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DISPLAY SUBSTRATE WITH ISOLATION STRUCTURE AND FILLING STRUCTURE, METHOD FOR MANUFACTURING THE SAME AND DISPLAY DEVICE

Abstract

A display substrate is provided, having a display area providing with an opening area. The display substrate includes: at least one isolation structure surrounding the opening area and including a first sidewall; a first filling structure on a side of the first sidewall away from the opening area, including a second sidewall facing the first sidewall and a third sidewall facing away from the first sidewall; a first inorganic thin film between the isolation structure and the first filling structure; a second inorganic thin film covering the isolation structure and the first filling structure; and a second filling structure, where the first and second filling structures are spaced from each other, and at least one contact portion between the first and second inorganic thin films is located between adjacent first and second filling structures.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION [0001] The present disclosure is a Continuation Application of U.S. patent application Ser. No. 18/371,323 filed on Sep. 21, 2023, now allowed, which is a Continuation Application of U.S. patent application Ser. No. 17/695,666 filed on Mar. 15, 2022, now U.S. Pat. No. 11,800,742, which is a Continuation Application of U.S. patent application Ser. No. 16/770,056 filed on Jun. 4, 2020, now U.S. Pat. No. 11,302,894, which is a Section 371 National Stage Application of International Application No. PCT/CN2019/128649, filed on Dec. 26, 2019, and claims priority to Chinese Patent Application No. 201910016514.9 filed on Jan. 8, 2019 in the National Intellectual Property Administration of China, the whole disclosure of each of which are incorporated herein by reference.

TECHNICAL FIELD
[0002] The present disclosure relates to a field of display technology, and in particular, to a display substrate, a method for manufacturing the same, and a display device.
BACKGROUND
[0003] In recent years, organic light emitting diode (OLED) display device has become a very popular emerging flat panel display product at home and abroad. This is because the OLED display device has characteristics of self-luminescence, wide viewing angle, short reaction time, high luminous efficiency, wide color gamut, low operating voltage, thin panel, large size and flexible panel, simple manufacturing process and the like, and it also has low-cost potential.
SUMMARY
[0004] In an aspect, a display substrate is provided, having a display area, an opening area being provided in the display area, the display substrate includes: a base substrate; at least one isolation structure provided on the base substrate and surrounding the opening area, the isolation structure includes a first sidewall; a first filling structure provided on a side of the first sidewall away from the opening area, the first filling structure includes a second sidewall facing the first sidewall and a third sidewall facing away from the first sidewall; a first inorganic thin film disposed between the isolation structure and the filling structure; and a second inorganic thin film covering the isolation structure and the first filling structure.
[0005] According to the embodiments, the display substrate further includes a second filling structure, the first filling structure and the second filling structure are spaced from each other, and at least one contact portion between the first inorganic thin film and the second inorganic thin film is located between adjacent first filling structure and second filling structure.
[0006] According to the embodiments, the display substrate further includes a second filling structure, the first filling structure and the second filling structure are spaced from each other, and

the second inorganic thin film spaces the first filling structure from the second filling structure that are adjacent to each other.
[0007] According to the embodiments, a slope angle of a sidewall of any one of the first filling structure and the second filling structure which are configured to carry the second inorganic thin film is an obtuse angle.
[0008] According to the embodiments, a height of the isolation structure in a direction perpendicular to a direction of the display substrate, and a height of any one of the first filling structure and the second filling structure in the direction perpendicular to the direction of the display substrate are higher than a height of a pixel defining layer in the direction perpendicular to the direction of the display substrate.
[0009] According to the embodiments, a height of each of the first filling structure and the second filling structure is less than or equal to a height of the isolation structure, and the height is a size along a direction perpendicular to the display substrate.
[0010] According to the embodiments, the second inorganic thin film is located on a side of the first inorganic thin film away from the isolation structure.
[0011] According to the embodiments, the first sidewall includes a first side and a second side, the second side is closer to the base substrate than the first side, and the first side is further away from the opening area than the second side in a direction parallel to the base substrate; and the second sidewall conforms to a shape of the first sidewall, the third sidewall includes a third side and a fourth side, the fourth side is closer to the base substrate than the third side, and the third side is closer to the opening area than the fourth side in the direction parallel to the base substrate.
[0012] According to the embodiments, the display substrate further includes a fourth sidewall facing the opening area, the fourth sidewall includes a fifth side and a sixth side, the sixth side is closer to the base substrate than the fifth side, and the fifth side is closer to the opening area than the sixth side in the direction parallel to the base substrate; and the second filling structure includes a fifth sidewall facing the fourth side wall and a sixth sidewall facing away from the fourth side wall, the fifth sidewall conforms to a shape of the fourth sidewall, the sixth sidewall includes a seventh side and an eighth side, the eighth side is closer to the base substrate than the seventh side, and the seventh side is further away from the opening area than the eighth side in the direction parallel to the base substrate.
[0013] According to the embodiments, the number of the at least one isolation structure is at least two.
[0014] According to the embodiments, the at least two isolation structures are sequentially arranged around the opening area; and the display substrate further includes: at least one groove formed between two adjacent isolation structures, and the groove is covered by the first inorganic thin film; and adjacent isolation structures are isolated by the groove.
[0015] According to the embodiments, the display substrate further includes an organic protective layer provided on a side of the first sidewall away from opening area.
[0016] According to the embodiments, the display substrate further includes an organic protective layer, the organic protective layer, the first filling structure and the second filling structure are disposed on the same layer.
[0017] According to the embodiments, the display area includes the opening area and an effective display area except the opening area; and the display substrate further includes an array structure layer located in the effective display area.
[0018] According to the embodiments, the display substrate further includes a light emitting structure layer; the light emitting structure layer includes a first portion located in an area surrounded by the at least two isolation structures.
[0019] According to the embodiments, the display substrate further includes a light emitting structure layer; the light emitting structure layer includes a third portion located on a surface of the isolation structure away from the array structure layer.

[0020] According to the embodiments, the display substrate further includes a light emitting structure layer; the light emitting structure layer includes a second portion located on a side close to the effective display area, of one of the at least two isolation structures which is away from the opening area.
[0021] According to the embodiments, the first filling structure is provided on the first side and/or the second side of the isolation structure close to the effective display area in the at least two isolation structures.
[0022] In another aspect, a display device is provided, including the display substrate described above.
[0023] In yet another aspect, a method for manufacturing a display substrate is provided, the display substrate including a display area, and the method includes: forming a base substrate; forming, on the base substrate, at least one isolation structure surrounding the opening area, the isolation structure includes a first sidewall; providing a first filling structure on a side of the first sidewall away from the opening area, the first filling structure includes a second sidewall facing the first sidewall and a third sidewall facing away from the first sidewall; forming a first inorganic thin film disposed between the isolation structure and the filling structure; and forming a second inorganic thin film covering the isolation structure and the first filling structure.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
[0024] The drawings are used to provide a further understanding of the technical solutions of the present disclosure, and constitute a part of the specification. The drawings are used to explain the technical solutions of the present disclosure together with the embodiments of the present application, and do not constitute limitations on the technical solutions of the present disclosure.
[0025] FIG. **1** is a schematic structural top view of an OLED display substrate according to some embodiments of the present disclosure;
[0026] FIG. **2** is a schematic view of the A-A cross-sectional structure in FIG. **1**;
[0027] FIG. **3** is a flowchart of a method for manufacturing a display substrate according to some embodiments of the present disclosure;
[0028] FIG. **4** is a schematic structural view of a display substrate after forming an active layer during a manufacturing process according to some embodiments of the present disclosure;
[0029] FIG. **5** is a schematic structural view of a display substrate after forming a gate electrode during a manufacturing process according to some embodiments of the present disclosure;
[0030] FIG. **6** is a schematic structural view of a display substrate after forming a source electrode and a drain electrode during a manufacturing process according to some embodiments of the present disclosure;
[0031] FIG. **7** is a schematic structural view of a display substrate after forming a first electrode layer during a manufacturing process according to some embodiments of the present disclosure;
[0032] FIG. **8** is a schematic structural view of a display substrate after forming an isolation substrate during a manufacturing process according to some embodiments of the present disclosure;
[0033] FIG. **9** is a schematic structural view of a display substrate after forming a pixel defining layer during a manufacturing process according to some embodiments of the present disclosure;
[0034] FIG. **10** is a schematic structural view of a display substrate after forming a light emitting structure layer during a manufacturing process according to some embodiments of the present disclosure;
[0035] FIG. **11** is a schematic structural view of a display substrate after forming a filling structure during a manufacturing process according to some embodiments of the present disclosure;
[0036] FIG. **12** is a schematic structural view of a display substrate after forming a first inorganic

thin film during a manufacturing process according to some embodiments of the present disclosure;
[0037] FIG. **13** is a schematic structural view of a display substrate after forming a filling structure during a manufacturing process according to some embodiments of the present disclosure; and
[0038] FIG. **14** is a schematic structural view of a display substrate after forming a second inorganic thin film during a manufacturing process according to some embodiments of the present disclosure.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0039] To make the objectives, technical solutions, and advantages of the present disclosure clearer, the embodiments of the present disclosure will be described in detail below with reference to the drawings. It should be noted that the embodiments in the present application and the features in the embodiments may be arbitrarily combined with each other without conflict.

[0040] An flexible OLED display device may be folded or curled like paper. After folding an edge of the flexible display device, narrow border display or even borderless display may be realized, and the screen ratio of the display device is improved. When narrow-border or borderless display is applied to mobile terminal products, it is necessary to set up a mounting hole in the display area of the flexible OLED display device to reserve an installation positions of hardware such as front camera, earpiece, home button or the like on the mobile terminal device.

[0041] In the related art, the OLEDs in the OLED display device are very sensitive to water vapor and oxygen. In order to prevent water and oxygen from intruding into the OLEDs, the OLEDs are generally protected by thin film packaging. When the mounting hole is opened in the display area of the flexible OLED display device, the packaging film is cut off at the edge of the mounting hole, so that the OLEDs around the mounting hole will not be protected by the packaging film, resulting in a severely shortened product life. In order to prevent water and oxygen from intruding into the OLEDs from the periphery of the mounting hole, in the related art, an isolation structure is provided around the mounting hole. During the formation of the OLED substrate, the isolation structure causes the light emitting structure layer of the OLED within an area surrounded by the isolation structure to be disconnected with that outside the area surrounded by the isolation structure. Therefore, when the mounting hole is opened in the area surrounded by the isolation structure, water and oxygen will not invade the light emitting structure layer outside the area surrounded by the isolation structure from the periphery of the mounting hole, ensuring the water and oxygen resistance of the effective display area. However, the arrangement of the isolation structure makes the packaging film around the isolation structure relatively thin, and at the same time, the packaging film generates a stress concentration area around the isolation structure. In the stress concentration area, the packaging film is prone to cracks, which eventually leads to the failure of the packaging film and reduces the reliability of the packaging film in the area around the mounting hole.

[0042] FIG. **1** is a schematic structural top view of an OLED display substrate according to some embodiments of the present disclosure. FIG. **2** is a schematic view of the A-A cross-sectional structure in FIG. **1**. As shown in FIG. **1**, the display substrate has a display area AA. The display area AA includes an opening area **100** and an effective display area **200** located outside the opening area **100**. The opening area **100** is used to open a mounting hole for mounting hardware, such as front camera, earpiece, home button or the like, therefore, the opening area **100** is a non-light emitting area.

[0043] As shown in FIG. **2**, the display substrate includes a base substrate **10**, a thin film transistor **20** provided on the base substrate **10**, and a planarization layer **30** provided on the thin film transistor **20**. The display substrate further includes a first electrode layer **41** disposed on the planarization layer **30**, and the first electrode layer **41** is electrically connected to a drain electrode or a source electrode of the thin film transistor **20** through a via hole. The display substrate further includes an isolation structure **50** disposed on a surface of the planarization layer **30** away from the base substrate **10**, and the isolation structure surrounds the opening area **100**. There may be one or

more isolation structures **50**. For example, as shown in FIGS. **1** and **2**, there are two isolation structures **50**. Two isolation structures **50** are sequentially arranged around the opening area **100**, that is, a first isolation structure **51** surrounds the opening area **100**, and a second isolation structure **52** surrounds the first isolation structure **51**. The cross section of the isolation structure **50** has an inverted trapezoid shape. As shown in FIG. **2**, the cross sections of the first isolation structure **51** and the second isolation structure **52** have inverted trapezoid shapes. Taking the second isolation structure **52** as an example, as shown in FIGS. **1** and **2**, the second isolation structure **52** includes a first side wall **521** facing away from the opening area **100** and a fourth side wall **522** facing to the opening area **100**. The first side wall **521** includes a first side **5211** away from the base substrate **10** and a second side **5212** close to the base substrate **10**. The first side **5211** is further away from the opening area **100** than the second side **5212** in a direction X parallel to the base substrate **10**, that is, the slope angle θ**1** of the first side wall **521** is an acute angle. The fourth side wall **522** includes a fifth side **5221** away from the base substrate **10** and a sixth side **5222** close to the base substrate **10**. The fifth side **5221** is closer to the opening area **100** than the sixth side **5222** in the direction X parallel to the base substrate **10**, that is, the slope angle θ**2** of the fourth side wall **522** is an acute angle. The first isolation structure **51** has a similar structure. The display substrate further includes a pixel defining layer **43** disposed on the first electrode layer **41**, and a light emitting structure layer **42** disposed on the pixel defining layer **43**. Since the cross section of the isolation structure **50** has an inverted trapezoidal shape, the light emitting structure layer **42** is cut off at both sides of the isolation structure **50** when the light emitting structure layer **42** is formed, so that the light emitting structure layer **42** is divided by the isolation structure **50** into a first portion **421** located in the area surrounded by the isolation structure **50** and a second portion **422** located in an area surrounding the isolation structure **50**.
[0044] In the embodiments, the case where the slope angles of both side walls of the isolation structure **50** are acute angles is taken as an example for description. In other embodiments, the isolation structure **50** may have only one side wall with an acute angle of slope. Taking the second isolation structure **52** as an example, the slope angle of one of the first side wall **521** and the fourth side wall **522** of the second isolation structure **52** is an acute angle, and the slope angle of the other is an obtuse angle or a right angle. It may also be achieved that the light emitting structure layer **42** is divided by the isolation structure **50**, so that the first portion **421** located in the area surrounded by the isolation structure and the second portion **422** located in the area surrounding the isolation structure are discontinuous. The light emitting structure layer **42** is disconnected at the side wall, provided with an acute angle of slope, of the isolation structure **50**.
[0045] The display substrate also includes a packaging film substantially covering the entire surface of the base substrate **10**. The packaging film includes an inorganic film **60**. The isolation structure **50**, such as the second isolation structure **52**, has an inverted trapezoidal cross-section. Therefore, the slope angles θ**1** and θ**2** of the two side walls of the second isolation structure **52** are both acute angles, which results in that slope angles β**1** and β**2** of the inorganic thin film **60** on both sides of the second isolation structure **52** are also acute angles. Since the slope angles β**1** and β**2** are acute angles, the vertexes of the slope angles β**1** and β**2** become stress concentration areas. Cracks are prone to occur in the stress concentration area, leading to package failure and reducing the reliability of the packaging film around the opening area.
[0046] In order to improve the reliability of the packaging film around the isolation structure, the embodiments of the present disclosure provide a method for manufacturing a display substrate. The display substrate includes a display area AA. The display area AA is provided with an opening area **100** and an effective display area **200** located outside the opening area **100**. The opening area **100** is used to open a mounting hole to install hardware such as front camera, earpiece, home key or the like. Therefore, the opening area **100** is a non-light emitting area. FIG. **3** is a flowchart of a method for manufacturing a display substrate according to some embodiments of the present disclosure. The manufacturing method includes: [0047] S**1**: providing a base substrate; [0048] S**2**: producing

an array structure layer on the base substrate; [0049] S**3**: forming at least one isolation structure around the opening area on the side of the array structure layer away from the base substrate, the isolation structure having a side wall with an acute angle of slope; and [0050] S**4**: forming a filling structure on a side, where the side wall is provided with an acute angle of slope, of the isolation structure.

[0051] In some embodiments, specifically, steps S**3** and S**4** may be performed as follows.

[0052] In the step S**3**, at least one isolation structure is formed around the opening area on the side of the array structure layer away from the base substrate, the isolation structure includes a first side wall facing away from the opening area. The first side wall includes a first side away from the base substrate and a second side close to the base substrate. The first side is further away from the opening area than the second side in a direction parallel to the base substrate, that is, the slope angle of the first side wall is an acute angle.

[0053] In the step S**4**, a first filling structure is formed on a side of the first side wall away from the opening area, the first filling structure includes a second side wall facing to the first side wall and a third side wall facing away from the first side wall. A shape of the second side wall conforms to a shape of the first side wall. The third side wall includes a third side away from the base substrate and a fourth side close to the base substrate. The third side is closer to the opening area than the fourth side in the direction parallel to the base substrate, that is, the slope angle of the third side wall is an obtuse angle.

[0054] In some embodiments, the isolation structure formed in the step S**3** further includes a fourth side wall facing to the opening area. The fourth side wall includes a fifth side away from the base substrate and a sixth side close to the base substrate. The fifth side is closer to the opening area than the sixth side in the direction parallel to the base substrate, that is, the slope angle of the fourth side wall is an acute angle. The step S**4** further includes forming a second filling structure on a side of the fourth side wall close to the opening area, the second filling structure includes a fifth side wall facing to the fourth side wall and a sixth side wall facing away from the fourth side wall. A shape of the fifth side wall conforms to a shape of the fourth side wall. The sixth side wall includes a seventh side away from the base substrate and an eighth side close to the base substrate. The seventh side is further away from the opening area than the eighth side in the direction parallel to the base substrate, that is, the slope angle of the sixth side wall is an obtuse angle.

[0055] In the following embodiments, it is explained as an example that the slope angles of the first side wall and the fourth side wall of the isolation structure are both acute angles.

[0056] In the method for manufacturing a display substrate provided by some embodiments of the present disclosure, a filling structure is formed on both sides of the isolation structure, that is, a first filling structure and a second filling structure. The filling structure is used to eliminate the stress concentration areas of the inorganic thin film, thereby avoiding the formation of stress concentration areas on both sides of the isolation structure by the inorganic film, which avoids the inorganic thin film from generating cracks on both sides of the isolation structure. Meanwhile, the uniformity of the thickness of the inorganic thin film is ensured, the packaging performance of the inorganic thin film is ensured, the packaging failure is avoided, and the reliability of the packaging film on both sides of the isolation structure (i.e., around the opening area) is improved.

[0057] The technical content of the present disclosure will be described in detail below through specific embodiments. Among them, the “patterning process” mentioned in the embodiments includes processes such as coating photoresist, mask exposure, development, etching, and stripping photoresist, which are existing mature producing processes. The deposition may use known processes such as sputtering, evaporation, chemical vapor deposition, the coating may use a known coating process, and the etching may use a known etching manner, which are not specifically limited herein.

[0058] Some embodiments of the present disclosure provide a method for manufacturing a display substrate. The display substrate includes a display area, and an opening area is provided in the display area. The method includes: [0059] S**1**: provide a base substrate; [0060] S**2**: producing an array structure layer on the base substrate; [0061] S**3**: forming at least one isolation structure around the opening area on the side of the array structure layer away from the base substrate, the isolation structure has two side walls, each of which is provided with an acute angle of slope, namely the first side wall and the fourth side wall; and [0062] S**4**: forming a filling structure on both sides of the isolation structure, namely the first filling structure and the second filling structure, which are used to eliminate the stress concentration areas of the inorganic thin film formed on the filling structure.

[0063] In the embodiments, before the step S**4**, the manufacturing method further includes forming a pixel defining layer and a light emitting structure layer; after the step S**4**, it further includes forming a first inorganic film covering the filling structure and the isolation structure.

[0064] A top gate type TFT is taken as an example to describe in detail a method for manufacturing a display substrate of some embodiments of the present disclosure.

[0065] In the step S**1**, a base substrate is provided.

[0066] In the step S**2**, an array structure layer is produced on the base substrate.

[0067] Specifically, FIG. **4** is a schematic structural view of the display substrate after forming an active layer during a manufacturing process according to some embodiments of the present disclosure. A barrier layer **76**, a buffer layer **73**, and an active layer **21** are sequentially formed on the base substrate **10**. As shown in FIG. **4**, the barrier layer **76** and the buffer layer **73** are sequentially formed on the base substrate **10** by using a chemical vapor deposition method. The active layer **21** is formed on the buffer layer **73** through a patterning process. The base substrate **10** may be a flexible substrate, and a material thereof may include polyimide. The material of the barrier layer **76** and the buffer layer **73** may include one or more of silicon nitride, silicon oxide, and silicon oxynitride. The active layer may be made of a material of amorphous silicon, polycrystalline silicon, or microcrystalline silicon, or a metal oxide material, and the metal oxide material may be indium gallium zinc oxide (IGZO) or indium tin zinc oxide (ITZO).

[0068] FIG. **5** is a schematic structural view of the display substrate after forming a gate electrode during a manufacturing process according to some embodiments of the present disclosure. A first insulating layer **74** is formed on the active layer **21**, and a gate electrode **22** is formed on the first insulating layer **74**. As shown in FIG. **5**, the first insulating layer **74** may be formed by a method commonly used in the art, such as a chemical vapor deposition method. The gate electrode **22** is formed by a patterning process. The material of the first insulating layer **74** may include one or more of silicon nitride, silicon oxide, and silicon oxynitride, and the material of the gate electrode **22** may include one or more of platinum Pt, ruthenium Ru, gold Au, argentum Ag, molybdenum Mo, Chromium Cr, aluminum Al, tantalum Ta, titanium Ti, wolfram W and other metals.

[0069] FIG. **6** is a schematic structural view of the display substrate after forming a source electrode and a drain electrode during a manufacturing process according to some embodiments of the present disclosure. A second insulating layer **75** is formed on the gate electrode **22**, and a source electrode **23** and a drain electrode **24** are formed on the second insulating layer **75**. The source electrode **23** is electrically connected to the active layer **21** through a first via hole penetrating the second insulating layer **75** and the first insulating layer **74**, and the drain electrode **24** is electrically connected to the active layer **21** through a second via hole penetrating the second insulating layer **75** and the first insulating layer **74**, as shown in FIG. **6**. The patterns of the source electrode **23** and the drain electrode **24** may be formed on the second insulating layer **75** by using a patterning process. The materials of the source electrode and the drain electrode may be the same, and may include one or more of platinum Pt, ruthenium Ru, gold Au, argentum Ag, molybdenum Mo, Chromium Cr, aluminum Al, tantalum Ta, titanium Ti, wolfram W and other metals.

[0070] FIG. **7** is a schematic structural view of the display substrate after forming a first electrode layer during a manufacturing process according to some embodiments of the present disclosure. A planarization layer **30** substantially covering the entire surface of the base substrate **10** is formed on the source electrode **23** and the drain electrode **24**, and a first electrode layer **41** is formed on the planarization layer **30**. The first electrode layer **41** is electrically connected to the source electrode **23** through a third via hole penetrating the planarization layer **30**, as shown in FIG. **7**. In the embodiments, the first electrode layer **41** serves as an anode layer of the OLED pixel. It is easy to understand that, in other embodiments, the first electrode layer **41** may also be configured to be electrically connected to the drain electrode **24**.

[0071] The aforementioned array structure layer **80** includes one or more of the barrier layer **76**, the buffer layer **73**, the active layer **21**, the first insulating layer **74**, the gate electrode **22**, the second insulating layer **75**, the source electrode **23**, the drain electrode **24**, the planarization layer **30** and the first electrode layers **41**.

[0072] In the step S**3**, at least one isolation structure around the opening area is formed on the side of the array structure layer away from the base substrate, and the isolation structure has two side walls, each of which is provided with an acute angle of slope, namely the first side wall and the fourth side wall.

[0073] Specifically, FIG. **8** is a schematic structural view of the display substrate after forming the isolation structure during a manufacturing process according to some embodiments of the present disclosure. As shown in FIG. **8**, at least one isolation structure **50** around the opening area **100** is formed on a top surface (i.e., a surface away from the base substrate **10**) of the planarization layer **30**. The isolation structure **50** has two side walls, each of which is provided with an acute angle of slope. In the embodiments, there are two isolation structures **50**. Two isolation structures **50** are sequentially arranged around the opening area **100**, that is, the first isolation structure **51** is arranged around the opening area **100**, and the second isolation structure **52** is arranged around the first isolation structure **51**. The cross section of the isolation structure **50** has an inverted trapezoid shape.

[0074] Taking the second isolation structure **52** as an example, as shown in FIGS. **1** and **8**, the second isolation structure **52** includes a first side wall **521** facing away from the opening area **100** and a fourth side wall **522** facing to the opening area **100**. The first side wall **521** includes a first side **5211** away from the base substrate **10** and a second side **5212** close to the base substrate **10**. The first side **5211** is further away from the opening area **100** than the second side **5212** in a direction X parallel to the base substrate **10**, that is, the slope angle θ**1** of the first side wall **521** is an acute angle. The fourth side wall **522** includes a fifth side **5221** away from the base substrate **10** and a sixth side **5222** close to the base substrate **10**. The fifth side **5221** is closer to the opening area **100** than the sixth side **5222** in the direction X parallel to the base substrate **10**, that is, the slope angle θ**2** of the fourth side wall **522** is an acute angle. The first isolation structure **51** has a similar structure. Therefore, the slope angles θ**1** and θ**2** of the side walls of the isolation structure **50** are both acute angles. In the embodiments, the isolation structure **50** has a circular ring shape. It is easy to understand that the isolation structure **50** may also have a polygonal shape, as long as the isolation structure **50** has a closed loop shape surrounding the opening area **100**. In the embodiments, the material of the isolation structure **50** may include a negative photoresist. A negative photoresist film may be coated on the upper surface of the planarization layer **30**, and then a pattern of the isolation structure **50** may be formed by method of exposure and development.

[0075] Between step S**3** and step S**4**, the manufacturing method of the display substrate further includes: forming a pixel defining layer on the first electrode layer.

[0076] Specifically, FIG. **9** is a schematic structural view of the display substrate after forming the pixel defining layer during a manufacturing process according to some embodiments of the present disclosure. As shown in FIG. **9**, in the effective display area **200**, the pixel defining layer **43** is formed on the first electrode layer **41**. In general, a cross-sectional shape of the pixel defining layer **43** has a positive trapezoid shape. In the embodiments, the cross-sectional shape of the isolation structure **50** is an inverted trapezoid, and the cross-sectional shape of the pixel defining layer **43** is a positive trapezoid. At the same time, the material of the isolation structure **50** and the material of the pixel defining layer **43** usually include organic materials, and the isolation structure and the pixel defining layer are formed by exposure and development. In order to form the pixel defining layer **43** without affecting the isolation structure that has been formed, the photoreaction polarity of the material of the pixel defining layer **43** is opposite to the photoreaction polarity of the material of the isolation structure. In the embodiments, the material of the isolation structure **50** includes a negative photoresist, then the material of the pixel defining layer **43** includes a positive photoresist, so as to ensure that the formed Isolation structure will not be affected while forming the pixel defining layer **43**.

[0077] It is easy to understand that in actual implementation, the order of the step of forming the isolation structure **50** and the step of forming the pixel defining layer **43** may be interchanged.

[0078] Between step S**3** and step S**4**, the manufacturing method of the display substrate further includes: forming a light emitting structure layer on the isolation structure and the pixel defining layer.

[0079] Specifically, FIG. **10** is a schematic view of the display substrate after forming the light emitting structure layer during a manufacturing process according to some embodiments of the present disclosure. As shown in FIG. **10**, in general, the light emitting structure layer **42** is formed on the isolation structure and the pixel defining layer **43** by an evaporation method. The slope angle of at least one side wall of the isolation structure **50** is an acute angle. In the embodiments, for the isolation structure **50**, taking the second isolation structure **52** as an example, it has a first side wall **521** and a fourth side wall **52** both with an acute angle of slope, the first isolation structure **51** has a similar structure. As a result, when the light emitting structure layer **42** is formed, the light emitting structure layer **42** is divided by the isolation structure **50**, and the light emitting structure layer **42** is divided by the isolation structure **50** into a first portion **421** located in the area surrounded by the isolation structure **50**, a second portion **422** located in the area surrounding the isolation structure **50**, and a third portion **423** located on the upper surface of the isolation structure **50**. The first portion **421**, the second portion **422**, and the third portion **423** are disconnected from each other. It is easily understood that the light emitting structure layer **42** may include, for example, a hole injection layer, a hole transport layer, a light emitting layer, an electron transport layer, and an electron injection layer.

[0080] In the step S**4**, a filling structure which is in contact with both side walls of the isolation structure and is used to eliminate the stress concentration areas of the inorganic thin film formed thereon is formed, and the slope angle of the side wall, for carrying the inorganic thin film, of the filling structure is an obtuse angle.

[0081] Specifically, FIG. **11** is a schematic view of the display substrate after forming the filling structures during a manufacturing process of according to some embodiments of the present disclosure. As shown in FIG. **11**, the filling structure **70** on both sides of the isolation structure **50** is formed on the light emitting structure layer **42**, and the filling structure **70** is used to eliminate the stress concentration areas of the inorganic thin film subsequently formed thereon. In the embodiments, the second isolation structure **52** is taken as an example for specific description. The cross section of the second isolation structure **52** is inverted trapezoid, in other words, the slope angles of both side walls of the second isolation structure **52** are acute angles, then it is necessary to form the filling structure **70** in contact with the side wall of the structure **52** on both sides of the second isolation structure **52**. The filling structure **70** includes a first filling structure **71** and a second filling structure **72**.

[0082] Specifically, the first filling structure **71** is formed on a side of the first side wall **521** of the second isolation structure **52** away from the opening area **100**. The first filling structure **71** includes a second side wall **711** facing to the first side wall **521** and a third side wall **712** facing away from the first side wall **521**. The shape of the second side wall **711** conforms to the shape of the first side wall **521**. In the embodiments, the second side wall **711** is in contact with the first side wall **521**. The third side wall **712** includes a third side **7121** away from the base substrate **10** and a fourth side

7122 close to the base substrate **10**. The third side **7121** is closer to the opening area **100** than the fourth side **7122** in the direction X parallel to the base substrate **10**, that is, the slope angle λ**1** of the third side wall **712** is an obtuse angle. The second filling structure **72** is formed on a side of the fourth side wall **522** of the second isolation structure **52** close to the opening area **100**. The second filling structure **72** includes a fifth side wall **721** facing to the fourth side wall **522** and a sixth side wall **722** facing away from the fourth side. The shape of the fifth side wall **721** conforms to the shape of the fourth side wall **522**. In the embodiments, the fifth side wall **721** is in contact with the fourth side wall **522**. The sixth side wall **722** includes a seventh side **7221** away from the base substrate **10** and an eighth side **7222** close to the base substrate **10**. The seventh side **7221** is further away from the opening area **100** than the eighth side **7222** in the direction X parallel to the base substrate **10**, that is, the slope angle λ**2** of the sixth side wall **722** is an obtuse angle.
[0083] After the filling structure **70** is formed, when the inorganic thin film on the filling structure **70** is subsequently formed, the side walls of the second isolation structure **52** no longer carry the inorganic film, but is exposed by the exposed side wall of the filling structure **70**, such as the first filling structure **71**. The third sidewall **712** and the sixth sidewall **722** of the second filling structure **72** carry an inorganic thin film.
[0084] After the filling structure **70** is formed, when the inorganic thin film on the filling structure **70** is subsequently formed, the side wall of the second isolation structure **52** no longer carries the inorganic film, but exposed side walls of the filling structure **70**, such as the third side wall **712** of the first filling structure **71** and the sixth side wall **722** of the second filling structure **72**, carry the inorganic thin film.
[0085] The process of forming the filling structure **70** may include: forming an organic material layer on both sides of the isolation structure **50** on the light emitting structure layer **42** using an inkjet printing method; and patterning the organic material layer (e.g., ashing) to form the pattern of the filling structure **70** contacting both side walls of the isolation structure **50**. The slope angle of the side wall of the filling structure **70** for carrying the inorganic thin film is an obtuse angle. In the embodiments, the filling structure **70** is in direct contact with the both side walls, each of which is provided with an acute angle of slope, of the isolation structure **50**. The side wall of the filling structure **70** for carrying the inorganic thin film is an exposed sidewall of the filling structure **70**, and the slope angle of the exposed sidewall is an obtuse angle. Therefore, the filling structure **70** may eliminate the stress concentration area of the inorganic thin film subsequently formed thereon.
[0086] When the organic material is printed on the light emitting structure layer **42** using an inkjet printing method, the organic material liquid will flow and diffuse, so that it can be sufficiently filled at both side walls of the isolation structure **50**. In the embodiments, the material of the filling structure **70** may include one or more of PET (polyethylene terephthalate), PEN (polyethylene naphthalate), PI (polyimide), PVC (polyvinyl chloride), PTFE (polytetrafluoroethylene), photoresist, epoxy resin, etc.
[0087] After step S**4**, the manufacturing method of the display substrate further includes: forming a first inorganic thin film covering the filling structure, specifically including:
[0088] FIG. **12** is a schematic structural view of a display substrate after forming a first inorganic thin film during a manufacturing process according to some embodiments of the present disclosure. As shown in FIG. **12**, after forming the filling structure **70**, the first inorganic thin film **61** covering the filling structure **70** and the isolation structure **50** is formed. The first inorganic thin film **61** may be formed by a chemical vapor deposition method.
[0089] In the embodiments, under the action of the filling structure **70**, the slope angles of the side walls for supporting the first inorganic thin film on both sides of the isolation structure **50** (i.e., the exposed side walls of the filling structure **70**) are obtuse angles. The slope angles of the first inorganic thin film **61** on both sides of the isolation structure **50** are also obtuse angles, so that the stress concentration areas formed by the first inorganic thin film **61** on both sides of the isolation structure **50** may be eliminated. In this way, no cracks are formed on the first inorganic thin film **61**

on both sides of the isolation structure **50**, thereby ensuring the film thickness uniformity of the first inorganic thin film **61**, ensuring the packaging performance of the first inorganic thin film **61**, avoiding the packaging failure, and improving the reliability of the packaging film on both sides of the isolation structure (i.e., around the opening area).

[0090] It is easily understood that some embodiments of the present disclosure may further include: forming an organic protective layer on the first inorganic thin film **61**; and forming a second inorganic thin film on the organic protective layer. The organic protective layer and the second inorganic thin film may be formed by methods known in the art.

[0091] In the above embodiments, the thin film transistors on the array structure layer are top-gate thin film transistors. It is easy to understand that the manufacturing method of the display substrate proposed by some embodiments of the present disclosure is also applicable to bottom-gate thin film transistors.

[0092] Some embodiments of the present disclosure provide a method for manufacturing a display substrate. The display substrate includes a display area AA, and an opening area **100** is provided in the display area AA. The manufacturing method includes: [0093] S**1**: provide a substrate; [0094] S**2**: producing an array structure layer on the base substrate; [0095] S**3**: forming at least one isolation structure around the opening area on the side of the array structure layer away from the base substrate, the isolation structure has two side walls, each of which is provided with an acute angle of slope, namely a first side wall and a fourth side wall. [0096] S**4**: forming a filling structure on both sides of the isolation structure, namely, the first filling structure and the second filling structure, which are used to eliminate the stress concentration area of the inorganic thin film formed on the filling structure.

[0097] In the embodiments, before the step S**4**, the manufacturing method further includes forming a pixel defining layer and a light emitting structure layer, and forming a first inorganic thin film covering the isolation structure. In the step S**4**, the organic protective layer is also formed in an area on a side of the isolation structure away from the opening area **100**, for example, the effective display area **200**. After the step S**4**, the manufacturing method further includes forming a second inorganic thin film covering both the filling structure and the isolation structure.

[0098] The manufacturing method of the display substrate provided by some embodiments of the present disclosure will be described in detail below by taking a top-gate TFT as an example.

[0099] In the embodiments, the steps S**1**-S**3** and the steps of forming the pixel defining layer and the light emitting structure layer are the same as those in the previous embodiments, and will not be repeated here.

[0100] Between the step S**3** and the step S**4**, the manufacturing method of the display substrate further includes: forming a first inorganic thin film covering the isolation structure.

[0101] Specifically, referring to FIG. **2**, a first inorganic thin film **61** covering the isolation structure **50** is formed on the light emitting structure layer **42**, the first inorganic thin film **61** substantially covers the entire upper surface of the base substrate **10**, that is, the first inorganic thin film **61** also covers an outer surface of the isolation structure **50**. The first inorganic thin film **61** may be formed on the light emitting structure layer **42** using a chemical vapor deposition method.

[0102] In the step S**4**, a filling structure which is in contact with the first inorganic thin film and is used to eliminate the stress concentration area of the second inorganic thin film subsequently formed thereon is formed on both sides of the isolation structure. The slope angle of the side wall of the filling structure which is used to carry the second inorganic thin film is an obtuse angle.

[0103] Specifically, FIG. **13** is a schematic structural view of a display substrate after forming a filling structure during a manufacturing process according to some embodiments of the present disclosure. The process of forming the filling structure may include: forming an organic material layer filling both sides of the isolation structure **50** on the first inorganic thin film **61** using an inkjet printing method; patterning the organic material layer to form an pattern of the filling structure **70** which is in contact with the two side walls of the isolation structure **50** through the first inorganic thin film **61**, the filling structure **70** includes a first filling structure **71** and a second filling structure **72**.

[0104] Specifically, a first filling structure **71** is formed on a side of the first side wall **521** of the second isolation structure **52** away from the opening area **100**. The first filling structure **71** includes a second side wall **711** facing to the first side wall **521** and a third side wall **712** facing away from the first side wall **521**. The shape of the second side wall **711** conforms to the shape of the first side wall **521**. In the embodiments, the second side wall **711** is in contact with the first inorganic thin film **61**. The third side wall **712** includes a third side **7121** away from the base substrate **10** and a fourth side **7122** close to the base substrate **10**. The third side **7121** is closer to the opening area **100** than the fourth side **7122** in the direction X parallel to the base substrate **10**, that is, the slope angle Al of the third side wall **712** is an obtuse angle. A second filling structure **72** is formed on the side of the fourth side wall **522** of the second isolation structure **52** close to the opening area **100**. The second filling structure **72** includes a fifth side wall **721** facing to the fourth side wall **522** and a sixth side wall **722** facing away from the fourth side wall **522**. The shape of the fifth side wall **721** conforms to the shape of the fourth side wall **522**. In the embodiments, the fifth side wall **721** contacts the first inorganic thin film **61**. The sixth side wall **722** includes a seventh side **7221** away from the base substrate **10** and an eighth side **7222** close to the base substrate **10**. The seventh side **7221** is further away from the opening area **100** than the eighth side **7222** in the direction X parallel to the base substrate **10**, that is, the slope angle λ**2** of the sixth side wall **722** is an obtuse angle.

[0105] The slope angles of the side walls of the filling structure **70** for carrying the second inorganic thin film to be formed are obtuse angles. Therefore, the filling structure **70** may eliminate the stress concentration area of the second inorganic thin film formed subsequently thereon. In the embodiments, the formed organic material layer covers the entire upper surface of the substrate. Therefore, when the organic material layer is patterned to form the filling structure **70**, the pattern of the organic protective layer **63** may be simultaneously formed. In the embodiments, the filling structure **70** and the organic protective layer **63** are formed by the same process. The organic protective layer **63** may play a role in planarization, and may also reduce the stress of the inorganic thin film in contact therewith.

[0106] When the organic material is printed on the first inorganic thin film **61** by the inkjet printing method, the organic material liquid will flow and diffuse, so that it can be sufficiently filled at both sides of the isolation structure **50**. In the embodiments, the material of the filling structure **70** may include one or more of PET (polyethylene terephthalate), PEN (polyethylene naphthalate), PI (polyimide), PVC (polyvinyl chloride), PTFE (polytetrafluoroethylene), photoresist, epoxy resin, etc.

[0107] As shown in FIG. **13**, the filling structure **70** located on both sides of the isolation structure **50** is formed on the first inorganic thin film **61**, and the filling structure is used to eliminate the stress concentration area of the second inorganic thin film subsequently formed thereon. Specifically, the filling structure **70** is formed at both side walls of the isolation structure **50**, where the slope angle is an acute angle. The slope angle of the side wall of the filling structure **70** for supporting the second inorganic thin film formed thereon (i.e., the exposed side wall of the filling structure **70**, for example, the third side wall **712** of the first filling structure **71** and the sixth side wall **722** of the second filling structure **72**) is an obtuse angle, so that the filling structure **70** may eliminate the stress concentration area of the second inorganic thin film subsequently formed thereon. In the embodiments, the second isolation structure **52** is taken as an example for specific description. The cross section of the second isolation structure **52** is inverted trapezoid, that is to say, the slope angles of the side walls of the second isolation structure **52** are both acute angles, then it is necessary to form filling structure **70** on both sides of the second isolation structure **52** respectively. After the filling structure **70** is formed, when the second inorganic thin film for packaging is subsequently formed, the two side walls of the second isolation structure **52** no longer carry the second inorganic thin film, but the exposed side wall of the filling structure **70** carries the second inorganic thin film.

[0108] After the step S4, the manufacturing method of the display substrate further includes: forming a second inorganic thin film covering the filling structure.

[0109] Specifically, FIG. **14** is a schematic structural view of the display substrate after forming a second inorganic thin film during a manufacturing process according to some embodiments of the present disclosure. As shown in FIG. **14**, the second inorganic thin film **62** is formed on the entire surface of the base substrate **10** on which the filling structure **70** and the organic protective layer **63** are formed. The second inorganic thin film **62** may be formed by a chemical vapor deposition method.

[0110] In the embodiments, under the action of the filling structure **70**, the slope angles of the side walls for supporting the second inorganic thin film on both sides of the isolation structure **50** (i.e., the exposed side wall of the filling structure **70**) are obtuse angles, thus, the slope angles of the second inorganic film **62** on both sides of the isolation structure **50** are also obtuse angles, so that the stress concentration areas formed by the second inorganic film **62** on both sides of the isolation structure **50** may be eliminated. In this way, no cracks are formed on the second inorganic film **62** on both sides of the isolation structure **50**, thereby ensuring the film thickness uniformity of the second inorganic film **62**, ensuring the packaging performance of the second inorganic film **62**, avoiding the package failure, and improving the reliability of the packaging film on both sides of the isolation structure **50** (i.e., around the opening area **100**).

[0111] In the above embodiments, the thin film transistors on the array structure layer are top-gate thin film transistors. It is easy to understand that the manufacturing methods of the display substrate proposed by some embodiments of the present disclosure are also applicable to bottom-gate thin film transistors.

[0112] Some embodiments of the present disclosure provide a display substrate. As shown in FIGS. **1** and **12**, the display substrate includes a display area AA. The display area AA is provided with an opening area **100** and an effective display area **200** except the opening area **100**. The display substrate includes: a base substrate **10**, and an array structure layer **80** disposed on the base substrate **10**; and at least one isolation structure **50** disposed on a side of the array structure layer **80** away from the base substrate **10** and around the opening area **100**. The isolation structure **50** has a side wall with an acute angle of slope. In the embodiments, the isolation structure **50** has a shape of an inverted trapezoid, and the slope angles of both side walls thereof are acute angles.

[0113] The display substrate further includes a filling structure **70** disposed on both sides of the isolation structure **50** for eliminating the stress concentration area of the inorganic thin film formed thereon, and the slope angle of the side wall of the filling structure **70** for carrying the inorganic thin film is an obtuse angle.

[0114] The array structure layer **80** may include a thin film transistor **20** disposed on the base substrate **10**, a planarization layer **30** disposed on the thin film transistor **20**, and a first electrode layer **41** disposed on the planarization layer **30**. The isolation structure **50** is disposed on a surface of the planarization layer **30** away from the base substrate **10**. It is easy to understand that the thin film transistor **20** and the first electrode layer **41** are both disposed in an area (i.e., the effective display area **200**) on a side of the isolation structure **50** away from the opening area **100**.

[0115] The display substrate further includes a pixel defining layer **43** disposed on the first electrode layer **41**, and a light emitting structure layer **42** disposed on the isolation structure **50** and the pixel defining layer **43**. The light emitting structure layer **42** is divided by the isolation structure **50** into a first portion **421** located in an area surrounded by the isolation structure **50** and a second portion **422** located in an area surrounding the isolation structure **50**. The first portion **421** and the second portion **422** are disconnected from each other. The filling structure **70** is disposed on the light emitting structure layer **42**.

[0116] Further, the display substrate further includes a first inorganic thin film **61** covering both the filling structure **70** and the isolation structure **50**.

[0117] The display substrate may further include an organic protective layer disposed on the first inorganic thin film and a second inorganic thin film disposed on the organic protective layer.
[0118] Some embodiments of the present disclosure provide a display substrate. As shown in FIGS. **1** and **14**, the display substrate includes a display area AA, and an opening area **100** is provided in the display area and an effective display area **200** except the opening area **100**. The display substrate includes: a base substrate **10**, an array structure layer **80** disposed on the base substrate **10**; and at least one isolation structure **50** disposed on a side of the array structure layer **80** away from the base substrate **10** and around the opening area **100**. The isolation structure **50** has a side wall with an acute angle of slope. In the embodiments, the isolation structure **50** has a shape of an inverted trapezoid, and the slope angles of both side walls thereof are acute angles.
[0119] The display substrate further includes a filling structure **70** disposed on both sides of the isolation structure **50** for eliminating the stress concentration area of the inorganic thin film formed thereon. The slope angle of the side wall of the filling structure **70** for carrying the inorganic thin film is an obtuse angle.
[0120] The array structure layer **80** may include a thin film transistor **20** disposed on the base substrate **10**, a planarization layer **30** disposed on the thin film transistor **20**, and a first electrode layer **41** disposed on the planarization layer **30**. The isolation structure **50** is provided on a surface of the planarization layer **30** away from the base substrate **10**. It is easy to understand that the thin film transistor **20** and the first electrode layer **41** are both disposed in an area (i.e., the effective display area **200**) on a side of the isolation structure **50** away from the opening area **100**.
[0121] The display substrate further includes a pixel defining layer **43** disposed on the first electrode layer **41**, and a light emitting structure layer **42** disposed on the isolation structure **50** and the pixel defining layer **43**. The light emitting structure layer **42** is divided by the isolation structure **50** into a first portion **421** located in an area surrounded by the isolation structure **50** and a second portion **422** located in an area surrounding the isolation structure **50**. The first portion **421** and the second portion **422** are disconnected from each other.
[0122] Further, the display substrate further includes a first inorganic thin film **61** covering the isolation structure **50**. The filling structure **70** is disposed on the first inorganic thin film **61**, and the filling structure **70** contacts the first side wall of the isolation structure **50** through the first inorganic thin film **61**.
[0123] The display substrate may further include an organic protective layer **63** disposed on the first inorganic thin film **61**, and a second inorganic thin film **62** covering the filling structure **70**, the isolation structure **50**, and the organic protective layer **63**. The organic protective layer **63** and the filling structure **70** are formed by the same process. The organic protective layer **63** is disposed in the effective display area **200**, which may play a role in planarization, and may also reduce the stress of the inorganic film layer in contact therewith.
[0124] Based on the inventive concepts of the foregoing embodiments, some embodiments of the present disclosure also provide a display device including the display substrate of the foregoing embodiments. The display device may be any product or component with a display function, such as a mobile phone, a tablet computer, a television, a display, a notebook computer, a digital photo frame, a navigator, and the like.
[0125] In the description of the embodiments of the present disclosure, it should be understood that the orientations or positional relationships indicated by the terms “upper”, “lower”, “front”, “rear”, “top”, “bottom”, “inner”, “outer”, etc. are based on the orientations or positional relationships shown in the drawings, and is merely for the convenience of describing the present disclosure and simplifying the description, rather than indicating or implying that the device or element referred to must have specific orientations, or be constructed and operated in specific orientations, and therefore they may not be construed as limitations of the present disclosure
[0126] In the description of the embodiments of the present disclosure, it should be noted that, unless otherwise clearly specified and limited, the term “contact” should be understood in a broad

sense, for example, it may be directly connected or indirectly contacted through an intermediate medium. For those skilled in the art, the specific meaning of the above terms in the present disclosure may be understood in specific situations.
[0127] Although the embodiments disclosed in the present disclosure are as described above, the described contents are only the embodiments adopted to facilitate understanding of the present disclosure, and are not intended to limit the present disclosure. Any person skilled in the art to which this disclosure belongs may make any modifications and changes in the form and details of implementation without departing from the spirit and scope disclosed in the present disclosure, but the patent protection scope of the present disclosure still needs to be subject to the scope defined in the appended claims.

Claims

1. (canceled)
2. A display substrate having a display area, an opening area being provided in the display area, wherein the display substrate comprises: a base substrate; at least one isolation structure provided on the base substrate and surrounding the opening area, wherein the isolation structure comprises a first sidewall; a first filling structure provided on a side of the first sidewall away from the opening area, wherein the first filling structure comprises a second sidewall facing the first sidewall and a third sidewall facing away from the first sidewall; a first inorganic thin film disposed between the isolation structure and the first filling structure; a second inorganic thin film covering the isolation structure and the first filling structure; and a second filling structure, wherein the first filling structure and the second filling structure are spaced from each other, and at least one contact portion between the first inorganic thin film and the second inorganic thin film is located between adjacent first filling structure and second filling structure, wherein the isolation structure further comprises a fourth sidewall facing the opening area, the fourth sidewall comprises a fifth side and a sixth side, the sixth side is closer to the base substrate than the fifth side, and the fifth side is closer to the opening area than the sixth side in the direction parallel to the base substrate; and wherein the second filling structure comprises a fifth sidewall facing the fourth side wall and a sixth sidewall facing away from the fourth side wall, the fifth sidewall conforms to a shape of the fourth sidewall, the sixth sidewall comprises a seventh side and an eighth side, the eighth side is closer to the base substrate than the seventh side, and the seventh side is further away from the opening area than the eighth side in the direction parallel to the base substrate.
3. The display substrate according to claim 2, wherein the second inorganic thin film spaces the first filling structure from the second filling structure that are adjacent to each other.
4. The display substrate according to claim 2, wherein a slope angle of a sidewall of any one of the first filling structure and the second filling structure which are configured to carry the second inorganic thin film is an obtuse angle.
5. The display substrate according to claim 2, wherein a height of the isolation structure in a direction perpendicular to a direction of the display substrate, and a height of any one of the first filling structure and the second filling structure in the direction perpendicular to the direction of the display substrate are higher than a height of a pixel defining layer in the direction perpendicular to the direction of the display substrate.
6. The display substrate according to claim 2, wherein a height of each of the first filling structure and the second filling structure is less than or equal to a height of the isolation structure, and the height is a size along a direction perpendicular to the display substrate.
7. The display substrate according to claim 2, wherein the second inorganic thin film is located on a side of the first inorganic thin film away from the isolation structure.
8. The display substrate according to claim 2, wherein the first sidewall comprises a first side and a second side, the second side is closer to the base substrate than the first side, and the first side is

further away from the opening area than the second side in a direction parallel to the base substrate; and wherein the second sidewall conforms to a shape of the first sidewall, the third sidewall comprises a third side and a fourth side, the fourth side is closer to the base substrate than the third side, and the third side is closer to the opening area than the fourth side in the direction parallel to the base substrate.

9. The display substrate according to claim 2, wherein the number of the at least one isolation structure is at least two.

10. The display substrate according to claim 9, wherein the at least two isolation structures are sequentially arranged around the opening area; and wherein the display substrate further comprises: at least one groove formed between two adjacent isolation structures, and the groove is covered by the first inorganic thin film; and wherein adjacent isolation structures are isolated by the groove.

11. The display substrate according to claim 2, further comprising an organic protective layer provided on a side of the first sidewall away from opening area.

12. The display substrate according to claim 2, further comprising an organic protective layer, wherein the organic protective layer, the first filling structure and the second filling structure are disposed on the same layer.

13. The display substrate according to claim 9, wherein the display area comprises the opening area and an effective display area except the opening area; and wherein the display substrate further comprises an array structure layer located in the effective display area.

14. The display substrate according to claim 13, further comprising a light emitting structure layer; wherein the light emitting structure layer comprises a first portion located in an area surrounded by the at least two isolation structures.

15. The display substrate according to claim 13, further comprising a light emitting structure layer; wherein the light emitting structure layer comprises a third portion located on a surface of the isolation structure away from the array structure layer.

16. The display substrate according to claim 13, further comprising a light emitting structure layer; wherein the light emitting structure layer comprises a second portion located on a side close to the effective display area, of one of the at least two isolation structures which is away from the opening area.

17. The display substrate according to claim 13, wherein the first filling structure is provided on the first side and/or the second side of the isolation structure close to the effective display area in the at least two isolation structures.

18. A display device, comprising the display substrate according to claim **1**.