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## DISPLAY PANEL, DISPLAY DEVICE AND MASK


### Abstract

Embodiments of the present application provide a display panel, a display device and a mask. The display panel includes: a substrate; a pixel defining layer, the pixel defining layer including an isolation portion and a plurality of pixel openings; and at least one support post arranged on a side of the isolation portion facing away from the substrate, the support post including a first section and a second section, an orthographic projection of at least part of the second section on the substrate being located within an orthographic projection of the first section on the substrate, where the isolation portion includes a first top surface distributed on a peripheral side of the first section, the first section includes a first side surface connected to the first top surface and extending toward the second section, and the first top surface intersects the first side surface.



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## Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS [0001] The application is a continuation application of International Application No. PCT/CN2023/083863, filed on Mar. 24, 2023, which claims priority to Chinese Patent Application No. 202211507437.5, entitled “DISPLAY PANEL, DISPLAY DEVICE AND MASK” and filed on Nov. 29, 2022, which is incorporated herein by reference in its entirety.

FIELD
[0002] The present application relates to the field of display equipment, and particularly to a display panel, a display device and a mask.
BACKGROUND
[0003] An organic light-emitting diode (OLED) is an active light-emitting device. Compared with a conventional liquid crystal display (LCD) method, an OLED display technology does not require a backlight and has a self-luminescence characteristic. The OLED uses a thin film layer of an organic material and a glass substrate. When a current passes through the film layer of the organic material, the organic material emits light. Therefore, an OLED display panel can significantly save power, can be made lighter and thinner, withstands a wider range of temperature changes than an LCD display panel, and has a larger viewing angle. The OLED display panel is expected to become the next generation of flat panel display technology after LCD, and is currently one of the flat panel display technologies that have attracted most attention.
[0004] The OLED display panel includes a pixel defining layer and at least one support post. The pixel defining layer includes an isolation portion and a plurality of pixel openings, and the support post is arranged on the isolation portion before a light-emitting material is evaporated in the pixel opening. During evaporation, scratching may occur between the support post and a mask for evaporating the light-emitting material, causing the support post to fall off, and accordingly the yield of the display panel is affected.
SUMMARY
[0005] Embodiments of the present application provide a display panel, a display device and a mask, which are intended to improve the yield of the display panel.
[0006] An embodiment of the present application provides a display panel. The display panel has an active area and includes: a substrate; a pixel defining layer arranged on one side of the substrate, the pixel defining layer including an isolation portion and a plurality of pixel openings which are enclosed by the isolation portion and located in the active area; and at least one support post, at least one support post being located in the active area and arranged on a side of the isolation portion facing away from the substrate, the support post including a first section and a second section which are distributed in a stacked manner in a direction away from the isolation portion, an orthographic projection of at least part of the second section on the substrate being located within an orthographic projection of the first section on the substrate, where the isolation portion includes a first top surface distributed on a peripheral side of the first section, the first section includes a first side surface connected to the first top surface and extending toward the second section, and the first

top surface intersects the first side surface.
[0007] An embodiment of the present application further provides a display device, including a display panel according to any one of the above embodiments.
[0008] An embodiment of the present application further provides a mask for fabricating a display panel, the display panel including a support post and a pixel defining layer. The mask includes:
[0009] a main mask area configured to fabricate the support post; and [0010] a plurality of auxiliary openings configured to fabricate a first top surface of an isolation portion of the pixel defining layer, the plurality of auxiliary openings being arranged around a peripheral side of the main mask area, and at least two of the auxiliary openings being located on the same side of the main mask area in a first direction.
[0011] In the display panel provided in the embodiments of the present application, the display panel includes the substrate, and the pixel defining layer and the support post which are arranged on the substrate. The pixel defining layer includes the isolation portion and the pixel opening located in an active area, and a light-emitting unit may be arranged in the pixel opening to achieve display of the display panel. The support post is arranged on the isolation portion of the pixel defining layer, and the support post can assist in supporting a film layer such as a cover plate. A support post includes a first section and a second section, the isolation portion includes the first top surface distributed on the peripheral side of the first section, the first section and the pixel opening are spaced apart from each other due to the presence of the first top surface, and a spacing between the support post and the pixel opening can thus be increased, so that when particles are generated due to the fact that the support post is scratched, it is unlikely for the particles to fall into the pixel opening, and thus the yield of the display panel can be improved. The first section includes the first side surface connected to the first top surface, and the first top surface intersects the first side surface, so that the structural strength of the support post can be increased, and the problem of the support post being prone to damage due to scratching can be alleviated.

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## Description

BRIEF DESCRIPTION OF THE DRAWINGS
[0012] By reading the following detailed description made with reference to the drawings for non-limiting embodiments, the other features, objectives and advantages of the present application will become more apparent, in which the same or similar features are denoted by the same or similar reference numerals.
[0013] FIG. **1** is a cross-sectional view of a display panel according to an embodiment of the present application;
[0014] FIG. **2** is a structural schematic partial enlarged view of FIG. **1** in an example;
[0015] FIG. **3** is a structural schematic partial enlarged view of FIG. **1** in another example;
[0016] FIG. **4** is a structural schematic partial enlarged view of FIG. **1** in still another example;
[0017] FIG. **5** is a structural schematic partial enlarged view of FIG. **1** in yet another example;
[0018] FIG. **6** is a structural schematic partial enlarged view of FIG. **1** in still yet another example;
[0019] FIG. **7** is a structural schematic partial enlarged view of a display panel according to an embodiment of the present application;
[0020] FIG. **8** is a structural schematic view of a mask according to an embodiment of the present application;
[0021] FIG. **9** is a structural schematic partial enlarged view of FIG. **8** in an example;
[0022] FIG. **10** is a structural schematic view of a mask in a use state according to an embodiment of the present application;
[0023] FIG. **11** is a diagram of a product fabricated by a mask according to an embodiment of the present application;

[0024] FIG. **12** is a structural schematic partial enlarged view of FIG. **8** in another example;
[0025] FIG. **13** is a structural schematic partial enlarged view of FIG. **8** in still another example; and
[0026] FIG. **14** is a structural schematic partial enlarged view of FIG. **8** in yet another example.

## DESCRIPTION OF THE EMBODIMENTS

[0027] The features and exemplary embodiments of the present application in various embodiments will be described in detail below. In the following detailed description, many specific details are set forth to comprehensively understand the present application. However, it will be very apparent in the art that the present application may be implemented without some of these specific details. The following description of the embodiments are merely to provide a better understanding for the present application by illustrating examples of the present application. In the drawings and the following description, at least part of known structures and techniques are not shown to avoid unnecessary ambiguousness of the present application; and for the ease of clarity, the dimensions of part of the structure may be enlarged. In addition, the features, structures or characteristics described below may be combined, in any suitable manner, in one or more embodiments.
[0028] In the description of the present application, it should be noted that “a plurality of” means two or more, unless otherwise specified. The orientation or position relationship indicated by the terms “upper”, “lower”, “left”, “right”, “inner”, “outer”, etc. is only for the convenience of describing the present application and simplifying the description, rather than indicating or implying that the device or element referred to must have a particular orientation or be constructed and operated in a particular orientation, and therefore should not be construed as a limitation on the present application. Moreover, the terms such as “first” and “second” are merely used for the illustrative purpose, and should not be construed as indicating or implying the relative importance.
[0029] The orientation terms used in the following description all indicate directions shown in the accompanying drawings, and do not limit the specific structure of the embodiment of the present application. In the description of the present application, it should also be noted that unless otherwise explicitly specified and defined, the terms “mounting” and “connection” should be understood in a broad sense, for example, they may be a fixed connection, a detachable connection, or an integrated connection, and may be a direct connection, or an indirect connection. The specific meanings of the terms mentioned above in the present application can be construed according to specific circumstances.
[0030] A display panel actually produced in the related art includes a substrate and a pixel defining layer arranged on the substrate, the pixel defining layer including an isolation portion and a plurality of pixel openings, and a support post being arranged on a side of the isolation portion facing away from the substrate. After the support post is fabricated, a light-emitting material is evaporated in the pixel opening by using a mask. The inventors have found that during the alignment of the mask with the pixel opening, the mask may scratch the support post, arrange damage the support post, and thus generate impurities such as particles. When these impurities fall into the pixel opening, the light emission of the light-emitting material is affected seriously, and accordingly the yield of the display panel is reduced.
[0031] In view of this, the present application is provided. In order to better understand the present application, a display panel, a display device and a mask of the embodiments of the present application will be described in detail below with reference to FIGS. **1** to **14**.
[0032] Referring to FIGS. **1** and **2**, FIG. **1** is a cross-sectional view of a display panel **10** according to an embodiment of the present application, and FIG. **2** is a structural schematic partial enlarged view of FIG. **1** in an example.
[0033] As shown in FIGS. **1** and **2**, the embodiment of the present application provides a display panel **10**. The display panel **10** has an active area, and the display panel **10** includes a substrate **100**, a pixel defining layer **200** and a support post **300**. The pixel defining layer **200** is arranged on one side of the substrate **100**, and the pixel defining layer **200** includes an isolation portion **210** and a

plurality of pixel openings **220** which are enclosed by the isolation portion **210** and located in the active area. At least one support post **300** is located in the active area and arranged on a side of the isolation portion **210** facing away from the substrate **100**. The support post **300** includes a first section **310** and a second section **320** which are distributed in a stacked manner in sequence in a direction away from the isolation portion **210**. An orthographic projection of at least part of the second section **320** on the substrate **100** is located within an orthographic projection of the first section **310** on the substrate **100**, the isolation portion **210** includes a first top surface **211** distributed on a peripheral side of the first section **310**, and the first section **310** includes a first side surface **311** extending toward the second section **320**.

[0034] In one embodiment, the entire orthographic projection of the second section **320** on the substrate **100** is located within the orthographic projection of the first section **310** on the substrate **100**.

[0035] In one embodiment, the first section **310** of the support post **300** is partially exposed to form the first top surface **211** and the first side surface **311** as shown in FIGS. **2** to **6**, thus forming a receiving space **22** for receiving impurities. That is, the first top surface **211** and the first side surface **311** are connected to each other in an intersecting manner, to form the receiving space **22** for receiving the impurities. As shown in FIGS. **2** to **5**, connecting the first top surface **211** and the first side surface **311** in an intersecting manner includes: the first top surface **211** and the first side surface **311** being connected to each other in an intersecting manner with an included angle formed therebetween, and the first top surface **211** may be a flat surface or an arc-shaped surface shown in FIG. **5**. Alternatively, connecting the first top surface **211** and the first side surface **311** in an intersecting manner includes, as shown in FIG. **6**, the first top surface **211** and the first side surface **311** being smoothly connected to each other in an intersecting manner.

[0036] In the display panel **10** according to the embodiments of the present application, the display panel **10** includes the substrate **100**, and the pixel defining layer **200** and the support post **300** which are arranged on the substrate **100**. The pixel defining layer **200** includes the isolation portion **210** and the pixel opening **220** located in the active area, and a light-emitting unit **230** may be arranged in the pixel opening **220** to achieve display of the display panel **10**. The support post **300** is arranged on the isolation portion **210** of the pixel defining layer **200**, and the support post **300** can assist in supporting a film layer such as a cover plate. The support post includes the first section **310** and the second section **320**. The isolation portion **210** includes the first top surface **211** distributed on the peripheral side of the first section **310**, and the first section **310** and the pixel opening **220** are spaced apart from each other due to the presence of the first top surface **211**, and a spacing between the support post **300** and the pixel opening **220** can thus be increased. When the impurities such as particles are generated due to the fact that the support post **300** is scratched, it is unlikely for the particulate impurities to fall into the pixel opening **220**, and accordingly the yield of the display panel **10** can be improved. The first section **310** includes the first side surface **311** connected to the first top surface **211**, and the first top surface **211** and the first side surface **311** intersect each other, or are smoothly connected to each other in such a manner that extending lines of the first top surface and the first side surface intersect each other, so that the structural strength of the support post **300** can be increased, and the problem of the support post **300** being prone to damage due to scratching can be alleviated.

[0037] The substrate **100** may be configured in a variety of forms. For example, the substrate **100** may be an array substrate, which may further include a pixel drive circuit. For example, the array substrate may include a base substrate **110**, and a first conductive layer M**1**, a second conductive layer M**2** and a third conductive layer M**3** which are arranged in a stacked manner on one side of the base substrate **110**. An insulating material layer is provided between adjacent conductive layers. By way of example, the pixel drive circuit arranged on the array substrate includes a transistor and a storage capacitor. The transistor includes a semiconductor, a gate, a source and a drain. The storage capacitor includes a first plate and a second plate. As an example, the gate and the first

plate may be located in the first conductive layer M**1**, the second plate may be located in the second conductive layer M**2**, and the source and the drain may be located in the third conductive layer M**3**.
[0038] In one embodiment, the display panel **10** further includes a planarization layer **120** located on a side of the third conductive layer facing away from the base substrate **110**, and a pixel electrode layer located on a side of the planarization layer **120** facing away from the base substrate **110**. The pixel electrode layer includes a plurality of pixel electrodes **130** (also referred to as anodes or first electrodes) distributed at intervals. In one embodiment, the display panel **10** further includes a common electrode layer **400** (also referred to as a cathode layer or a second electrode layer) located on the side of the pixel defining layer **200** facing away from the substrate **100**. The common electrode layer **400** and the pixel electrode **130** act together to drive the light-emitting unit **230** in the pixel opening **220** to emit light.
[0039] Referring to FIGS. **2** to **4** together, FIG. **3** is a structural schematic partial enlarged view of FIG. **1** in another example, and FIG. **4** is a structural schematic partial enlarged view of FIG. **1** in still another example.
[0040] In some embodiments, as shown in FIGS. **2** to **4**, a first included angle a formed by the first side surface **311** and the first top surface **211** is greater than or equal to 90 degrees.
[0041] In these embodiments, when the first included angle a is greater than or equal to 90 degrees, a cross-section of the first section **310** is consistent or gradually decreases in a direction away from the substrate **100**, so that the structural strength of the first section **310** can be increased, and the problem of the support post **300** being prone to damage due to scratching can be alleviated. The cross-section of the first section **310** is parallel to a surface where the substrate **100** is located.
[0042] In one embodiment, as shown in FIGS. **3** and **4**, the first included angle is in the range of 130°-160°. In this way, the cross-section of the first section **310** gradually decreases in the direction away from the substrate **100**, and the structural strength of the support post **300** can be further increased. The first included angle a is within the above-mentioned value range. For example, when the first included angle α is 130°, 140°, 150° or 160°, it is possible to alleviate the problem of insufficient extension height of the first section **310** in a thickness direction Z due to the excessively large first included angle α, affecting the support performance of the support post **300**; and it is also possible to alleviate the problem of insufficient structural strength of the support post **300** due to the excessively small first included angle α.
[0043] Referring to FIG. **5**, FIG. **5** is a structural schematic partial enlarged view of FIG. **1** in yet another example.
[0044] The first top surface **211** may be configured in a variety of forms. As shown in FIG. **5**, for example, the first top surface **211** is shaped to protrude toward the support post **300**.
[0045] In some embodiments, with continued reference to FIGS. **2** to **4**, the first top surface **211** is a flat surface. Since the first top surface **211** is a flat surface rather than a recessed surface, it can be ensured that the isolation portion **210** has a sufficient thickness, the display problem caused by the short-circuit connection between the common electrode layer **400** and the pixel electrode is alleviated, and the yield of the display panel **10** can further be improved. In addition, since the first top surface **211** is flat surface, the flatness of a surface of the isolation portion **210** facing away from the substrate **100** can be improved, and the problem of wear particles being generated due to the uneven surface of the isolation portion **210** when the mask **500** scratches the isolation portion **210** during evaporation can be alleviated.
[0046] In one embodiment, with continued reference to FIGS. **2** to **4**, the first top surface **211** is parallel to a plane where the substrate **100** is located. Generally, a surface of the planarization layer **120** facing the pixel defining layer **200** is parallel to the plane where the substrate **100** is located, the first top surface **211** is parallel to where the substrate **100** is located, and the first top surface **211** is thus parallel to the surface of the planarization layer **120** facing the pixel defining layer **200**, such that the pixel defining layer **200** trends to be uniform in thickness at different positions.
[0047] In some embodiments, with continued reference to FIGS. **2** to **4**, the cross-sectional area of

the second section **320** gradually decreases in a direction from the first section **310** to the second section **320**.

[0048] In these embodiments, since the cross-section of the second section **320** gradually decreases in the direction away from the substrate **100**, the structural strength of the second section **320** can be increased, the structural strength of the support post **300** can thus be increased, and the support post **300** is less prone to damage or breakage when being scratched by the mask **500** during evaporation.

[0049] In one embodiment, the second section **320** includes a second top **322** and a second side surface **321** connecting the second top **322** and the first side surface **311**, and the second side surface **321** is inclined toward the second top **322** in the direction from the first section **310** to the second section **320**. The structural strength of the second section **320** can be increased, and the orthographic projection area of the second section **320** on the substrate **100** is less than or equal to the orthographic projection area of the first section **310** on the substrate **100**, that is, the cross-sectional dimension of the second section **320** is less than or equal to the cross-sectional dimension of the first section **310**, so that the first section **310** can provide sufficient support to second section **320**, and the problem of the support post **300** being prone to damage due to the scratching can be better alleviated.

[0050] In some embodiments, the second section **320** is configured to be arranged centrosymmetrically with respect to the second top **322**. The centrosymmetry herein does not mean symmetry in the geometric sense, as long as the second section **320** is arranged centrosymmetrically with respect to the second top **322** within a range of manufacturing errors.

[0051] In these embodiments, when the second section **320** is arranged centrosymmetrically with respect to the second top **322**, the shape of the second section **320** is more regular, so that it is easier to fabricate and form the second section **320**. In addition, the structure strength of the second section **320** can also tend to be consistent at the different positions, and when the mask **500** scratches the support post **300** in different directions, the second section **320** at the different positions is less prone to damage due to scratching to generate impurities such as the particles.

[0052] In one embodiment, the second section **320** may be in the shape of a cone, a truncated cone, or a polygonal pyramid. When the second section **320** is in the shape of a polygonal pyramid, the cross-section of the second section **320** is in the shape of a regular polygon, such that the second section **320** is arranged centrosymmetrically with respect to the second top **322**.

[0053] In some embodiments, the first section **310** is arranged centrosymmetrically with respect to the second top **322**. The centrosymmetry herein does not mean symmetry in the geometric sense, as long as the first section **310** is arranged centrosymmetrically with respect to the second top **322** within a range of manufacturing errors.

[0054] In these embodiments, when the first section **310** is arranged centrosymmetrically with respect to the second top **322**, the shape of the first section **310** is more regular, so that it is easier to fabricate and form the first section **310**. In addition, the structure strength of the first section **310** can also tend to be consistent at the different positions, and when the mask **500** scratches the support post **300** in different directions, the first section **310** at the different positions is less prone to damage due to scratching to generate impurities such as the particles.

[0055] In one embodiment, the first section **310** may be in the shape of a truncated cone or a truncated polygonal pyramid. When that first section **310** is in the shape of the truncated polygonal pyramid, the cross-section of the first section **310** is in the shape of a regular polygon, such that the first section **310** is arranged centrosymmetrically with respect to the second top **322**.

[0056] In one embodiment, the cross-sectional shape of the first section **310** is identical to the cross-sectional shape of the second section **320**. For example, the cross-sections of the first section **310** and the second section **320** may both be circular, such that the shape of the support post **300** is more regular. Alternatively, the cross-sections of the first section **310** and the second section **320** are both polygonal. In one embodiment, the sides of the cross-section of the first section **310** are

configured to be parallel to the sides of the cross-section of the second section **320** to further simplify the shape and structure of the support post **300**.

[0057] The first section **310** may be shaped in a variety of forms. In one embodiment, with continued reference to FIGS. **3** and **4**, the cross-sectional area of the first section **310** gradually decreases in the direction from the first section **310** to the second section **320**.

[0058] In these embodiments, the cross-sectional area of the first section **310** gradually decreases in the direction away from the substrate **100**, and the first section **310** is of a structure having a larger top and a smaller bottom, so that the structural strength of the first section **310** can be increased, the structural strength of the support post **300** can be thus increased, and the problem of the support post **300** being prone to damage due to scratching can be alleviated.

[0059] In one embodiment, the orthographic projection of the second section **320** on the substrate **100** is located within the orthographic projection of the first section **310** on the substrate **100**, so that the first section **310** can better support the second section **320**, and the structural strength of the support post **300** can further be increased.

[0060] In one embodiment, the first section **310** has a first support surface **312** (schematically shown by a dotted line in FIG. **3**) facing the second section **320**, and the orthographic projection of the second section **320** on the substrate **100** completely overlaps with an orthographic projection of the first support surface **312** on the substrate **100**, such that the second section **320** has a large enough dimension.

[0061] In some other embodiments, as shown in FIG. **2**, the cross-sectional area of the first section **310** is constant in the direction from the first section **310** to the second section **320**, that is, the first section **310** is configured to have a uniform cross-section, such that the first section **310** has a large enough area to support the second section **320**, and the structural strength of the support post **300** can also be increased.

[0062] In one embodiment, an inner included angle ß between the second side surface **321** and the first side surface **311** is greater than **90** degrees and less than or equal to 180 degrees. In one embodiment, as shown in FIGS. **2** and **4**, the inner included angle β between the second side surface **321** and the first side surface **311** is equal to 180 degrees, such that a surface of the support post **300** is smoother and is less likely to be scratched by the mask **500**. For example, in the direction away from the substrate **100**, the first side surface **311** and the second side surface **321** are coplanar and are both inclined toward the second top **322**. Alternatively, as shown in FIGS. **2** and **3**, the inner included angle β between the second side surface **321** and the first side surface **311** is greater than 90 degrees and less than 180 degrees, and an included angle between the second side surface **321** and the thickness direction Z is greater than an included angle between the first side surface **311** and the thickness direction Z, so that the structural strength of the second section **320** can further be increased, and the second section **320** located at the top end of the support post **300** is less prone to damage when being scratched by the mask **500**.

[0063] In one embodiment, as shown in FIGS. **3** and **4**, when the cross-sectional area of the first section **310** gradually decreases in the direction away from the substrate **100**, the inner included angle β between the first side surface **311** and the second side surface **321** is greater than 90 degrees and less than or equal to 180 degrees. When the cross-sectional area of the first section **310** is constant in the direction away from the substrate **100**, as shown in FIG. **2**, the included angle β between the first side surface **311** and the second side surface **321** is greater than 90 degrees and less than 180 degrees. When the first section **310** is configured to have a uniform cross-section, the cross-section of the second section **320** gradually decreases in the direction away from the substrate **100** to increase the structural strength of second section **320**.

[0064] In one embodiment, the extension dimension of the first top surface **211** in the peripheral direction of the first section **310** is greater than or equal to 1 μm, so that the problem is alleviated that the extension dimension of the first top surface **211** is excessively small, that is, the extension dimension of the first top surface **211** is greater than or equal to 1 μm in a direction radiating

outward from the second top **322** to the pixel opening **220**, resulting in the first section **310** and the pixel opening **220** being too close, and thus when the support post **300** is frictionally damaged to generate impurities such as particles, the impurities are prone to falling into the pixel opening **220**.

[0065] In some embodiments, the extension height of the support post **300** in the thickness direction Z is in the range of 1.5-2.5 μm. When the height of the support post **300** is within the above value range, the problem of being unlikely to support a structural member such as the cover plate due to the insufficient height of the support post **300** can be alleviated, and the problem of the excessively large height of the support post **300** affecting the structural strength of the support post **300** and thus the support post **300** being prone to damage due to the scratching can also be alleviated.

[0066] In one embodiment, the extension height of the first section **310** in the thickness direction Z of the display panel **10** is in the range of 0.8-1.0 μm, and the extension height of the second section **320** in the thickness direction Z of the display panel **10** is in the range of 1.4-2.4 μm.

[0067] The support post **300** may be made of a variety of materials. For example, the material of the support post **300** is the same as the material of the pixel defining layer **200**, so that the support post **300** and the pixel defining layer **200** can be fabricated and formed in the same process step, a fabrication process for the display panel **10** can be simplified, and the fabrication efficiency of the display panel **10** can be improved.

[0068] When the pixel defining layer **200** and the support post **300** are fabricated by using the mask, the first side surface **311**, the second side surface **321** and the first top surface **211** formed may not be planes in the geometric sense due to the limitations of the process, and thus it is unlikely to present an included angle in the geometric sense. As shown in FIG. **7**, within the range of process errors, it is enough that rough planes can be found to represent the first side surface **311**, the second side surface **321** and the first top surface **211**, and included angles between these planes can be determined.

[0069] An embodiment of the present application further provides a display device, including a display panel **10** of any one of the above embodiments. Since the display device according to the embodiment of the present application includes the display panel **10** of any one of the above embodiments, the display device according to the embodiment of the present application has the beneficial effects of the display panel **10** of any one of the above embodiments, and will not be described in detail here.

[0070] The display device in the embodiment of the present application includes, but is not limited to devices having a display function, such as a cell phone, a personal digital assistant (PDA), a tablet computer, an e-book, a television, an access control, a smart fixed-line telephone, or a control console.

[0071] Referring to FIGS. **8** and **9**, FIG. **8** is a structural schematic view of a mask **500** according to an embodiment of the present application, and FIG. **9** is a structural schematic partial enlarged view of FIG. **8** in an example. An embodiment of the present application further provides a mask **500**, the mask **500** being configured to fabricate the support post **300** and the pixel defining layer **200** in any one of the above embodiments.

[0072] Referring to FIGS. **1** to **9** together, the mask **500** according to the embodiments of the present application includes a main mask area **510** and a plurality of auxiliary openings **520**. The main mask area **510** is configured to fabricate the support post **300**; and the auxiliary openings **520** are configured to fabricate the first top surface **211**. The plurality of auxiliary openings **520** are arranged around a peripheral side of the main mask area **510**, and at least two of the auxiliary openings **520** are located on the same side of the main mask area **510** in a first direction X. Referring to FIGS. **1** to **11** together, FIG. **10** is a structural schematic view of a mask **500** in a use state according to an embodiment of the present application, and FIG. **11** is a product fabricated by FIG. **10**.

[0073] As shown in FIG. **10**, when the mask **500** is configured to fabricate the display panel **10**, it

is possible that after the substrate **100** is coated with a functional material layer **600** for fabricating the pixel defining layer **200** of the support post **300**, the mask **500** is arranged on a side of the functional material layer **600** facing away from the substrate **100**, and a side of the mask **500** facing away from the functional material layer **600** is then irradiated with laser, enabling the laser to pattern the functional material layer **600**. As shown in FIG. **11**, a part of the functional material layer **600** corresponding to the main mask area **510** can form the support post **300**, and a part of the functional material layer **600** corresponding to the auxiliary opening **520** can form the first top surface **211**. FIG. **10** shows an incidence direction of the laser with arrows.

[0074] In one embodiment, two or more auxiliary openings **520** are arranged in a column at equal intervals on the same side of the main mask area **510**.

[0075] In the mask **500** according to the embodiment of the present application, the plurality of auxiliary openings **520** are arranged around the peripheral side of the main mask area **510**. At least two of the auxiliary openings **520** are located on the same side of the main mask area **510** in the first direction X, that is, two or more auxiliary openings **520** are arranged at intervals on the same side of the main mask area **510**, the laser cannot pass through a region between two adjacent auxiliary openings **520**, but the laser can be irradiated to the functional material layer **600** through the auxiliary openings **520**, thus forming the first top surface **211** and the first side surface **311** which can constitute the receiving space **22** for receiving the impurities. Compared with a solution in which an elongated opening is formed on the same side of the main mask area **510**, the smaller-sized auxiliary openings **520** can allow a decrease in the amount of laser irradiated to the functional material layer **600**, thereby alleviating the problem of the breakdown of the functional material layer **600** caused by the excessive amount of laser, and the resulting short-circuit connection between the common electrode layer **400** and the pixel electrode **130**. Compared with a solution in which no openings are formed in the peripheral side portions of the main mask area **510**, by providing the auxiliary openings **520**, the first top surface **211** can be formed for receiving the particles generated by scratching, thereby alleviating the problem of the particles generated when the support post **300** is scratched being likely to enter the pixel opening **220** due to the relatively small distance between the support post **300** and the pixel openings **220**, and thus affecting the evaporation yield of a subsequent process procedure.

[0076] Therefore, in the mask **500** according to the embodiment of the present application, by providing at least two auxiliary openings **520** distributed at intervals on the same side of the main mask area **510**, it is not only possible to alleviate the problem of the breakdown of the functional material layer **600** caused by the excessive amount of laser, and it is also possible to alleviate the problem of the excessively small distance between the fabricated support post **300** and the pixel opening **220**.

[0077] In one embodiment, the plurality of auxiliary openings **520** are distributed in a grid pattern, such that the laser can better pass through the plurality of auxiliary openings **520**, to form the first top surface **211** as described above.

[0078] Referring to FIGS. **9**, **12** and **13** together, FIG. **12** is a structural schematic partial enlarged view of FIG. **8** in another example, and FIG. **13** is a structural schematic partial enlarged view of FIG. **8** in still another example.

[0079] In some embodiments, as shown in FIGS. **9**, **12** and **13**, the plurality of auxiliary openings **520** are distributed at intervals along an annular path L surrounding the main mask area **510**. The number of annular paths L is N, where N is less than or equal to **3**.

[0080] The annular path L is a virtual path, and the annular path L does not limit the structure of the mask **500**, but merely functions as a reference that is set for more conveniently describing a distribution pattern of the plurality of auxiliary openings **520**. In one embodiment, the annular path L is in the shape of a closed annulus around the main mask area **510**, and when N is greater than or equal to 2, the plurality of annular paths L are nested with each other.

[0081] In these embodiments, N is less than or equal to 3, that is, the number of annular paths L is

relatively small, and the number of auxiliary openings **520** arranged on the same side of the main mask area **510** side by side in a direction from the main mask area **510** to the auxiliary openings **520** is relatively small. It is possible to alleviate the problem of the breakdown of the functional material layer **600** due to the fact that an excessive number of auxiliary openings **520** causes an excessive amount of laser to be irradiated to the functional material layer **600** during use of the mask **500**. Moreover, when N is relatively small, by properly setting the positions of the auxiliary openings **520**, it is also possible to decrease the maximum distance between the auxiliary opening **520** and the main mask area **510**, thus reducing the influence of the auxiliary opening **520** on the shaping of the pixel opening **220**.

[0082] In one embodiment, as shown in FIG. **11**, N=1. That is, the plurality of auxiliary openings **520** are formed on the peripheral side of the main mask area **510**, and the auxiliary openings **520** are distributed at intervals in a single-row manner around the main mask area **510**, so that the distance between the auxiliary opening **520** and the main mask area **510** can be reasonably controlled, and the structure of the mask **500** can be simplified.

[0083] In one embodiment, the auxiliary opening **520** may be shaped in a variety of forms. For example, the auxiliary opening **520** is in a circular or polygonal shape, so that the auxiliary opening **520** is more regular in shape and can be easily fabricated and formed. For example, the auxiliary opening **520** may be in a circular, square, rectangular, or zigzag shape.

[0084] In one embodiment, the auxiliary opening **520** has a maximum width b of 1-2 μm. When the maximum width of the auxiliary opening **520** is within the above value range, it is possible to alleviate the problem of the failure of the formation of the first top surface **211** caused by insufficient amount of laser due to the excessively small size of the auxiliary opening **520**, and it is also possible to alleviate the problem of the breakdown of the functional material layer **600** caused by excessive amount of laser due to the excessively large size of the auxiliary opening **520**.

[0085] In one embodiment, the maximum width b of the auxiliary opening **520** may be the extension dimension of the auxiliary opening **520** in any direction on the plane where the surface of the mask **500** is located. For example, the maximum width of the auxiliary opening **520** may be the extension dimension of the auxiliary opening **520** in the first direction X or in a second direction Y.

[0086] In one embodiment, a minimum distance a between the auxiliary opening **520** and the main mask area **510** is greater than 0 and less than or equal to 2 μm. When the minimum distance a between the auxiliary opening **520** and the main mask area **510** is within the above value range, it is possible to reduce the influence of the excessively large minimum distance a between the auxiliary opening **520** and the main mask area **510** on the fabrication of the first top surface **211**, and it is also possible to reduce the influence of the auxiliary opening **520** on the formation of the pixel opening **220**.

[0087] In one embodiment, the mask **500** further includes a pixel opening formation area **530**. The pixel opening formation area **530** is configured to form the pixel opening **220**. In one embodiment, the auxiliary opening **520** is located between the pixel opening formation area **530** and the main mask area **510**.

[0088] In some embodiments, the auxiliary openings **520** distributed at intervals along the same annular path L are arranged equidistant from an edge of the main mask area **510**. The distances between the plurality of auxiliary openings **520** and the main mask area **510** trend to be consistent to form the first top surface **211** surrounding the peripheral side of the first section **310**, so that the dimensions of the first top surface **211** at different positions in the peripheral direction of the first section **310** trend to be uniform.

[0089] In one embodiment, the auxiliary openings **520** on two sides of the main mask area **510** in the first direction X are the same in number, such that in the display panel **10** fabricated by using the mask **500**, the distribution areas of the first top surface **211** on two sides of the support posts **300** in the first direction X trend to be consistent.

[0090] In one embodiment, the auxiliary openings **520** on two sides of the main mask area **510** in

the second direction Y are the same in number, such that in the display panel **10** fabricated by using the mask **500**, the distribution areas of the first top surface **211** on two sides of the support posts **300** in the second direction Y trend to be consistent.

[0091] As shown in FIGS. **9**, **12** and **13**, when the main mask area **510** is in a square shape, the auxiliary openings **520** on the two sides of the main mask area **510** in the first direction X are the same in number, the auxiliary openings **520** on the two sides of the main mask area **510** in the second direction Y are the same in number, and the number of auxiliary openings **520** located on one side of the main mask area **510** in the first direction X is the same as the number of auxiliary openings **520** located on one side of the main mask area **510** in the second direction Y. In this way, in the display panel **10** fabricated by using the mask **500**, the distribution areas of the first top surface **211** on the two sides of the support post **300** in the first direction X and the second direction Y trend to be consistent.

[0092] In one embodiment, when the main mask area **510** is in a circular shape, the plurality of auxiliary openings **520** are arranged at equal intervals on the peripheral side of the main mask area **510**. In this way, in the display panel **10** fabricated by using the mask **500**, the distribution areas of the first top surface **211** at different positions of the support post **300** in the peripheral direction trend to be consistent.

[0093] In the display panel **10**, the display panel **10** includes an array substrate in which a plurality of metal layers are provided, a pixel electrode **130** is also provided on a side of the array substrate facing the pixel defining layer **200**, these metal layers and the pixel electrode **130** may reflect the laser, resulting in an excessive amount of laser in their corresponding regions, and thus affecting the shapes of the pixel defining layer **200** and the support post **300** formed.

[0094] Referring to FIGS. **8** to **14** together, FIG. **14** is a structural schematic partial enlarged view of FIG. **8** in yet another example.

[0095] In some embodiments, the auxiliary openings **520** include a plurality of first auxiliary openings **521** and a plurality of second auxiliary openings **522**. The first auxiliary opening **521** is configured to fabricate a first region S**1** of the first top surface **211**, and the second auxiliary opening **522** is configured to fabricate a second region S**2** of the first top surface **211**. The first region S**1** is misaligned with a reflecting portion of the display panel **10** in the thickness direction Z of the display panel, the second region S**2** at least partially overlaps with the reflecting portion in the thickness direction Z, and the area of the second auxiliary opening **522** is less than the area of the first auxiliary opening **521**.

[0096] In these embodiments, as shown in FIG. **11**, the first top surface **211** includes the first region S**1** and the second region S**2**. Since the first region S**1** is misaligned with the reflecting portion of the display panel **10** in the thickness direction Z, it is unlikely for the laser reflected by the reflecting portion to enter the first region S**1**. Since the second region S**2** at least partially overlaps with the reflecting portion in the thickness direction Z, the laser reflected by the reflecting portion can easily enter the second region S**2**, resulting in an excessive amount of laser in the second region S**2**. In the embodiments of the present application, the area of the second auxiliary opening **522** for forming the second region S**2** by means of evaporation is less than the area of the first auxiliary opening **521**, so that the problem of the breakdown of the functional material layer **600** caused by the excessive amount of laser in the second region S**2**, and the resulting short-circuit connection between the common electrode layer **400** and the pixel electrode **130** can be alleviated.

[0097] The reflecting portion may be configured in a variety of forms, and a wire, the pixel electrode **130**, etc. in the display panel **10** that has a reflecting function may be considered as the reflecting portion. In one embodiment, as shown in FIG. **11**, the reflecting portion is the pixel electrode **130**. A distance between the pixel electrode **130** and the pixel defining layer **200** is relatively small, and thus the reflection of the laser by the pixel electrode **130** is prone to affecting the formation of the pixel defining layer and the support post **300**. By setting the second auxiliary opening **522** for evaporation of the second region S**2** to be relatively small, the problem caused by

the excessive amount of laser due to laser reflection by the pixel electrode **130** can be alleviated.
[0098] In one embodiment, the first auxiliary opening **521** is closer to the main mask area **510** than the second auxiliary opening **522**. A distance between the reflecting portion (e.g., the pixel electrode **130**) in the display panel and the pixel opening **220** is smaller than a distance between the pixel electrode **130** and the support post **300**. By making the first auxiliary opening **521** closer to the main mask area **510** than the second auxiliary opening **522**, the second auxiliary opening **522** is closer to the pixel electrode **130**, so that the first auxiliary opening **521** being closer to the main mask area **510** than the second auxiliary opening **522** can be better improved, and the problem caused by the excessive amount of laser due to laser reflection by the pixel electrode **130** can be alleviated.
[0099] Although the present application is described with reference to some embodiments, various modifications can be made, and equivalents can be provided to substitute for the components thereof without departing from the scope of the present application. In particular, the features mentioned in the embodiments can be combined in any manner, provided that there is no structural conflict. The present application is not limited to the specific embodiments disclosed herein but includes all the embodiments that fall within the scope of the claims.

## Claims

**1**. A display panel having an active area, the display panel comprising: a substrate; a pixel defining layer arranged on one side of the substrate, the pixel defining layer comprising an isolation portion and a plurality of pixel openings which are enclosed by the isolation portion and located in the active area; and at least one support post, the at least one support post being located in the active area and arranged on a side of the isolation portion facing away from the substrate, the support post comprising a first section and a second section which are distributed in a stacked manner in a direction away from the isolation portion, an orthographic projection of at least part of the second section on the substrate being located within an orthographic projection of the first section on the substrate, wherein the isolation portion comprises a first top surface distributed on a peripheral side of the first section, the first section comprises a first side surface connected to the first top surface and extending toward the second section, and the first top surface intersects the first side surface.
**2**. The display panel according to claim 1, wherein a first included angle is formed between the first side surface and the first top surface, the first included angle being greater than or equal to 90 degrees.
**3**. The display panel according to claim 2, wherein the first included angle is in a range of 90-130 degrees.
**4**. The display panel according to claim 1, wherein the first top surface is a flat surface.
**5**. The display panel according to claim 1, wherein the first top surface is a protruding surface, and a first included angle is formed between the first side surface and the first top surface, the first included angle being less than 90 degrees.
**6**. The display panel according to claim 1, wherein the first side surface and the first top surface are smoothly connected to each other.
**7**. The display panel according to claim 1, wherein the second section comprises a second top, and a second side surface connecting the second top and the first side surface, a cross-sectional area of the second section gradually decreases in a direction from the first section to the second section, and the second side surface is inclined toward the second top.
**8**. The display panel according to claim 7, wherein the second section is arranged centrosymmetrically with respect to the second top; and the first section is arranged centrosymmetrically with respect to the second top.
**9**. The display panel according to claim 7, wherein a cross-sectional area of the first section gradually decreases or is constant in the direction from the first section to the second section, and

an inner included angle between the second side surface and the first side surface is greater than 90 degrees and less than or equal to 180 degrees.

**10**. The display panel according to claim 1, wherein an extension dimension of the first top surface in a peripheral direction of the first section is greater than or equal to 1 μm; and an extension height of the support post in a thickness direction of the display panel is in a range of 1.5-2.5 μm.

**11**. The display panel according to claim 1, wherein an extension height of the first section in a thickness direction of the display panel is in a range of 0.8-1.0 μm; and an extension height of the second section in the thickness direction of the display panel is in a range of 1.4-2.4 μm.

**12**. A display device, comprising a display panel according to any one of claims 1.

**13**. A mask for fabricating a display panel, the display panel comprising at least one support post and a pixel defining layer, the mask comprising: a main mask area configured to fabricate the support post; and a plurality of auxiliary openings configured to fabricate a first top surface of an isolation portion of the pixel defining layer, the plurality of auxiliary openings being arranged around a peripheral side of the main mask area, and at least two of the auxiliary openings being located on the same side of the main mask area in a first direction.

**14**. The mask according to claim 13, wherein the plurality of auxiliary openings are distributed at intervals along at least one annular path surrounding the main mask area, a number of annular paths being N, where N is less than or equal to 3.

**15**. The mask according to claim 14, wherein N=1.

**16**. The mask according to claim 14, wherein a maximum width b of the auxiliary opening is in a range of 1-2 μm; and a minimum distance a between the auxiliary opening and the main mask area is greater than 0 and less than or equal to 2 μm.

**17**. The mask according to claim 14, wherein the plurality of auxiliary openings distributed at intervals along the same annular path are arranged equidistant from an edge of the main mask area.

**18**. The mask according to claim 17, wherein the auxiliary openings on two sides of the main mask area in the first direction are the same in number; and the auxiliary openings on two sides of the main mask area in a second direction are the same in number.

**19**. The mask according to claim 13, wherein the auxiliary openings comprise: a plurality of first auxiliary openings configured to fabricate a first region of the first top surface, and a plurality of second auxiliary openings configured to fabricate a second region of the first top surface, wherein the first region is misaligned with a reflecting portion of the display panel in a thickness direction of the display panel, the second region at least partially overlaps with the reflecting portion in the thickness direction, and an area of the second auxiliary opening is less than an area of the first auxiliary opening.

**20**. The mask according to claim 19, wherein the first auxiliary opening is closer to the main mask area than the second auxiliary opening.