensing electrodes to each other, and patterning the fourth dielectric layer to form contact holes, the bridge electrodes to the first sensing electrodes may be connected via the contact holes.

According to exemplary embodiments of the present invention, an organic light emitting display device including an ambient light reflection preventing unit capable of photovoltaic generation may be provided.

The foregoing general description and the following detailed description are exemplary and explanatory and are intended to provide further explanation of the claimed subject matter.

BRIEF DESCRIPTION OF THE DRAWINGS

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

FIG. 1 illustrates a portion of a stacked structure of an organic light emitting display device according to an exemplary embodiment of the present invention.

FIG. 2 illustrates a stacked structure of an ambient light reflection preventing unit according to an exemplary embodiment of the present invention.

FIGS. 3A and 3B illustrate an organic light emitting display device according to an exemplary embodiment of the present invention.

FIGS. 4A and 4B illustrate an organic light emitting display device according to an exemplary embodiment of the present invention.

FIG. 5 illustrates an organic light emitting display device according to an exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

In the following description, for the purposes of explanation, numerous specific details are set forth in order to

provide a thorough understanding of various exemplary embodiments. It is apparent, however, that various exemplary embodiments may be practiced without these specific details or with one or more equivalent arrangements. In other instances, well-known structures and devices are shown in block diagram form in order to avoid unnecessarily obscuring various exemplary embodiments.

In the accompanying figures, the size and relative sizes of layers, films, panels, regions, etc., may be exaggerated for clarity and descriptive purposes. Also, like reference numerals denote like elements.

When an element or layer is referred to as being "on," "connected to," or "coupled to" another element or layer, it may be directly on, connected to, or coupled to the other element or layer or intervening elements or layers may be present. When, however, an element or layer is referred to as being "directly on," "directly connected to," or "directly coupled to" another element or layer, there are no intervening elements or layers present. For the purposes of this disclosure, "at least one of X, Y, and Z" and "at least one selected from the group consisting of X, Y, and Z" may be construed as X only, Y only, Z only, or any combination of two or more of X, Y, and Z, such as, for instance, XYZ, XYY, YZ, and ZZ. Like numbers refer to like elements throughout. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items.

Although the terms first, second, etc. may be used herein to describe various elements, components, regions, layers, and/or sections, these elements, components, regions, layers, and/or sections should not be limited by these terms. These terms are used to distinguish one element, component, region, layer, and/or section from another element, component, region, layer, and/or section. Thus, a first element, component, region, layer, and/or section discussed below could be termed a second element, component, region, layer, and/or section without departing from the teachings of the present disclosure.

Spatially relative terms, such as "beneath," "below," "lower," "above," "upper," and the like, may be used herein for descriptive purposes, and, thereby, to describe one element or feature's relationship to another element(s) or feature(s) as illustrated in the drawings. Spatially relative terms are intended to encompass different orientations of an apparatus in use, operation, and/or manufacture in addition to the orientation depicted in the drawings. For example, if the apparatus in the drawings is turned over, elements described as "below" or "beneath" other elements or features would then be oriented "above" the other elements or features. Thus, the exemplary term "below" can encompass both an orientation of above and below. Furthermore, the apparatus may be otherwise oriented (e.g., rotated 90 degrees or at other orientations), and, as such, the spatially relative descriptors used herein interpreted accordingly.

The terminology used herein is for the purpose of describing particular embodiments and is not intended to be limiting. As used herein, the singular forms, "a," "an," and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. Moreover, the terms "comprises," "comprising," "includes," and/or "including," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, components, and/or groups thereof, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

Various exemplary embodiments are described herein with reference to sectional illustrations that are schematic illustrations of idealized exemplary embodiments and/or intermediate structures. As such, variations from the shapes of the illustrations as a result, for example, of manufacturing techniques and/or tolerances, are to be expected. Thus, exemplary embodiments disclosed herein should not be construed as limited to the particular illustrated shapes of regions, but are to include deviations in shapes that result from, for instance, manufacturing. For example, an implanted region illustrated as a rectangle will, typically, have rounded or curved features and/or a gradient of implant concentration at its edges rather than a binary change from implanted to non-implanted region. Likewise, a buried region formed by implantation may result in some implantation in the region between the buried region and the surface through which the implantation takes place. Thus, the regions illustrated in the drawings are schematic in nature and their shapes are not intended to illustrate the actual shape of a region of a device and are not intended to be limiting.

Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this disclosure is a part. Terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense, unless expressly so defined herein.

FIG. 1 illustrates a portion of a stacked structure of an organic light emitting display device according to an exemplary embodiment of the present invention.

Referring to FIG. 1, the organic light emitting display device according to the present exemplary embodiment includes an insulation substrate **100**, an organic light emitting element forming layer **200**, a thin film encapsulation layer **300**, an ambient light reflection preventing unit **400**, and a photovoltaic unit **500**.

The insulation substrate **100** may be formed of an insulating material, for example, a glass or a plastic such as polyimide. The insulation substrate **100** may be a flexible substrate.

The organic light emitting element forming layer **200** including organic light emitting elements **210a**, **210b**, and **210c** (illustrated in FIGS. 3A and 3B) is formed on the insulation substrate **100**.

The organic light emitting elements **210a**, **210b**, and **210c** may include a cathode and an anode, and may further include a hole injection layer, a hole transport layer, an electron transport layer, an electron injection layer or the like between the cathode and the anode.

A thin-film transistor formed in the organic light emitting element forming layer **200** may be connected to the anode or the cathode of the organic light emitting elements **210a**, **210b**, and **210c**. A driving transistor among the thin-film transistors may adjust a current applied to the organic light emitting elements **210a**, **210b**, and **210c** based on a data voltage, to adjust a degree of light emission.

The thin film encapsulation layer **300** is formed on the organic light emitting element forming layer **200**. Alternatively, the ambient light reflection preventing unit **400** may be configured to perform the function of the thin film encapsulation layer **300**.

The thin film encapsulation layer **300** may prevent penetration of oxygen and moisture in the air into the organic light emitting elements **210a**, **210b**, and **210c**. The thin film

encapsulation layer **300** may have a structure of an inorganic layer and an organic layer that are alternately stacked. The number of alternation and the number of stacked layers may vary according to a display device to be manufactured.

An inorganic layer may prevent penetration of oxygen or moisture, and an organic layer may mitigate internal stress of the inorganic layer or may fill cracks in the inorganic layer.

The ambient light reflection preventing unit **400** is formed on the thin film encapsulation layer **300**. The ambient light reflection preventing unit **400** may be formed by alternately stacking a dielectric layer and a metal layer. The ambient light reflection preventing unit **400** may be a black thin film (BTF). The ambient light reflection preventing unit **400** will be described in detail with reference to FIG. 2.

The photovoltaic unit **500** may be integrally formed with the ambient light reflection preventing unit **400**. The photovoltaic unit **500** may be a solar cell element.

The photovoltaic unit **500** may have a stacked structure including a first electrode, a light receiving layer, and a second electrode.

Hereinafter, for convenience of description, a first electrode and a second electrode are respectively referred to as a cathode and an anode, but the first electrode and the second electrode may also correspond to an anode and a cathode, respectively.

The first electrode may be formed of a transparent conductive oxide (TCO) such as an indium tin oxide (ITO), and the second electrode may be formed of a material including a metal, such as molybdenum (Mo), a molybdenum oxide (MoOx), aluminum (Al), an aluminum alloy (AlNd), chromium (Cr), chromium oxide (CrOx), or the like. As will be described below, the first electrode and the second electrode may respectively correspond to a first metal layer **410** and a second metal layer **420**. The type of metal may be selected in consideration of light transmittance and reflectivity.

A light receiving layer may vary according to a type of the photovoltaic unit **500**, but may typically be formed of a semiconductor material. The semiconductor material may be formed of a dielectric material to form a second dielectric layer **460**.

The light receiving layer may be formed of one of materials selected from a p-n junction semiconductor, polysilicon, amorphous silicon, copper indium gallium selenide (CIGS), and the like.

FIG. 2 illustrates a stacked structure of an ambient light reflection preventing unit **400** according to an exemplary embodiment of the present invention.

Referring to FIG. 2, the ambient light reflection preventing unit **400** according to an exemplary embodiment of the present invention includes a second metal layer **420**, a second dielectric layer **460**, a first metal layer **410**, and a first dielectric layer **450** stacked sequentially.

According to an exemplary embodiment of the present invention, the ambient light reflection preventing unit **400** may include two layers of a dielectric layer and a metal layer. Alternatively, the ambient light reflection preventing unit **400** may include more layers, for example, three, five, six layers or the like. The structure of the ambient light reflection preventing unit **400** may vary according to types of constituent materials of a metal layer and a dielectric layer, and a thickness of the dielectric layer, a configuration of an OLED, or the like.

The first metal layer **410** and the second metal layer **420** may be formed of a conductive material such as Ag, Au, Cu, Mg, W, Pt, or the like, in addition to the materials forming the first and second electrodes.

The first dielectric layer **450** and the second dielectric layer **460** may also be formed of a material such as silicon nitride (SiNx), silicon oxide (SiOx), zinc sulfide (ZnS), cadmium sulfide (CdS), silicon carbide (SiC), gallium phosphide (GaP), titanium oxide (TiOx), or the like, in addition to the materials forming the light receiving layer.

The ambient light reflection preventing unit **400** prevents reflection of ambient light by using destructive interference of light reflected on a metal layer. In addition, the metal layer, which has light absorbing properties, in the ambient light reflection preventing unit **400** may absorb ambient light that is not completely offset due to destructive interference. Accordingly, the ambient light reflection preventing unit **400** may replace a circular polarizing element, and thus it may be possible to manufacture a thin and flexible display device.

More particularly, by adjusting a relative phase between ambient light reflected by a metal layer of the ambient light reflection preventing unit **400**, and ambient light reflected by a metal layer of the organic light emitting element forming layer **200** that includes the organic light emitting elements **210a**, **210b**, and **210c**, to about 180 degrees, amplitudes of the ambient light are opposite to and may offset each other.

In order to adjust a relative phase, a thickness of a dielectric layer of the ambient light reflection preventing unit **400** may be adjusted. As adjusting a relative phase of reflected ambient light close to 180 degrees for all wavelengths of visible light using a single dielectric layer may be difficult, the ambient light reflection preventing unit **400** may include multiple dielectric layers.

Referring to FIG. 2, the first metal layer **410**, the second dielectric layer **460**, and the second metal layer **420** form the photovoltaic unit **500**. The first metal layer **410** functions as the first electrode of the photovoltaic unit **500**, the second dielectric layer **460** functions as the light receiving layer of the photovoltaic unit **500**, and the second metal layer **420** functions as the second electrode of the photovoltaic unit **500**.

FIGS. 3A and 3B illustrate an organic light emitting display device according to an exemplary embodiment of the present invention.

FIG. 3A illustrates a portion of the organic light emitting display device according to the present exemplary embodiment, and FIG. 3B is a cross-sectional view of the portion of the organic light emitting display device taken along line III-III' of FIG. 3A.

In FIG. 3A, only the second metal layer **420** and the organic light emitting elements **210a**, **210b**, **210c**, **211**, and **212** are illustrated for convenience of description.

Referring to FIGS. 3A and 3B, the organic light emitting elements **210a**, **210b**, **210c**, **211**, and **212** are arranged in a matrix form.

The organic light emitting elements **210a**, **210b**, **210c**, **211**, and **212** may be formed of a material that includes colors or may include additional color filters. The organic light emitting elements **210a**, **210b**, **210c**, **211**, and **212** may be arranged in an S-stripe type, as illustrated in FIG. 3A. Alternatively, the organic light emitting elements **210a**, **210b**, **210c**, **211**, and **212** may be arranged in a RGB-stripe type where rectangles having the same sizes are sequentially arranged, a RGBW type where a W sub-pixel is further disposed, or a pentile type in which RG-GB configurations are repeatedly arranged, or the like.

An area where the organic light emitting elements **210a**, **210b**, **210c**, **211**, and **212** emit display light may be a display area DA. An area where light is not emitted or an area where a thin-film transistor, a contact hole, or the like are formed to block light may be a non-display area NDA.

The second metal layer **420** may be patterned to correspond to the non-display area NDA. A width of the second metal layer **420** may be equal to the width of the non-display area NDA or may be smaller or greater than the width of the non-display area NDA.

The second metal layer **420** may be patterned to be formed as light blocking members **420a** and **420b**. More particularly, the second metal layer **420** may include a metal having a high light reflectivity or a high light absorption ratio. The light blocking members **420a** and **420b** may perform the function of a black matrix. Accordingly, the ambient light reflection preventing unit **400** according to the present exemplary embodiment may prevent reflection of ambient light and self-emit using ambient light without additional configuration.

Referring to FIG. 3A, the second metal layer **420** is patterned to surround two dots, each dot formed of the organic light emitting elements **211**, **212**, and **210b** of having three different colors. The second metal layer **420** may also be patterned to surround each dot or every three or more dots. Alternatively, the second metal layer **420** may be patterned to individually surround each of the organic light emitting elements **211**, **212**, and **210b**.

The light blocking members **420a** and **420b** formed of the second metal layer **420** may be formed by patterning the second metal layer **420**. A configuration of the light blocking members **420a** and **420b** may vary depending on a mask used in the manufacturing process of a display device and a resolution of the display device with respect to a display area.

Referring to FIG. 3B, the first dielectric layer **450** is an uppermost layer of the ambient light reflection preventing unit **400**. A stacked structure including a metal layer and a dielectric layer may be further included on the first dielectric layer **450**.

FIGS. 4A and 4B illustrate an organic light emitting display device according to an exemplary embodiment of the present invention.

FIG. 4A illustrates sensing electrodes formed by patterning the second metal layer **420** and a third metal layer, and FIG. 4B illustrates a cross-section of a portion of the organic light emitting display device taken along line IV-IV' of FIG. 4A.

Referring to FIGS. 4A and 4B, the ambient light reflection preventing unit **400** includes the photovoltaic unit **500** and a touch sensing unit **600** of an on-cell type.

A mutual capacitance method may be implemented as a method of sensing a touch of a user. Alternatively, a self-capacitance method may be implemented by varying a patterning structure of the second metal layer **420**, the third metal layer, a third dielectric layer **470**, and wiring structures connected to respective sensing electrodes.

The third metal layer is patterned to form the sensing electrodes **431a**, **431b**, and **432**. The second metal layer **420** is patterned to form bridge electrodes that connect sensing electrodes **431a** and **431b** of the sensing electrodes to one another.

The sensing electrodes **431a** and **431b** of the sensing electrodes may be one of a transmitting electrode Tx and a receiving electrode Rx. Remaining sensing electrodes **432** of the sensing electrodes may be the receiving electrode Rx or the transmitting Tx.

The transmitting electrode Tx may receive a touch driving signal, and a readout circuit may be connected to the receiving electrode Rx electrode to detect a variation in capacitance between the transmitting electrode Tx and the receiving electrode Rx according to a touch of a user.

As described above, the second metal layer **420** is configured to correspond to the second electrode of the photovoltaic unit **500**. According to an exemplary embodiment of the present invention, the second metal layer **420** is patterned to be electrically connected to the sensing electrodes **431a** and **431b** of the sensing electrodes as a bridge electrode, and thus, the sensing electrodes **431a** and **431b** of the sensing electrodes may also correspond to the second electrode of the photovoltaic unit **500**.

Although the bridge electrode **420** is illustrated to have a bar shape connecting the sensing electrodes **431a** and **431b** of the sensing electrodes in FIG. **4A**, the bridge electrode **420** may also be formed of a diamond pattern or the like, which is identical to a pattern of the sensing electrodes **431a** and **431b** of the sensing electrodes, or may have a plate shape.

The third dielectric layer **470** may have contact holes **471** so that the bridge electrode **420** is electrically connected to the sensing electrodes **431a** and **431b** of the sensing electrodes.

The third dielectric layer **470** may be configured to fill a gap **435** so that the transmitting electrode Tx and the receiving electrode Rx of the third metal layer are insulated from each other.

Ambient light may penetrate through the gap **435** that may cause light leakage. Accordingly, the light blocking member of FIG. **3A** may be formed by considering the light leakage. More particularly, the third dielectric layer **470** may be formed, a trench may be patterned in the form of a sensing electrode, and then the third metal layer may be deposited.

When the second electrode layer **420** is patterned while not maintaining a plate shape, the second dielectric layer **460** and the third dielectric layer **470** may contact each other. The second dielectric layer **460** and the third dielectric layer **470** may be formed of the same material and at the same time in the same process. More particularly, the third dielectric layer **470** may also function as the light receiving layer of the photovoltaic unit **500**.

According to an exemplary embodiment of the present invention, as the touch sensing unit **600** and the photovoltaic unit **500** share the second metal layer **420**, the third dielectric layer **470**, and the third metal layer, the touch sensing unit **600**, and the photovoltaic unit **500** may be driven in a time-divisional manner according to each mode.

More particularly, while the touch sensing unit **600** functions, the photovoltaic unit **500** may be turned off, and when the touch sensing unit **600** does not function, the photovoltaic unit **500** may be turned on.

According to the present exemplary embodiment, by utilizing constituent layers of the ambient light reflection preventing unit **400**, the functions of the photovoltaic unit **500** and the touch sensing unit **600** may be performed together.

FIG. **5** illustrates an organic light emitting display device according to an exemplary embodiment of the present invention.

An ambient light reflection preventing unit illustrated in FIG. **5** further includes a fourth dielectric layer **480** and a fourth metal layer as compared to the ambient light reflection preventing unit illustrated with reference to FIGS. **4A** and **4B**.

In the ambient light reflection preventing unit **400** according to the present exemplary embodiment, a bridge electrode is formed in the third electrode layer **430**, and sensing electrodes **441a**, **441b**, and **442** are formed in the fourth metal layer.

Accordingly, as the photovoltaic unit **500** and the touch sensing unit **600** are formed in separate layers from each other, the function of the photovoltaic unit **500** and the function of the touch sensing unit **600** may be simultaneously performed without having to be driven in a time-divisional manner.

As the fourth dielectric layer **480** and the fourth metal layer are further included, a thickness of a dielectric layer for destructive interference of ambient light may be determined more selectively.

Although certain exemplary embodiments and implementations have been described herein, other embodiments and modifications will be apparent from this description. Accordingly, the inventive concept is not limited to such exemplary embodiments, but rather to the broader scope of the presented claims and various obvious modifications and equivalent arrangements.

What is claimed is:

1. An organic light emitting display device, comprising: an organic light emitting element disposed on an insulation substrate; and an ambient light reflection preventing unit disposed on the organic light emitting element, the ambient light reflection preventing unit comprising: a first metal layer; a first dielectric layer disposed on the first metal layer, the first metal layer and the first dielectric layer contacting each other; and a photovoltaic unit comprising the first metal layer as a first electrode.
2. The organic light emitting display device of claim 1, wherein: the ambient light reflection preventing unit further comprises a second dielectric layer; the first metal layer is disposed between the first dielectric layer and the second dielectric layer; and the photovoltaic unit comprises the second dielectric layer as a light receiving layer.
3. The organic light emitting display device of claim 2, wherein: the ambient light reflection preventing unit further comprises a second metal layer; the second dielectric layer is disposed between the first metal layer and the second metal layer; and the photovoltaic unit comprises the second metal layer as a second electrode.
4. The organic light emitting display device of claim 3, wherein: the organic light emitting element is disposed in a matrix form; and the second metal layer is patterned to correspond to a non-display area, the non-display area not comprising the organic light emitting element.
5. The organic light emitting display device of claim 4, wherein the second metal layer comprises a light blocking member.
6. The organic light emitting display device of claim 3, wherein: the ambient light reflection preventing unit further comprises a third dielectric layer; and the second metal layer is disposed between the second dielectric layer and the third dielectric layer.
7. The organic light emitting display device of claim 6, wherein: the ambient light reflection preventing unit further comprises a third metal layer;

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the third dielectric layer is disposed between the second metal layer and the third metal layer;
the third metal layer comprises a first pattern comprising sensing electrodes;

the second metal layer comprises a second pattern comprising bridge electrodes, the bridge electrodes connecting a first portion of the sensing electrodes to each other; and

the second electrode of the photovoltaic unit comprises the first portion of the sensing electrodes.

8. The organic light emitting display device of claim 7, wherein:

the third dielectric layer comprises contact holes; and the bridge electrodes and the first portion of the sensing electrodes are connected via the contact holes.

9. The organic light emitting display device of claim 8, wherein:

the first portion of the sensing electrodes comprise one of transmitting electrodes Tx and receiving electrodes Rx; and

a second portion of the sensing electrodes not comprising the first portion of the sensing electrodes comprise the receiving electrodes Rx or the transmitting electrodes Tx to oppose to the first portion of the sensing electrodes.

10. The organic light emitting display device of claim 6, wherein:

the ambient light reflection preventing unit further comprises:

a third metal layer, the third dielectric layer disposed between the second metal layer and the third metal layer;

a fourth metal layer; and

a fourth dielectric layer disposed between the third metal layer and the fourth metal layer;

the fourth metal layer comprises a first pattern comprising sensing electrodes; and

the third metal layer comprises a second pattern comprising bridge electrodes connecting a first portion of the sensing electrodes to each other.

11. The organic light emitting display device of claim 10, wherein:

the fourth dielectric layer comprises contact holes; and the bridge electrodes and the first portion of the sensing electrodes are connected via the contact holes.

12. The organic light emitting display device of claim 1, wherein the insulation substrate is flexible.

13. The organic light emitting display device of claim 9, wherein the third dielectric layer is disposed between a transmitting electrode Tx and a receiving electrode Rx, the third dielectric layer insulating the transmitting and receiving electrodes Tx and Rx from each other.

14. A method of forming an organic light emitting display device, the method comprising:

forming an organic light emitting element on an insulation substrate;

forming a thin film encapsulation layer on the organic light emitting element; and

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forming an ambient light reflection preventing unit comprising a photovoltaic unit on the thin film encapsulation layer,

wherein:

forming the ambient light reflection preventing unit comprises sequentially forming a second metal layer, a second dielectric layer, a first metal layer, and a first dielectric layer on the thin film encapsulation layer; and the photovoltaic unit comprises the second metal layer, the second dielectric layer, and the first metal layer.

15. The method of claim 14, further comprising forming a light blocking member by patterning the second metal layer to correspond to a non-display area, the non-display area not comprising the organic light emitting element.

16. The method of claim 14, further comprising forming a touch sensing unit in the photovoltaic unit,

wherein forming the touch sensing unit comprises:

sequentially forming a third dielectric layer and a third metal layer between the second metal layer the second dielectric layer;

patterning the third metal layer to form first sensing electrodes and second sensing electrodes;

patterning the second metal layer to form bridge electrodes connecting the first sensing electrodes to each other; and

patterning the third dielectric layer to form contact holes, the bridge electrodes to the first sensing electrodes are connected via the contact holes.

17. The method of claim 16, wherein:

the first sensing electrodes are formed as one of transmitting electrodes Tx and receiving electrodes Rx; and the second sensing electrodes are formed as the receiving electrodes Rx or the transmitting electrodes Tx to oppose the first sensing electrodes.

18. The method of claim 14, further comprising forming a touch sensing unit,

wherein forming the touch sensing unit comprises:

sequentially forming a fourth metal layer, a fourth dielectric layer, a third metal layer, and a third dielectric layer between the thin film encapsulation layer and the second metal layer;

patterning the fourth metal layer to form first sensing electrodes and second sensing electrodes;

patterning the third metal layer to form bridge electrodes connecting the first sensing electrodes to each other; and

patterning the fourth dielectric layer to form contact holes, the bridge electrodes to the first sensing electrodes are connected via the contact holes.

19. The method of claim 18, wherein:

the first sensing electrodes are formed as one of transmitting electrodes Tx and receiving electrodes Rx; and the second sensing electrodes are formed as the receiving electrodes Rx or the transmitting electrodes Tx to oppose the first sensing electrodes.

* * * * *

专利名称(译)	有机发光显示装置		
公开(公告)号	US9590018	公开(公告)日	2017-03-07
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[标]申请(专利权)人(译)	三星显示有限公司		
申请(专利权)人(译)	三星DISPLAY CO. , LTD.		
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外部链接	Espacenet USPTO		

摘要(译)

一种有机发光显示装置，包括设置在绝缘基板上的有机发光元件，以及设置在所述有机发光元件上的环境光反射防止单元，所述环境光反射防止单元包括第一金属层，设置有第一介电层在第一金属层上，第一金属层和第一介电层彼此接触，以及包括第一金属层作为第一电极的光伏单元。

