Doc Code: ECOMM.AUTH/ECOMM.WTDW
Doc Description: Internet Communications Authorized/Internet Communications Authorization Withdrawn

PTO/SB/439 (11-15)

AUTHORIZATION FOR INTERNET COMMUNICATIONS IN A PATENT APPLICATION OR REQUEST TO WITHDRAW AUTHORIZATION FOR INTERNET COMMUNICATIONS		
	Application No.	
	Filing Date	
	First Named Inventor	Zhou, Jing
	Art Unit	
	Examiner Name	
	Practitioner Docket No.	TP204027-US

To: Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

I. To authorize permission for Internet Communications.

☑ Recognizing that Internet communications are not secure, I hereby authorize the USPTO to communicate with the undersigned and practitioners in accordance with 37 CFR 1.33 and 37 CFR 1.34 concerning any subject matter of this application via video conferencing, instant messaging, or electronic mail. I understand that a copy of these communications will be made of record in the application file. (MPEP 502.03)

II. To withdraw authorization for Internet Communications.

☐ The authorization given on _____, to the USPTO to communicate with the undersigned and any practitioner in accordance with 37 CFR 1.33 and 37 CFR 1.34 concerning any subject matter of this application via Internet communications such as video conferencing, instant messaging, or electronic mail is hereby withdrawn. I understand that the withdrawal is effective when approved rather than when received.

I am the

☐ applicant.

☑ attorney or agent of record. Registration number 43325.

☐ attorney or agent acting under 37 CFR 1.34. Registration number _____.

/Wei Te Chung/ — Signature

06/29/2021 — Date

Wei Te Chung — Typed or printed name

(408) 253-9926 — Telephone Number

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Juristic entities must be represented by a patent practitioner (see 37 CFR 1.31, which is applicable to any paper filed on or after September 16, 2012, that is presented on behalf of a juristic entity, regardless of application filing date). Submit multiple forms if more than one signature is required, see below*.

☑ * Total of 1 forms are submitted.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	DISPLAY DEVICE
First Named Inventor/Applicant Name:	Jing Zhou
Filer:	Wei Te Joseph Chung
Attorney Docket Number:	TP204027-US

Filed as Large Entity

Filing Fees for U.S. National Stage under 35 USC 371

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
NATIONAL STAGE FEE	1631	1	320	320
NATIONAL STAGE SEARCH - ALL OTHER CASES	1632	1	700	700
NATIONAL STAGE EXAM - ALL OTHER CASES	1633	1	800	800
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Petitioner Samsung Ex-1004, 0003

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1820**

Electronic Acknowledgement Receipt

EFS ID:	43127761
Application Number:	17419713
International Application Number:	PCT/CN2021/097527
Confirmation Number:	9383
Title of Invention:	DISPLAY DEVICE
First Named Inventor/Applicant Name:	Jing Zhou
Customer Number:	168853
Filer:	Wei Te Joseph Chung
Filer Authorized By:	
Attorney Docket Number:	TP204027-US
Receipt Date:	29-JUN-2021
Filing Date:	
Time Stamp:	23:56:27
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$1820
RAM confirmation Number	E20216SN56481509
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Petitioner Samsung Ex-1004, 0005

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	TP204027ads.pdf	86424 ddce46107f707217d1b8c0e9b763dbde8b6f2845	no	7
Warnings:					
Information:					
This is not an USPTO supplied ADS fillable form					
2	Transmittal of New Application	TP204027transmittal.pdf	118530 b3faf45a3c69bd3e7e60d4eeeccb4309b028eea0	no	4
Warnings:					
Information:					
3	Power of Attorney	TP204027poa.pdf	877619 98c71b118acf0bb5936a4bfb34d8a056a796e9ff	no	2
Warnings:					
Information:					
4	Assignee showing of ownership per 37 CFR 3.73	TP204027ownership.pdf	99280 1ea97add5b1726046ac618fe414aba1429f3ce0a	no	3
Warnings:					
Information:					
5	Documents submitted with 371 Applications	TP204027pct1.pdf	1526660 2c6d1b3a3dc29c12a36955c1b4263c814464eee8	no	4
Warnings:					
Information:					
6	Documents submitted with 371 Applications	TP204027pct2.pdf	11035725 3b47563c879373f7e6d552b4069b959d735ad7ea	no	19
Warnings:					

Information:					
7	Specification	TP204027spec.pdf	111345 d7684b7058c54d93d0d5222c613d49686a9cc932	no	18
Warnings:					
Information:					
8	Claims	TP204027claims.pdf	21198 ce67255bf980ec52a5eebbb8402fa722bc87dd1c	no	3
Warnings:					
Information:					
9	Abstract	TP204027abstract.pdf	8061 e1bd95736ffb8b17b7659bac270a45f71750711a	no	1
Warnings:					
Information:					
10	Drawings-only black and white line drawings	TP204027drawing.pdf	89338 5ba0c676c94accb349e6549695f9e3a08387524c	no	3
Warnings:					
Information:					
11	Oath or Declaration filed	TP204027Declaration.pdf	1049624 9860b264e77975ef7715269ed950e92a4bb69035	no	2
Warnings:					
Information:					
12	Internet Communications Authorized	TP204027internet.pdf	155127 d7de8d171daa84cd9c1e06277b4a265931fb5883	no	2
Warnings:					
Information:					
13	Preliminary Amendment	TP204027am.pdf	37987 42bf9d3a7428dd3df8464339f2b27ce1a7861d89	no	7
Warnings:					
Information:					

14	Fee Worksheet (SB06)	fee-info.pdf	35090 a4d144657b4f6e72a486e185b565311a08f4f1b5	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	15252008	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	TP204027-US
	Application Number	
Title of Invention	DISPLAY DEVICE	

Secrecy Order 37 CFR 5.2

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1					
Legal Name					
Prefix	**Given Name**	**Middle Name**		**Family Name**	**Suffix**
	Jing			Zhou	
Residence Information (Select One) ○ **US Residency** ⊙ **Non US Residency** ○ **Active US Military Service**					
City	Wuhan	**State/Province**	Hubei	**Country**	CN

Mailing Address of Inventor:			
Address 1	305 Room, Building C5, Biolake of Optics Valley, No. 666		
Address 2	Gaoxin Avenue, Wuhan East Lake High-tech Development Zone		
City	Wuhan	**State/Province**	Hubei
Postal Code	430079	**Country**	CN

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ An Address is being provided for the correspondence Information of this application.

Customer Number	**168853**
Email Address	wetchung@hotmail.com

Application Information:

Title of the Invention	DISPLAY DEVICE		
Attorney Docket Number	TP204027-US	**Small Entity Status Claimed** ☐	
Application Type	Nonprovisional		
Subject Matter	Utility		
Suggested Class (If any)		**Sub Class (If any)**	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	**3**	**Suggested Figure for Publication (if any)**	1

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	TP204027-US
	Application Number	
Title of Invention	DISPLAY DEVICE	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	⊙ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	168853		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

Prior Application Status			
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	a 371 of international	PCT/CN2021/097527	2021-05-31

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	TP204027-US
	Application Number	
Title of Invention	DISPLAY DEVICE	

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX) the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Number	Country	Filing Date (YYYY-MM-DD)	Access Code (if applicable)
202110548905.2	CN	2021-05-20	0135

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant must opt-out of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is ONLY reviewed and processed with the INITIAL filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search

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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	TP204027-US
	Application Number	
Title of Invention	DISPLAY DEVICE	

results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant 1

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

X Assignee	O Legal representative under 35 U.S.C 117
O Person to whom the inventor is obligated to assign.	O Person who shows sufficient propriety interest

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor :	

If the Assignee is an Organization check here. **X**

Organization Name	WUHAN CHINA STAR OPTOELECTRONICS SEMICONDUCTOR DISPLAY TECHNOLOGY CO., LTD.
Mailing Address Information:	
Address 1	305 Room, Building C5, Biolake of Optics Valley, No. 666

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	TP204027-US
	Application Number	
Title of Invention	DISPLAY DEVICE	

Address 2	Gaoxin Avenue, Wuhan East Lake High-tech Development Zone		
City	Wuhan	**State/Province**	Hubei
Country CN		Postal Code	430079
Phone Number		Fax Number	
Email Address			

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Assignee 1

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

If the Assignee or Non-Applicant Assignee is an Organization check here. **X**

Organization Name:	WUHAN CHINA STAR OPTOELECTRONICS SEMICONDUCTOR DISPLAY TECHNOLOGY CO., LTD.

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1	305 Room, Building C5, Biolake of Optics Valley, No. 666		
Address 2	Gaoxin Avenue, Wuhan East Lake High-tech Development Zone		
City	Wuhan	**State/Province**	Hubei
Country CN		Postal Code	430079
Phone Number		Fax Number	
Email Address			

Signature:

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications

Signature	/Wei Te Chung/			Date (YYYY-MM-DD)	2021-06-29
First Name	Wei Te	Last Name	Chung	Registration Number	43325

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	TP204027-US
	Application Number	
Title of Invention	DISPLAY DEVICE	

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The information provided by you in this form will be subject to the following routine uses:

1 The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3 A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: ZHOU, Jing
Int'l App. No.: PCT/CN2021/097527
Int'l Filing Date: May 31, 2021
Priority Date: May 20, 2021
Title: DISPLAY DEVICE
Docket No.: TP204027-US
Customer No.: 168853

PRELIMINARY AMENDMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Madam/Sir:

Prior to prosecution on the merits, please amend the above-identified application as follows:

Amendments to the Specification begin on page 2 of this paper

Amendments to the Claims begin on page 3 of this paper.

Remarks/Arguments begin on page 7 of this paper.

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Amendments to the Specification:

Please insert at page 1, line 2 below the title, the following paragraphs:

RELATED APPLICATIONS

This application is a Notional Phase of PCT Patent Application No. PCT/CN2021/097527 having international filing date of May 31, 2021, which claims the benefit of priority of Chinese Patent Application No. 202110548905.2 filed on May 20, 2021. The contents of the above applications are all incorporated by reference as if fully set forth herein in their entirety.

Petitioner Samsung Ex-1004, 0017

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently amended) A display device, comprising:

a flexible screen body comprising a planar area and a bending area connected to the planar area;

a color filter disposed on the flexible screen body and at least covering the planar area;

a protective layer disposed on the flexible screen body and at least covering a part of the bending area; and

a coverplate disposed on the color filter and at least covering the planar area;

wherein in an overlapping area of the protective layer and the coverplate, a distance between the protective layer and the coverplate is greater than or equal to a default value, wherein the default value is greater than 0.

2. (Currently amended) The display device according to claim 1, wherein the protective layer is disposed on a surface of the flexible screen body, and a thickness of the protective layer on the surface of the flexible screen body is less than ~~or equal to~~ a distance between one side of the coverplate adjacent to the flexible screen body and one side of the flexible screen body adjacent to the coverplate.

3. (Currently amended) The display device according to claim 1, further comprising a touch control layer disposed between the flexible screen body and the color filter and an insulating layer disposed between the touch control layer and the color filter; wherein the protective layer is disposed on a surface of the insulating layer, and a thickness of the protective layer on the surface of the insulating layer is less than ~~or equal to~~ a distance between one side of the coverplate adjacent to the insulating layer and one side of the insulating layer adjacent to the coverplate.

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4. (Currently amended) The display device according to claim 2, wherein the protective layer is further disposed on a surface of the color filter, and a thickness of the protective layer on the surface of the color filter is less than ~~or equal to~~ a distance between one side of the coverplate adjacent to the color filter and one side of the color filter adjacent to the coverplate.

5. (Currently amended) The display device according to claim 1, wherein the bending area comprises a transitional bending sub-area, a bending sub-area, and an extending bending sub-area ~~connected to the planar area and~~ defined in sequence, and the transitional bending sub-area is connected to and flush with the planar area;

the protective layer completely covers the bending sub-area and covers at least a part of the transitional bending sub-area; and

the coverplate is connected to the color filter by an optical adhesive, and the coverplate completely covers the planar area and covers at least the part of the transitional bending sub-area.

6. (Original) The display device according to claim 5, wherein a thickness of the optical adhesive is greater than a maximum thickness of the protective layer on the transitional bending sub-area.

7. (Original) The display device according to claim 5, wherein the protective layer further covers at least a part of the extending bending sub-area.

8. (Original) The display device according to claim 5, wherein the protective layer is a UV glue.

9. (Original) The display device according to claim 5, further comprising:

a support layer, wherein one side of the support layer supports the planar area and the transitional bending sub-area, and another side of the support layer away from the planar area supports the extending bending sub-area.

10. (Currently amended) The display device according to claim 9, wherein the support layer comprises a first backplate disposed on one side of the planar area and the transitional bending sub-area away from the coverplate and a second

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backplate disposed on one side of the ~~transitional bending sub-area~~extending bending sub-area away from the protective layer.

11. (Original) The display device according to claim 10, wherein a foam is disposed between the first backplate and the second backplate.

12. (Original) The display device according to claim 11, wherein a stiffener plate is disposed between the foam and the second backplate.

13. (Original) The display device according to claim 12, wherein a heat dissipation layer is disposed between the foam and the stiffener plate.

14. (Canceled)

15. (Original) The display device according to claim 5, wherein a distance between one side end of the protective layer adjacent to the planar area and an initial bending position of the flexible screen body is greater than a first default value, wherein the first default value is greater than or equal to 0, and the initial bending position is a jointed position of the bending sub-area and the transitional bending sub-area.

16. (Currently amended) The display device according to claim [[5]]15, wherein a distance between one side end of the protective layer adjacent to the extending bending sub-area and a terminal bending position of the flexible screen body is greater than a second default value, wherein the second default value is greater than or equal to 0.

17. (Original) The display device according to claim 1, wherein the planar area comprises a plurality of red sub-pixel units, green sub-pixel units, and blue sub-pixel units, the color filter comprises a plurality of color resists and a black matrix disposed among the color resists, and the color resists comprise red color resists, green color resists, and blue color resists; and wherein the red color resists are disposed corresponding to the red sub-pixel units, the green color resists are disposed corresponding to the green sub-pixel units, and the blue color resists are disposed corresponding to the blue sub-pixel units.

18. (Original) The display device according to claim 5, wherein the optical adhesive is an optically clear adhesive (OCA).

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19. (Original) The display device according to claim 13, wherein a material of the heat dissipation layer is a metal material or graphite, and the metal material comprises one or more combinations of copper foil, aluminum foil, or stainless steel foil.

20. (Original) The display device according to claim 9, further comprising a driving unit disposed on one surface of the extending bending sub-area away from the support layer.

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REMARKS/ARGUMENTS

The foregoing Preliminary Amendment is requested. Claims 1-5, 10, and 16 are amended for clarity and formalities, claim 14 is canceled, and claims 6-9, 11-13, 15, and 17-20 are original. Claim 1 is amended by incorporating claim 14, and support for the amendments to claims 5 and 10 can be found in FIGs. 1-4. No new matter has been added. It is respectfully submitted that the present application is in a condition for allowance and a Notice to that effect is earnestly solicited.

If there is any matter that the examiner would like to discuss, the examiner is invited to contact the undersigned.

Respectfully submitted,

BY /Wei Te Chung/
Wei Te Chung
Reg. No. 43325
Attorney for Applicant

Date: June 29, 2021

Petitioner Samsung Ex-1004, 0022

PTO-1390 (10-20)
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TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A SUBMISSION UNDER 35 U.S.C. 371

Attorney Docket No.	
TP204027-US	
U.S. Application No. (if known, see 37 CFR 1.5)	

International Application No.	International Filing Date	Priority Date Claimed
PCT/CN2021/097527	May 31, 2021	May 20, 2021

Title of Invention
DISPLAY DEVICE

First Named Inventor
Zhou , Jing

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information.

1. ■ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). NOTE: The express request under 35 U.S.C. 371(f) will not be effective unless the requirements under 35 U.S.C. 371(c)(1), (2), and (4) for payment of the basic national fee, copy of the International Application and English translation thereof (if required), and the oath or declaration of the inventor(s) have been received.
2. ■ A copy of the International Application (35 U.S.C. 371(c)(2)) is attached hereto (not required if the International Application was previously communicated by the International Bureau or was filed in the United States Receiving Office (RO/US)).
3. An English language translation of the International Application (35 U.S.C. 371(c)(2))
   a. ■ is attached hereto.
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
4. An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4))
   a. ■ is attached.
   b. ☐ was previously filed in the international phase under PCT Rule 4.17(iv).

Items 5 to 8 below concern amendments made in the international phase.

PCT Article 19 and 34 amendments

5. ☐ Amendments to the claims under PCT Article 19 are attached (not required if communicated by the International Bureau) (35 U.S.C. 371(c)(3)).
6. ☐ English translation of the PCT Article 19 amendment is attached (35 U.S.C. 371(c)(3)).
7. ☐ English translation of annexes (Article 19 and/or 34 amendments only) of the International Preliminary Examination Report is attached (35 U.S.C. 371(c)(5)).

Cancellation of amendments made in the international phase

8a. ☐ Do not enter the amendment made in the international phase under PCT Article 19.

8b. ☐ Do not enter the amendment made in the international phase under PCT Article 34.

NOTE: A proper amendment made in English under Article 19 or 34 will be entered in the U.S. national phase application absent a clear instruction from applicant not to enter the amendment(s).

The following items 9 to 17 concern a document(s) or information included.

9. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
10. ■ A preliminary amendment.
11. ■ An Application Data Sheet under 37 CFR 1.76.
12. ☐ A substitute specification. NOTE: A substitute specification cannot include claims. See 37 CFR 1.125(b).
13. ■ A power of attorney and/or change of address letter.
14. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13*ter*.3 and 37 CFR 1.821-1.825 (not required if sequence listing in text format was indicated on the PCT Request as part of the International Application and the sequence listing was published as part of the international application).
15. ☐ Assignment papers *(cover sheet and document(s))*. Name of Assignee: _____
16. ■ 37 CFR 3.73(c) Statement *(when there is an Assignee)*.

This collection of information is required by 37 CFR 1.414 and 1.491-1.492. The information is required to obtain or retain a benefit by the public, which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 15 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Mail Stop PCT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

U.S. APPLN. No. (if known – see 37 CFR 1.5)	INTERNATIONAL APPLICATION No.	ATTORNEY DOCKET No.
	PCT/CN2021/097527	TP204027-US

17. ■ Other items or information:

18 pages specification, 3 pages claims, 1 page abstract, 3 pages drawings all reflecting translation of IA.
2 pages Internet authoriziation form, 4 pages PCT request form

The following fees have been submitted.	CALCULATIONS
18. ■ Basic national fee (37 CFR 1.492(a)) **$320**	$320
19. ■ Examination fee (37 CFR 1.492(c)) • If the written opinion prepared by ISA/US or the international preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article 33(1)-(4)..... **$0** • All other situations **$800**	$800
20. ■ Search fee (37 CFR 1.492(b)) • If the written opinion prepared by ISA/US or the international preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article 33(1)-(4)..... **$0** • Search fee (37 CFR 1.445(a)(2)) has been paid on the international application to the USPTO as an International Searching Authority ..... **$140** • International Search Report prepared by an ISA other than the US and provided to the Office or previously communicated to the US by the IB..... **$540** • All other situations **$700**	$700
TOTAL OF 18, 19, and 20 =	$1820
☐ Additional fee for specification and drawings filed in paper over 100 sheets (excluding sequence listing in compliance with 37 CFR 1.821(c) or (e) in an electronic medium or computer program listing in an electronic medium) (37 CFR 1.492(j)). Fee for each additional 50 sheets of paper or fraction thereof **$420**	$

Total Sheets	Extra Sheets	Number of each additional 50 or fraction thereof (round **up** to a whole number)	RATE
- 100 =	/ 50 =		x **$420**

Surcharge for furnishing any of the search fee, examination fee, or the oath or declaration after the date of commencement of the national stage (37 CFR 1.492(h))..... **$160**	$

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	
Total claims	19 - 20 =	0	x **$100**	$
Independent claims	1 - 3 =	0	x **$480**	$
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ **$860**	$

Fee for submission of Sequence Listing text file of 300 MB to 800 MB (37 CFR 1.21(o)(1))..... **$1,060**	$
Fee for submission of Sequence Listing text file of more than 800 MB (37 CFR 1.21(o)(2))..... **$10,500**	$
Processing fee for furnishing the English translation later than 30 months from the earliest claimed priority date (37 CFR 1.492(i))..... **$140 +**	$
TOTAL OF ABOVE CALCULATIONS =	$ 1820
☐ **Applicant asserts small entity status.** See 37 CFR 1.27. Fees above are reduced by ½.	
☐ **Applicant certifies micro entity status.** See 37 CFR 1.29. Fees above are reduced by ¾. Applicant must attach form PTO/SB/15A or B or equivalent.	
TOTAL NATIONAL FEE =	$1820
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31)..... **$50.00** per property **+**	$
TOTAL FEES ENCLOSED =	$1820

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a. ☐ A check in the amount of $_____ to cover the above fees is enclosed.

b. ☒ Please charge my Deposit Account No. 603449 in the amount of $1820 to cover the above fees.

c. ☒ The Director is hereby authorized to charge additional fees which may be required, or credit any overpayment, to Deposit Account No. 603449 as follows:

i. ☐ any required fee.

ii. ☒ any required fee except for excess claims fees required under 37 CFR 1.492(d) and (e) and multiple dependent claim fee required under 37 CFR 1.492(f).

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038. The PTO-2038 should only be mailed or faxed to the USPTO. However, when paying the basic national fee, the PTO-2038 may NOT be faxed to the USPTO.

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NOTE: Where an appropriate time limit under 37 CFR 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the International Application to pending status.

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013, and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.

NOTE 1: By providing this statement under 37 CFR 1.55 or 1.78, **this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA**.

NOTE 2: A U.S. national stage application may not claim priority to the international application of which it is the national phase. The filing date of a U.S. national stage application is the international filing date. See 35 U.S.C. 363.

Correspondence Address

☒ The address associated with Customer Number: 168853 **OR** ☐ Correspondence address below

Name					
Address					
City		State		Zip Code	
Country		Telephone			
Email					

Signature	/Wei Te Chung/	Date	06/29/2021
Name (Print/Type)	Wei Te Chung	Registration No. (Attorney/Agent)	43325

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Doc Code: PA..
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PTO/AIA/82A (07-13)
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NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	
Filing Date	
First Named Inventor	Zhou, Jing
Title	DISPLAY DEVICE
Art Unit	
Examiner Name	
Attorney Docket Number	TP204027-US

SIGNATURE of Applicant or Patent Practitioner

Signature	/Wei Te Chung/	Date (Optional)	06/29/2021
Name	Wei Te Chung	Registration Number	43325
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ *Total of _____ forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☑ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 168853

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

☑ The address associated with the above-mentioned Customer Number

OR

☐ The address associated with Customer Number:

OR

Firm or Individual Name	Wuhan China Star Optoelectronics Semiconductor Display Technology Co., LTd.				
Address	305 Room,Building C5,Biolake of Optics Valley · No.666 Gaoxin Avenue · Wuhan East Lake High-tech Development Zone				
City	Wuhan	State	Hubei	Zip	430079
Country	China				
Telephone		Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

Wuhan China Star Optoelectronics Semiconductor Display Technology Co., LTd.

☐ Inventor or Joint Inventor (title not required below)

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☑ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature	WANG Jianfeng	Date (Optional)	2020.5.9
Name	WANG Jianfeng		
Title	IP MANAGER		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ Total of forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Petitioner Samsung Ex-1004, 0028

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STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Zhou, Jing

Application No./Patent No.: _____ Filed/Issue Date: _____

Titled: DISPLAY DEVICE

WUHAN CHINA STAR OPTOELECTRONICS SEMICONDUCTOR DISPLAY TECHNOLOGY CO., LTD., a Corporation

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☑ The assignee of the entire right, title, and interest.

2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):

   ☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

   ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. ☑ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: _____ To: _____

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This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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STATEMENT UNDER 37 CFR 3.73(c)

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☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☑ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Wei Te Chung/	06/29/2021
Signature	Date
Wei Te Chung	43325
Printed or Typed Name	Title or Registration Number

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5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

PCT请求书

打印件(原件为电子形式)

0	由受理局填写	
0-1	国际申请号	
0-2	国际申请日	
0-3	受理局名称和"PCT国际申请"	

0-4	**PCT/RO/101表 PCT请求书**	
0-4-1	软件版本	**CEPCT** 版本 **10.25.41(20201201) MT/FOP 20140331/0.20.5.21**
0-5	请求 下列签字人请求按照专利合作条约的规定处理本国际申请	
0-6	申请人指定的受理局	中国国家知识产权局 **(RO/CN)**
0-7	申请人或代理人的档案号	**WH201336PCT**
I	发明名称	显示装置
II	申请人	
II-1	该人是	申请人 **(applicant only)**
II-2	是对下列国家的申请人	所有指定国 **(all designated States)**
II-4zh	名称	武汉华星光电半导体显示技术有限公司
II-4en	Name:	**WUHAN CHINA STAR OPTOELECTRONICS SEMICONDUCTOR DISPLAY TECHNOLOGY CO., LTD.**
II-5zh	地址	中国湖北省武汉市 东湖新技术开发区高新大道**666**号光谷生物创新园**C5**栋**305**室 **430079**
II-5en	Address	**305 Room,Building C5,Biolake of Optics Valley,No.666 Gaoxin Avenue,Wuhan East Lake High-tech Development Zone,** **Wuhan, Hubei 430079** **China**
II-6	国籍	中国 **CN**
II-7	居所	中国 **CN**
II-8	电话号码	**86-0755-83066895**
II-9	传真号码	**86-0755-83066895**
II-10	电子邮址	**wipo@purplevineip.com**
II-10(a)	电子邮件授权 授权受理局、国际检索单位、国际局和国际初步审查单位，如果其愿意，使用本电子邮件地址发送有关本国际申请的通知书	作为随后纸件通知书的预送本
II-11	申请人在专利局的登记号	

PCT请求书

打印件(原件为电子形式)

III-1	申请人和/或发明人	
III-1-1	该人是	发明人 **(inventor only)**
III-1-3	对下列国家的发明人	
III-1-4zh	姓名:	周 菁
III-1-4en	Name (LAST, First):	**ZHOU, Jing**
III-1-5zh	地址:	中国湖北省武汉市 东湖新技术开发区高新大道**666**号光谷生物创新园**C5**栋**305**室 **430079**
III-1-5en	Address	**305 Room,Building C5,Biolake of Optics Valley,No.666 Gaoxin Avenue,Wuhan East Lake High-tech Development Zone, Wuhan, Hubei 430079 China**
IV-1	代理人,共同代表或通信地址 下列人员被委托/已经被委托为代表申请人在主管国际单位办理事务的	代理人 **(agent)**
IV-1-1zh	名称	深圳紫藤知识产权代理有限公司
IV-1-1en	Name:	**PURPLEVINE INTELLECTUAL PROPERTY (SHENZHEN) CO., LTD.**
IV-1-2zh	地址:	中国广东省深圳市 南山区粤海街道大冲社区华润置地大厦**C**座**2901** **518052**
IV-1-2en	Address:	**2901 Block C, China Resources Land Building,Dachong Community, Yuehai Street, Nanshan District Shenzhen, Guangdong 518052 China**
IV-1-3	电话号码	**86-0755-83066895**
IV-1-4	传真号码	**86-0755-83066895**
IV-1-5	电子邮址	**wipo@purplevineip.com**
IV-1-5(a)	电子邮件授权 授权受理局、国际检索单位、国际局和国际初步审查单位，如果其愿意，使用本电子邮件地址发送有关本国际申请的通知书：	作为随后纸件通知书的预送本
IV-1-6	代理人登记号	**44570**
V	国家的指定	
V-1	根据细则**4.9(a)**，提交本请求书即为，指定在国际申请日受**PCT**约束的所有成员国,以要求获得可以获得的所有保护类型，适用情况下，要求获得地区专利和国家专利。	
V-2	**V-2**栏只可用于（不可悔改地）排除对有关国家的指定，如果本国际申请在提交时或者在根据细则**26**之二**.1**的后续程序中，第**VI**栏包含有对在该有关国家提出的在先国家申请的优先权要求，以避免被要求优先权的该在先国家申请因国家法律而停止效力。	

PCT请求书

打印件(原件为电子形式)

VI-1	要求在先国家申请的优先权		
VI-1-1	申请日	**2021年 5月 20日 (20.05.2021)**	
VI-1-2	号码	**202110548905.2**	
VI-1-3	国家	**中国 CN**	
VI-2	优先权文件请求		
	请国际局从数字图书馆获取上面指明的在先申请的证明副本，查询码为：	**VI-1 查询码: 0135**	
VII-1	选定的国际检索单位	**中国国家知识产权局 (ISA/CN)**	
VIII	声明	声明数目	
VIII-1	关于发明人身份的声明	-	
VIII-2	关于申请人在国际申请日有权申请和被授予专利的声明	-	
VIII-3	关于申请人在国际申请日有权要求在先申请的优先权的说明	-	
VIII-4	发明人资格声明(仅为指定美国目的)	-	
VIII-5	关于不影响新颖性的公开或缺乏新颖性的例外的声明	-	
IX	清单	页数	附以电子文档
IX-1	请求书(包括声明页)	**4**	✓
IX-2	说明书	**12**	✓
IX-3	权利要求	**3**	✓
IX-4	摘要	**1**	✓
IX-5	附图	**3**	✓
IX-7	共计	**23**	
	附件	附以纸件	附以电子文档
IX-8	费用计算页	-	✓
IX-9	单独委托书原件	-	✓
IX-18	PCT-SAFE 物理载体	-	-
IX-20	应与摘要一起公布的附图图号	**1**	
IX-21	国际申请所用语言	中文	
X-1	申请人，代理人或共同代表的签字		
X-1-1	姓名:		
X-1-2	签字人姓名		
X-1-3	还要注明此人是以什么名义签字的		

打印件(原件为电子形式)

由受理局填写

10-1	据称的国际申请文件的实际收到日期	
10-2	附图:	
10-2-1	收到	
10-2-2	未收到	
10-3	由于随后在期限内收到补充国际申请的文件或附图,更改的实际收到日期	
10-4	在期限内收到根据**PCT**第**11(2)**条所进行的改正的日期	
10-5	国际检索单位	**ISA/CN**
10-6	检索本的传送推迟到缴纳检索费后	

由国际局填写

11-1	国际局收到登记本的日期	

说明书

发明名称：显示装置

技术领域

[0001] 本申请涉及显示技术领域，尤其涉及一种显示装置。

背景技术

[0002] 对于有机发光二极管（Organic Light-Emitting Diode，OLED）显示面板而言，偏光片能够有效降低强光下OLED显示面板的反射率，却导致OLED显示面板损失了将近58%的出光，这极大地增加了OLED显示面板的使用寿命负担，并且，偏光片的厚度约为100μm，其厚度较大且材质脆，不利于动态弯折产品的开发。

[0003] 为了开发基于OLED显示面板的动态弯折产品，通常采用无偏光片（POL-less）技术制作OLED显示面板，POL-less技术指的是采用彩膜（Color Filter，CF）替代偏光片的技术。其中，彩膜由红色色阻、绿色色阻、蓝色色阻和黑色矩阵（Black Matrix，BM）组成，在OLED显示面板中，红色色阻、绿色色阻和蓝色色阻分别承担着红色子像素单元、绿色子像素单元和蓝色子像素单元的出光，黑色矩阵主要承担着防止OLED显示面板漏光以及降低OLED显示面板的反射率的作用。彩膜不仅能够在一定程度上降低强光下OLED显示面板的反射率，还能够将OLED显示面板的出光率从42%提高到60%，并且，彩膜的厚度约为5μm，其远小于偏光片的厚度且柔韧性高，能够降低OLED显示面板的整体厚度，有利于动态弯折产品的开发。

[0004] 进一步地，为了实现OLED显示面板的窄边框设计，通常将OLED显示面板的弯折区弯折到OLED显示面板的背面，从而减小边框的宽度。然而，OLED显示面板的弯折区的弯折容易导致OLED显示面板内的线路断裂，为了防止弯折导致的线路断裂，通常将UV胶覆盖于OLED显示面板的弯折区，缓解OLED显示面板的弯折区的弯折应力。

[0005] 然而，UV胶的厚度约为95μm，当盖板与彩膜通过光学胶粘接时，由于彩膜与光学胶的厚度均较薄，因此盖板会挤压UV胶，导致OLED显示面板存在开裂风险。

Petitioner Samsung Ex-1004, 0036

发明概述

技术问题

[0006] 本申请提供一种显示装置，以解决现有的OLED显示面板存在开裂风险的问题。

问题的解决方案

技术解决方案

[0007] 本申请提供一种显示装置，其中，所述显示装置包括：

[0008] 柔性屏体，包括平面区以及与所述平面区连接的弯折区；

[0009] 彩膜，设置在所述柔性屏体上且至少覆盖所述平面区；

[0010] 保护层，设置在所述柔性屏体上且至少覆盖部分所述弯折区；

[0011] 盖板，设置在所述彩膜上且至少覆盖所述平面区；

[0012] 其中，在所述保护层与所述盖板重叠的区域内，所述保护层与所述盖板之间的距离大于或等于预设值。

[0013] 在一些实施例中，所述保护层仅设置在所述柔性屏体的表面，所述柔性屏体的表面的所述保护层的厚度小于或等于所述盖板靠近所述柔性屏体的一侧到所述柔性屏体靠近所述盖板的一侧之间的距离。

[0014] 在一些实施例中，所述显示装置还包括设置在所述柔性屏体与所述彩膜之间的触控层，以及设置在所述触控层与所述彩膜之间的绝缘层，所述保护层仅设置在所述绝缘层的表面，所述绝缘层的表面的所述保护层的厚度小于或等于所述盖板靠近所述绝缘层的一侧到所述绝缘层靠近所述盖板的一侧之间的距离。

[0015] 在一些实施例中，所述保护层还设置在所述彩膜的表面，所述彩膜的表面的所述保护层的厚度小于或等于所述盖板靠近所述彩膜的一侧到所述彩膜靠近所述盖板的一侧之间的距离。

[0016] 在一些实施例中，所述弯折区包括与所述平面区连接并依次设置的弯折过渡子区、弯折子区以及弯折延伸子区，所述弯折过渡子区与所述平面区平齐；

[0017] 所述保护层完全覆盖所述弯折子区，并至少覆盖部分所述弯折过渡子区；

[0018] 盖板，所述盖板通过光学胶与所述彩膜连接，所述盖板完全覆盖所述平面区，并至少覆盖部分所述弯折过渡子区。

Petitioner Samsung Ex-1004, 0037

[0019] 在一些实施例中，所述光学胶的厚度大于所述保护层在所述弯折过渡子区的最大厚度。

[0020] 在一些实施例中，所述保护层还至少覆盖部分所述弯折延伸子区。

[0021] 在一些实施例中，所述保护层为UV胶。

[0022] 在一些实施例中，所述显示装置还包括：

[0023] 支撑层，所述支撑层的一侧支撑所述平面区和所述弯折过渡子区，所述支撑层远离所述平面区的一侧支撑所述弯折延伸子区。

[0024] 在一些实施例中，所述支撑层包括设置在所述平面区和所述弯折过渡子区远离所述盖板的一侧的第一背板以及设置在所述弯折过渡子区远离所述保护层的一侧的第二背板。

[0025] 在一些实施例中，所述第一背板和所述第二背板之间设置有泡棉。

[0026] 在一些实施例中，所述泡棉和所述第二背板之间设置有补强板。

[0027] 在一些实施例中，所述泡棉和所述补强板之间设置有散热层。

[0028] 在一些实施例中，所述预设值大于0。

[0029] 在一些实施例中，所述保护层靠近所述平面区的侧边与所述柔性屏体的初始弯折位置之间的距离大于第一预设值，所述第一预设值大于或等于0，其中，所述初始弯折位置为所述弯折子区和所述弯折过渡子区衔接的位置。

[0030] 在一些实施例中，所述保护层靠近所述弯折延伸子区的侧边与所述柔性屏体的末端弯折位置之间的距离大于第二预设值，所述第二预设值大于或等于0。

[0031] 在一些实施例中，所述平面区包括红色子像素单元、绿色子像素单元和蓝色子像素单元，所述彩膜包括多个彩色色阻以及设置在不同的所述彩色色阻之间的黑色矩阵，多个所述彩色色阻包括红色色阻、绿色色阻和蓝色色阻，所述红色色阻对应所述红色子像素单元设置，所述绿色色阻对应所述绿色子像素单元设置，所述蓝色色阻对应所述蓝色子像素单元设置。

[0032] 在一些实施例中，所述光学胶为OCA光学胶。

[0033] 在一些实施例中，所述散热层的材料为金属材料或石墨，其中，所述金属材料包括铜箔、铝箔和不锈钢箔中的任意一种或多种的组合。

[0034] 在一些实施例中，所述显示装置还包括驱动单元，所述驱动单元设置在所述弯

Petitioner Samsung Ex-1004, 0038

折延伸子区远离所述支撑层的表面。

发明的有益效果

有益效果

[0035] 本申请提供的显示装置，通过在保护层与盖板重叠的区域内，使保护层与盖板之间的距离大于或等于预设值，如此，盖板不会挤压保护层，消除了显示装置的开裂风险。

对附图的简要说明

附图说明

[0036] 图1为本申请实施例提供的显示装置的结构示意图。

[0037] 图2为本申请另一实施例提供的显示装置的结构示意图。

[0038] 图3为本申请再一实施例提供的显示装置的结构示意图。

[0039] 图4为本申请又一实施例提供的显示装置的结构示意图。

[0040] 图5为本申请实施例提供的显示装置的制作方法流程图。

发明实施例

本发明的实施方式

[0041] 为使本申请的目的、技术方案及效果更加清楚、明确，以下参照附图并举实施例对本申请进一步详细说明。应当理解，此处所描述的具体实施例仅用以解释本申请，并不用于限定本申请。

[0042] 本申请实施例提供一种显示装置，显示装置可以为可穿戴设备，例如智能手环、智能手表或虚拟现实（Virtual Reality，VR）等设备，也可以为移动电话机、电子书、电子报纸、电视机或个人便携电脑，还可以为可弯曲和可折叠的柔性OLED显示或照明设备，本申请实施例对显示装置的具体形式不作具体限定。

[0043] 图1为本申请实施例提供的显示装置的结构示意图，如图1所示，显示装置包括柔性屏体10、彩膜50、保护层30和盖板40，可选地，显示装置还可以包括支撑层20和光学胶60，以下分别对柔性屏体10、支撑层20、保护层30、盖板40、彩膜50和光学胶60进行具体说明。

[0044] 柔性屏体10指的是能够进行弯曲和折叠的柔韧性高的屏幕，柔性屏体10可以划

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分为平面区AA和自平面区AA延伸的弯折区，平面区AA指的是能够进行显示的区域，弯折区指的是不能够进行显示的区域。弯折区可以包括依次设置的弯折过渡子区B1、弯折子区B2和弯折延伸子区B3，其中，弯折过渡子区B1的相对两端分别与平面区AA和弯折子区B2连接，弯折子区B2的相对两端分别与弯折过渡子区B1和弯折延伸子区B3连接。其中，弯折过渡子区B1与平面区AA平齐，也即弯折过渡子区B1与平面区AA位于同一平面，弯折子区B2和弯折延伸子区B3均不与平面区AA平齐，也即弯折子区B2与平面区AA位于不同平面，弯折延伸子区B3与平面区AA位于不同平面。

[0045] 具体而言，柔性屏体10包括柔性衬底，柔性衬底为由柔性材料制作而成的衬底，柔性材料优选为聚酰亚胺（PI），柔性衬底可以划分为第一区域和自第一区域延伸的第二区域。

[0046] 柔性衬底的第一区域上可以集成显示层，显示层可以包括多个用于显示图像的显示部件，从而使柔性衬底的第一区域与显示层共同形成柔性屏体10的平面区AA。显示层可以包括诸如薄膜晶体管、栅极线、数据线、电容、阳极、阴极和发光层等不同的显示部件，本申请实施例对柔性屏体10的平面区AA本身的结构并没有改进，采用本领域常用的结构即可，本申请实施例对其结构不作具体限定。

[0047] 柔性衬底的第二区域上设置有用于实现信号传输和驱动图像显示等功能的集成电路，从而使柔性衬底的第二区域与集成电路共同形成柔性屏体10的弯折区，本申请实施例对柔性屏体10的弯折区本身的结构并没有改进，采用本领域常用的结构即可，本申请实施例对其结构不作具体限定。

[0048] 为了实现显示装置的窄边框设计，通常将柔性屏体10的弯折区进行弯折，如图1所示，本申请实施例具体将柔性屏体10的弯折子区B2进行180°弯折，使得平面区AA与弯折过渡子区B1所组成的整体与弯折延伸子区B3相对且相互平行，此时，弯折子区B2呈半圆弧状，平面区AA、弯折过渡子区B1、弯折子区B2和弯折延伸子区B3形成一个容纳槽，支撑层20位于该容纳槽内。

[0049] 需要说明的是，一方面，由于柔性屏体10的弯折区包括设置在平面区AA和弯折子区B2之间的弯折过渡子区B1，因此使得柔性屏体10的初始弯折位置为弯折

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子区B2和弯折过渡子区B1衔接的位置，即柔性屏体10的初始弯折位置偏离平面区AA和弯折区衔接的位置，初始弯折位置的两侧均为弯折区域，有效缓解了柔性屏体10的初始弯折位置因其两侧区域的结构不同而导致的应力集中的现象，实现对柔性屏体10的弯折起始位置的保护；另一方面，由于弯折子区B2和平面区AA不直接相邻，两者之间设置有弯折过渡子区B1，因此减小了弯折子区B2弯折时作用于平面区AA上的应力，从而对平面区AA进行保护，例如防止平面区AA开裂。

[0050] 支撑层20的一侧支撑柔性屏体10的平面区AA和弯折过渡子区B1，支撑层20远离平面区AA的一侧支撑柔性屏体10的弯折延伸子区B3，即柔性屏体10的平面区AA和弯折过渡子区B1设置在支撑层20的同一侧，柔性屏体10的弯折延伸子区B3设置在支撑层20远离平面区AA的另一侧。

[0051] 需要说明的是，支撑层20主要用于固定并支撑柔性屏体10，防止柔性屏体10的弯折子区B2由于弯折程度过大而折断。支撑层20可以为兼具硬度和弹性的材料，从而既可以对柔性屏体10进行支撑，又可以对柔性屏体10进行减震。支撑层20可以为一层，也可以为多层结构，本申请实施例对此不作具体限定。

[0052] 保护层30设置在柔性屏体10远离支撑层20的一侧，保护层30至少覆盖部分弯折区，图1所示的保护层30完全覆盖柔性屏体10的弯折子区B2，并至少覆盖部分柔性屏体10的弯折过渡子区B1。其中，图1所示的保护层30完全覆盖柔性屏体10的弯折子区B2和弯折过渡子区B1，当然，在其他实施例中，保护层30还可以完全覆盖柔性屏体10的弯折子区B2且覆盖部分弯折过渡子区B1。

[0053] 需要说明的是，保护层30完全覆盖柔性屏体10的弯折子区B2，从而缓解弯折子区B2的弯折应力；保护层30至少覆盖部分柔性屏体10的弯折过渡子区B1，从而使保护层30能够从柔性屏体10的初始弯折位置靠近平面区AA的一侧开始更好地缓解柔性屏体10的初始弯折位置的弯折应力，需要说明的是，保护层30靠近平面区AA的侧边与柔性屏体10的初始弯折位置之间的距离还可以大于第一预设值，第一预设值为大于或等于0的值，第一预设值可以根据实际需求进行灵活调整，本申请实施例对此不作具体限定。

[0054] 柔性屏体10的平面区AA包括红色子像素单元、绿色子像素单元和蓝色子像素

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单元，其中，红色子像素单元用于发出红色的光，绿色子像素单元用于发出绿色的光，蓝色子像素单元用于发出蓝色的光。

[0055] 彩膜50设置在柔性屏体10远离支撑层20的一侧，彩膜50至少覆盖平面区AA，彩膜50用于替代偏光片，承担着防止显示装置的漏光以及降低显示装置的反射率的作用。

[0056] 具体而言，彩膜50包括多个彩色色阻以及设置在不同的彩色色阻之间的黑色矩阵，多个彩色色阻包括红色色阻、绿色色阻和蓝色色阻，其中，红色色阻对应红色子像素单元设置，红色色阻承担着红色子像素单元的出光；绿色色阻对应绿色子像素单元设置，绿色色阻承担着绿色子像素单元的出光；蓝色色阻对应蓝色子像素单元设置，蓝色色阻承担着蓝色子像素单元的出光；黑色矩阵主要承担着防止显示装置漏光以及降低显示装置的反射率的作用。

[0057] 盖板40设置在彩膜50远离柔性屏体10的一侧，盖板40至少覆盖平面区AA，图1所示的盖板40通过光学胶60与彩膜50连接，其中，光学胶60用于胶结光学元件，光学胶60可以为具有无色透明、光透过率在90%以上、胶结强度良好、可在室温或中温下固化且固化收缩小等特点的OCA光学胶，在本申请实施例中，光学胶60用于将盖板40与彩膜50进行胶结。盖板40用于保护柔性屏体10不受外界的冲击力而损伤。

[0058] 本申请实施例提供的显示装置，在保护层30与盖板40重叠的区域内，保护层30与盖板40之间的距离大于或等于预设值，需要说明的是，预设值为大于0的值，预设值可以根据实际需求（例如制程精度）进行灵活调整，本申请实施例对此不作具体限定。如此，盖板40不会挤压保护层30，消除了显示装置的开裂风险。

[0059] 基于上述实施例，请参阅图2，保护层30仅设置在柔性屏体10的表面，柔性屏体10的表面的保护层30的厚度小于或等于盖板40靠近柔性屏体10的一侧到柔性屏体10靠近盖板40的一侧之间的距离。

[0060] 基于上述实施例，请参阅图3，显示装置还包括设置在柔性屏体10与彩膜50之间的触控层70，以及设置在触控层70与彩膜50之间的绝缘层80，保护层30仅设置在绝缘层80的表面，绝缘层80的表面的保护层30的厚度小于或等于盖板40靠

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近绝缘层80的一侧到绝缘层80靠近盖板40的一侧之间的距离。

[0061] 基于上述实施例，请参阅图1和图4，保护层30还设置在彩膜50的表面，彩膜50的表面的保护层30的厚度小于或等于盖板40靠近彩膜50的一侧到彩膜50靠近盖板40的一侧之间的距离。

[0062] 基于上述实施例，在本申请实施例中，光学胶60的厚度大于保护层30在柔性屏体10的弯折过渡子区B1的最大厚度，如此，即可保证覆盖柔性屏体10的弯折过渡子区B1的盖板40与覆盖柔性屏体10的弯折过渡子区B1的保护层30具有一定间隔，盖板40不会挤压保护层30，消除了显示装置的开裂风险。

[0063] 基于上述实施例，本申请实施例对显示装置进行进一步说明，保护层30还至少覆盖部分柔性屏体10的弯折延伸子区B3，以更好地缓解柔性屏体10的末端弯折位置的弯折应力。需要说明的是，保护层30靠近弯折延伸子区B3的侧边与柔性屏体10的末端弯折位置之间的距离还可以大于第二预设值，第二预设值为大于或等于0的值，第二预设值可以根据实际需求进行灵活调整，本申请实施例对此不作具体限定。其中，图1所示的保护层30覆盖部分柔性屏体10的弯折延伸子区B3，当然，在其他实施例中，保护层30还可以完全覆盖柔性屏体10的弯折延伸子区B3。

[0064] 基于上述实施例，在一些实施例中，保护层30为UV胶，当然，在其他实施例中，保护层30不限于UV胶，还可以是热固化胶或其他种类的光固化胶，本申请实施例对此不作具体限定。需要说明的是，在满足盖板40与保护层30之间的距离大于0的情况下，本领域技术人员可以根据柔性屏体10的大小、种类、弯折子区B2的弯折半径、保护层30的柔韧性以及缓解应力的能力为保护层30设置合适的厚度，本申请实施例对其不作具体限定。

[0065] 基于上述实施例，本申请实施例对显示装置进行进一步说明，支撑层20包括设置在柔性屏体10的平面区AA和弯折过渡子区B1远离盖板40的一侧的第一背板201，以及设置在柔性屏体10的弯折延伸子区B3远离保护层30的一侧的第二背板202。其中，弯折延伸子区B3可以通过胶粘或者物理方法固定于第二背板202上。

[0066] 需要说明的是，第一背板201用于支撑和保护柔性屏体10的平面区AA和弯折过渡子区B1，避免其受到外界的冲击力而损伤，第二背板202用于支撑和保护柔性

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屏体10的弯折延伸子区B3、避免其受到外界的冲击力而损伤。第一背板201和第二背板202的材料可以为聚对苯二甲酸乙二醇酯（Polyethylene terephthalate，PET）材料，由于PET材料具有弹性模量低和受热不易膨胀的优点，因此采用PET材料制作而成的第一背板201和第二背板202不会因为环境温度的变化而变形，降低了第一背板201与其连接的膜层剥离的可能性以及第二背板202与其连接的膜层剥离的可能性，从而提高了显示装置的良率和可靠性。

[0067] 进一步地，为了防止第一背板201和第二背板202影响柔性屏体10的弯折子区B2的弯折，必须确保第一背板201和第二背板202均避开弯折子区B2。优选地，为了更好的支撑柔性屏体10的平面区AA和弯折过渡子区B1，第一背板201的边缘与柔性屏体10的初始弯折位置重合，同理，为了更好的支撑柔性屏体10的弯折延伸子区B3，第二背板202的边缘与柔性屏体10的末端弯折位置重合。

[0068] 基于上述实施例，在一些实施例中，支撑层20还包括设置在第一背板201和第二背板202之间的垫高块，垫高块的高度还可以根据柔性屏体10的弯折子区B2的宽度进行调整，本申请实施例对其不作具体限定。垫高块可以为硅胶等材料，垫高块可以具有一定弹性和硬度，垫高块具有一定硬度以避免所述柔性屏体10被挤压变形，垫高块具有一定弹性以避免所述柔性屏体10由于受到局部应力而损坏。

[0069] 具体而言，垫高块避开柔性屏体10的弯折子区B2设置。当然，在其他实施例中，垫高块靠近柔性屏体10的弯折子区B2的一端的表面与弯折子区B2弯折后的形状匹配，以使得弯折子区B2靠近垫高块一侧的表面与垫高块的表面相贴合，进而对弯折子区B2具有一定的支撑作用，且不易变形损坏。可以理解的是，在其他实施例中，还可以通过增加第一背板201和第二背板202的厚度，或增加其他支撑结构，以确保柔性屏体10的平面区AA和弯折延伸子区B3之间的距离。

[0070] 基于上述实施例，在一些实施例中，第一背板201和第二背板202之间设置有泡棉203。需要说明的是，泡棉203是塑料粒子发泡过的材料，其既能起到缓冲作用，也能起到遮光作用。

[0071] 基于上述实施例，在一些实施例中，泡棉203和第二背板202之间设置有补强板204。需要说明的是，补强板204用于提高柔性屏体10的强度。其中，补强板204

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可以为聚酰亚胺层，也可以为石墨层，其中，石墨层的外表面还可用聚酰亚胺包覆，本申请实施例对此不作具体限定。

[0072] 基于上述实施例，在一些实施例中，泡棉203和补强板204之间设置有散热层205。其中，散热层205起到屏蔽和散热作用，散热层205的材料为散热材料，具体可以为金属材料或石墨等，其中，金属可以为铜箔、铝箔或不锈钢箔等，本申请实施例对此不作具体限定。

[0073] 基于上述实施例，在一些实施例中，显示装置还包括设置在所述弯折延伸子区B3的驱动单元。具体而言，驱动单元设置在柔性屏体10的弯折延伸子区B3远离支撑层20的表面。驱动单元包括驱动芯片和柔性电路板，其中，驱动芯片和柔性电路板均设置在柔性屏体10的弯折延伸子区B3远离支撑层20的表面，柔性电路板与驱动芯片之间的距离大于0。

[0074] 基于上述实施例，在一些实施例中，柔性屏体10的平面区AA包括柔性衬底、薄膜晶体管、显示器件和封装层，其中，柔性衬底设置在第一背板201上，薄膜晶体管设置在柔性衬底上，显示器件设置在薄膜晶体管上，封装层设置在显示器件上。

[0075] 柔性衬底为由柔性材料制作而成的衬底，柔性材料优选为聚酰亚胺（PI）。

[0076] 显示器件用于进行发光，显示器件通常包括设置在薄膜晶体管上的阳极（Anode）、设置在阳极上的空穴注入层（Hole Injection Layer，HIL）、设置在空穴注入层上的空穴传输层（Hole Tranport Layer，HTL）、设置在空穴传输层上的发光层（Emission layer，EML）、设置在发光层上的电子传输层（Electron Transport Layer，ETL）、设置在电子传输层上的电子注入层（Electron Injection Layer，EIL）以及设置在电子传输层上的阴极（Cathode）。可选地，显示器件中还可设置有空穴阻挡层（Hole Block Layer，HBL），电子阻挡层(Electron Block Layer，EBL）和封盖层（Capping Layer，CPL）。

[0077] 发光层包括红色子像素单元、绿色子像素单元和蓝色子像素单元，其中，红色子像素单元用于发出红色的光，绿色子像素单元用于发出绿色的光，蓝色子像素单元用于发出蓝色的光。

[0078] 彩膜50用于替代偏光片，承担着防止显示装置的漏光以及降低显示装置的反射

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率的作用。具体而言，彩膜50包括多个彩色色阻以及设置在不同的彩色色阻之间的黑色矩阵，多个彩色色阻包括红色色阻、绿色色阻和蓝色色阻，其中，红色色阻对应红色子像素单元设置，红色色阻承担着红色子像素单元的出光；绿色色阻对应绿色子像素单元设置，绿色色阻承担着绿色子像素单元的出光；蓝色色阻对应蓝色子像素单元设置，蓝色色阻承担着蓝色子像素单元的出光；黑色矩阵主要承担着防止显示装置漏光以及降低显示装置的反射率的作用。

[0079] 封装层用于为显示装置隔绝外界的水和氧气，保证显示装置的良率。封装层通常为有机层、无机层和有机层构成的三明治结构。

[0080] 基于上述实施例，本申请实施例对上述显示装置的制作方法进行说明。图5为本申请实施例提供的显示装置的制作方法流程图，如图5所示，制作方法包括：

[0081] S1，在玻璃基板上制作柔性屏体10。

[0082] 柔性屏体10指的是能够进行弯曲和折叠的柔韧性高的屏幕，柔性屏体10可以划分为平面区AA和自平面区AA延伸的弯折区，平面区AA指的是能够进行显示的区域，弯折区指的是不能够进行显示的区域。弯折区包括依次设置的弯折过渡子区B1、弯折子区B2和弯折延伸子区B3，其中，弯折过渡子区B1的相对两端分别与平面区AA和弯折子区B2连接，弯折子区B2的相对两端分别与弯折过渡子区B1和弯折延伸子区B3连接。其中，弯折过渡子区B1与平面区AA平齐，也即弯折过渡子区B1与平面区AA位于同一平面，弯折子区B2和弯折延伸子区B3均不与平面区AA平齐，也即弯折子区B2与平面区AA位于不同平面，弯折延伸子区B3与平面区AA位于不同平面。

[0083] S2，在柔性屏体10上制作彩膜50。

[0084] 具体而言，柔性屏体10的平面区AA包括红色子像素单元、绿色子像素单元和蓝色子像素单元，彩膜50包括多个彩色色阻以及设置在不同的彩色色阻之间的黑色矩阵，多个彩色色阻包括红色色阻、绿色色阻和蓝色色阻，红色色阻对应红色子像素单元设置，绿色色阻对应绿色子像素单元设置，蓝色色阻对应蓝色子像素单元设置。需要说明的是，在一些实施例中，还可以在彩膜50上制作平坦层以对彩膜50进行平坦化。

[0085] S3，对柔性屏体10的弯折区进行驱动芯片和柔性电路板的邦定，并对柔性屏体

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10的弯折区进行UV胶覆盖。

[0086] 具体而言，将驱动芯片和柔性电路板均设置在柔性屏体10的弯折延伸子区B3远离支撑层20的表面，并使柔性电路板与驱动芯片之间的距离大于0。对柔性屏体10的弯折区进行UV胶覆盖，使得UV胶完全覆盖弯折子区B2，并至少覆盖部分弯折过渡子区B1。

[0087] S4，将玻璃基板进行剥离，并将支撑层20与柔性屏体10进行贴合。

[0088] 具体而言，支撑层20的一侧支撑柔性屏体10的平面区AA和弯折过渡子区B1，支撑层20远离平面区AA的一侧支撑柔性屏体10的弯折延伸子区B3，即柔性屏体10的平面区AA和弯折过渡子区B1设置在支撑层20的同一侧，柔性屏体10的弯折延伸子区B3设置在支撑层20远离平面区AA的另一侧。需要说明的是，支撑层20主要用于固定并支撑柔性屏体10，防止柔性屏体10的弯折子区B2由于弯折程度过大而折断。支撑层20可以为兼具硬度和弹性的材料，从而既可以对柔性屏体10进行支撑，又可以对柔性屏体10进行减震。支撑层20可以为一层，也可以为多层结构，本申请实施例对此不作具体限定。

[0089] S5，将盖板40与彩膜50通过光学胶60进行贴合，其中，光学胶60的厚度大于UV胶的最大厚度。

[0090] 具体而言，使用光学胶60将盖板40与彩膜50进行贴合，使盖板40完全覆盖柔性屏体10的平面区AA，并至少覆盖部分柔性屏体10的弯折过渡子区B1。由于光学胶60的厚度大于UV胶的最大厚度，因此在盖板40与彩膜50的贴合过程中，盖板40不会对UV胶产生压力，降低了显示装置的模组制程风险。

[0091] 需要说明的是，上述步骤的标号并不严格代表步骤的执行顺序，在一些实施例中，可以严格按照上述步骤的标号顺序执行对应的步骤，当然，在另一些实施例中，某些步骤可以同时执行，或者调换顺序执行，本申请实施例对此不作具体限定。

[0092] 可以理解的是，对本领域普通技术人员来说，可以根据本申请的技术方案及其申请构思加以等同替换或改变，而所有这些改变或替换都应属于本申请所附的权利要求的保护范围。

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权利要求书

[权利要求 1] 一种显示装置，其中，所述显示装置包括：

柔性屏体，包括平面区以及与所述平面区连接的弯折区；

彩膜，设置在所述柔性屏体上且至少覆盖所述平面区；

保护层，设置在所述柔性屏体上且至少覆盖部分所述弯折区；

盖板，设置在所述彩膜上且至少覆盖所述平面区；

其中，在所述保护层与所述盖板重叠的区域内，所述保护层与所述盖板之间的距离大于或等于预设值。

[权利要求 2] 根据权利要求1所述的显示装置，其中，所述保护层仅设置在所述柔性屏体的表面，所述柔性屏体的表面的所述保护层的厚度小于或等于所述盖板靠近所述柔性屏体的一侧到所述柔性屏体靠近所述盖板的一侧之间的距离。

[权利要求 3] 根据权利要求1所述的显示装置，其中，所述显示装置还包括设置在所述柔性屏体与所述彩膜之间的触控层，以及设置在所述触控层与所述彩膜之间的绝缘层，所述保护层仅设置在所述绝缘层的表面，所述绝缘层的表面的所述保护层的厚度小于或等于所述盖板靠近所述绝缘层的一侧到所述绝缘层靠近所述盖板的一侧之间的距离。

[权利要求 4] 根据权利要求2所述的显示装置，其中，所述保护层还设置在所述彩膜的表面，所述彩膜的表面的所述保护层的厚度小于或等于所述盖板靠近所述彩膜的一侧到所述彩膜靠近所述盖板的一侧之间的距离。

[权利要求 5] 根据权利要求1所述的显示装置，其中，所述弯折区包括与所述平面区连接并依次设置的弯折过渡子区、弯折子区以及弯折延伸子区，所述弯折过渡子区与所述平面区平齐；

所述保护层完全覆盖所述弯折子区，并至少覆盖部分所述弯折过渡子区；

盖板，所述盖板通过光学胶与所述彩膜连接，所述盖板完全覆盖

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所述平面区，并至少覆盖部分所述弯折过渡子区。

[权利要求 6] 根据权利要求5所述的显示装置，其中，所述光学胶的厚度大于所述保护层在所述弯折过渡子区的最大厚度。

[权利要求 7] 根据权利要求5所述的显示装置，其中，所述保护层还至少覆盖部分所述弯折延伸子区。

[权利要求 8] 根据权利要求5所述的显示装置，其中，所述保护层为UV胶。

[权利要求 9] 根据权利要求5所述的显示装置，其中，所述显示装置还包括：支撑层，所述支撑层的一侧支撑所述平面区和所述弯折过渡子区，所述支撑层远离所述平面区的一侧支撑所述弯折延伸子区。

[权利要求 10] 根据权利要求9所述的显示装置，其中，所述支撑层包括设置在所述平面区和所述弯折过渡子区远离所述盖板的一侧的第一背板以及设置在所述弯折过渡子区远离所述保护层的一侧的第二背板。

[权利要求 11] 根据权利要求10所述的显示装置，其中，所述第一背板和所述第二背板之间设置有泡棉。

[权利要求 12] 根据权利要求11所述的显示装置，其中，所述泡棉和所述第二背板之间设置有补强板。

[权利要求 13] 根据权利要求12所述的显示装置，其中，所述泡棉和所述补强板之间设置有散热层。

[权利要求 14] 根据权利要求1所述的显示装置，其中，所述预设值大于0。

[权利要求 15] 根据权利要求5所述的显示装置，其中，所述保护层靠近所述平面区的侧边与所述柔性屏体的初始弯折位置之间的距离大于第一预设值，所述第一预设值大于或等于0，其中，所述初始弯折位置为所述弯折子区和所述弯折过渡子区衔接的位置。

[权利要求 16] 根据权利要求5所述的显示装置，其中，所述保护层靠近所述弯折延伸子区的侧边与所述柔性屏体的末端弯折位置之间的距离大于第二预设值，所述第二预设值大于或等于0。

[权利要求 17] 根据权利要求1所述的显示装置，其中，所述平面区包括红色子像素单元、绿色子像素单元和蓝色子像素单元，所述彩膜包括多个

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彩色色阻以及设置在不同的所述彩色色阻之间的黑色矩阵，多个所述彩色色阻包括红色色阻、绿色色阻和蓝色色阻，所述红色色阻对应所述红色子像素单元设置，所述绿色色阻对应所述绿色子像素单元设置，所述蓝色色阻对应所述蓝色子像素单元设置。

[权利要求 18] 根据权利要求5所述的显示装置，其中，所述光学胶为OCA光学胶。

[权利要求 19] 根据权利要求13所述的显示装置，其中，所述散热层的材料为金属材料或石墨，其中，所述金属材料包括铜箔、铝箔和不锈钢箔中的任意一种或多种的组合。

[权利要求 20] 根据权利要求9所述的显示装置，其中，所述显示装置还包括驱动单元，所述驱动单元设置在所述弯折延伸子区远离所述支撑层的表面。

摘要

本申请提供一种显示装置，通过在保护层与盖板重叠的区域内，使保护层与盖板之间的距离大于或等于预设值，如此，盖板不会挤压保护层，消除了显示装置的开裂风险。

附　图

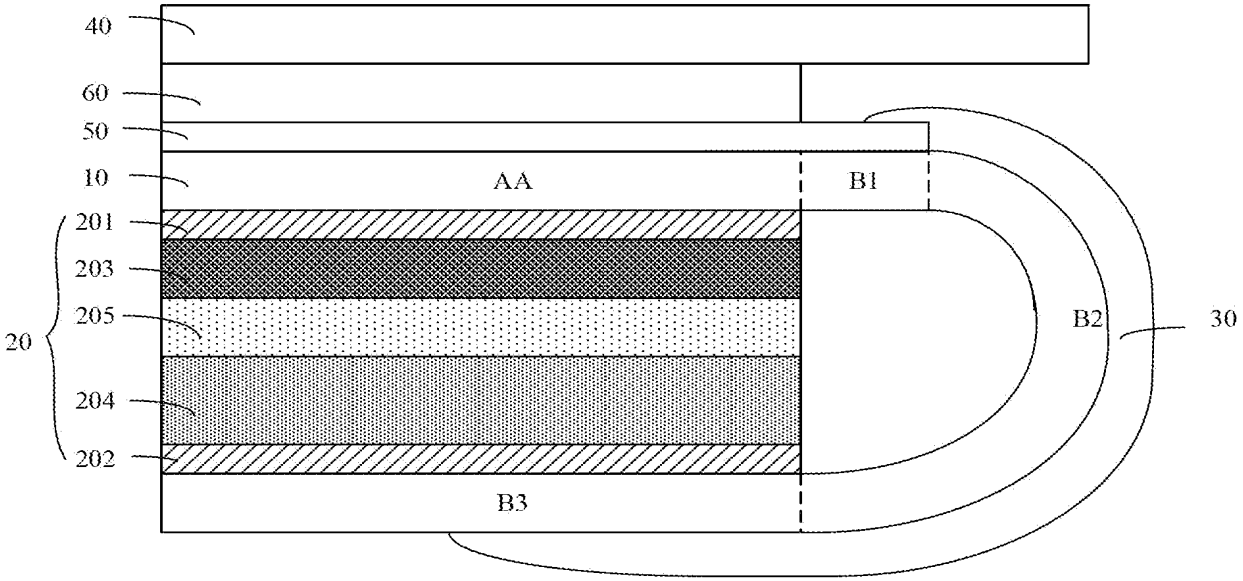

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AA
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B3

图 1

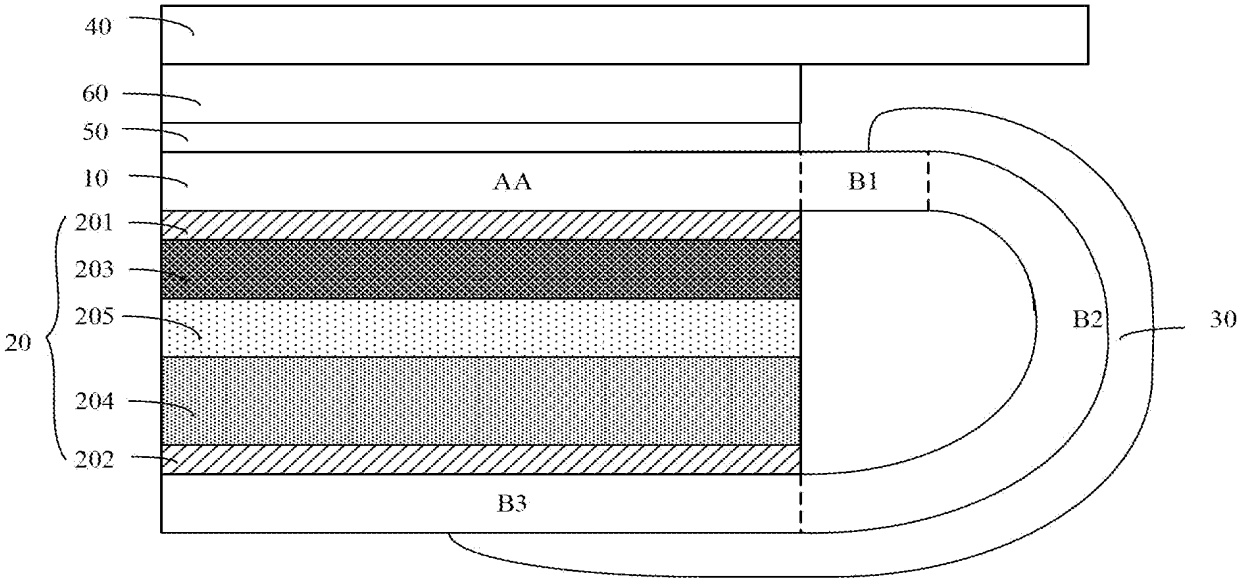

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图 2

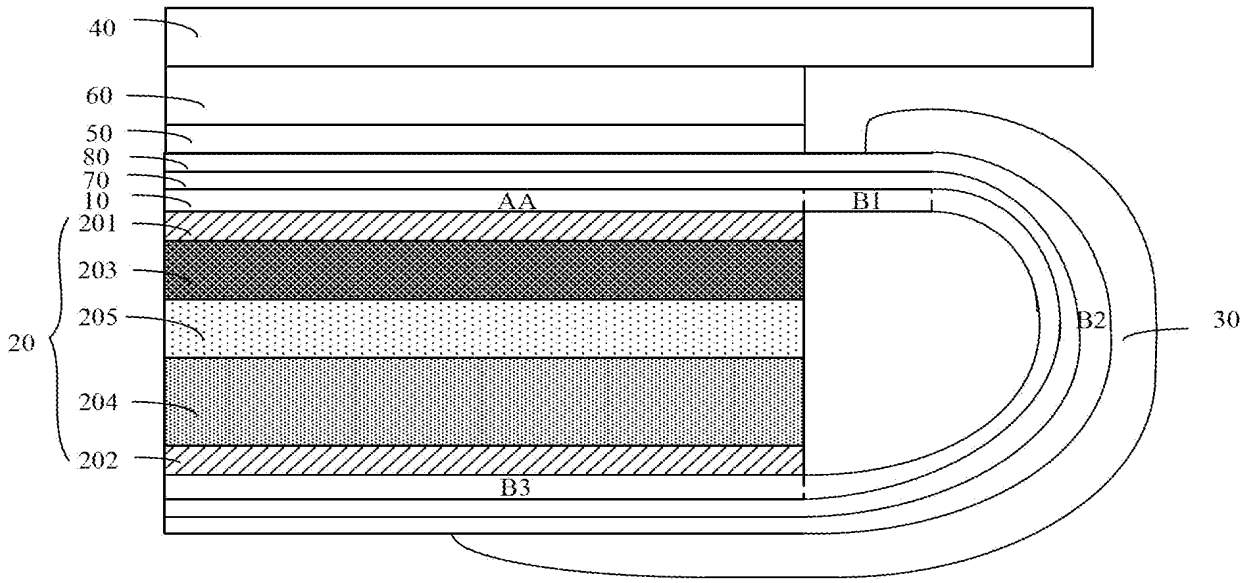

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图 3

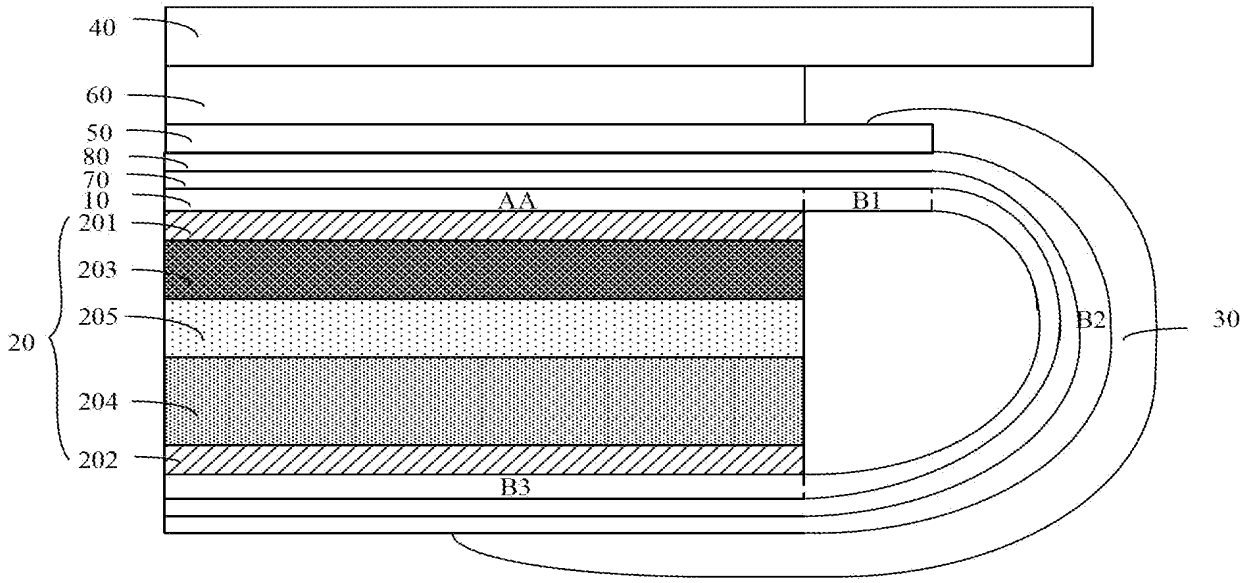

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AA
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B2
B3
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图 4

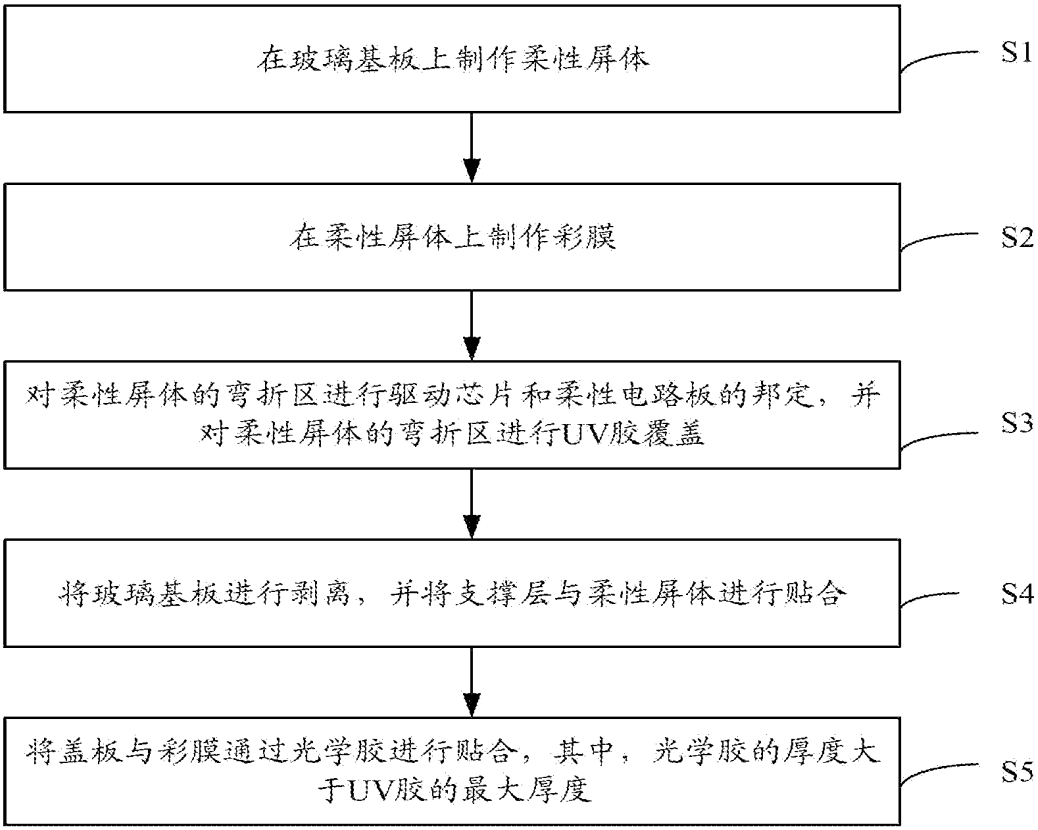


图 5

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DISPLAY DEVICE

FIELD OF INVENTION

[0001] The present disclosure relates to the field of display technologies, and more particularly, to a display device.

BACKGROUND OF INVENTION

[0002] For organic light-emitting diode (OLED) display panels, although polarizers can effectively reduce reflectivity of the OLED display panels under strong light, they cause the OLED display panels to lose nearly 58% of light extraction efficiency, which greatly increases a burden of service life for the OLED display panels. In addition, a thickness of the polarizers is about 100 μm, which is a greater thickness, and material of the polarizers is brittle, thereby being unbeneficial for development of dynamic bending products.

[0003] In order to develop the dynamic bending products based on the OLED display panels, a POL-less technique is usually used to manufacture the OLED display panels. The POL-less technique means a technique using color filters (CFs) to replace the polarizers.

[0004] Wherein, the color filters consist of red color resists, green color resists, blue color resists, and a black matrix (BM). In the OLED display panels, the red color resists, the green color resists, and the blue color resists are responsible for light extraction of red sub-pixel units, green sub-pixel units, and blue sub-pixel units, respectively, and the black matrix is mainly responsible for preventing light leakage of the OLED display panels and reducing reflectivity of the OLED display panels. The color filters can not only reduce the reflectivity of the OLED display panels to a certain degree under the strong light, but can also increase the light extraction efficiency of the OLED display panels from 42% to 60%. In addition, a thickness of the color filters is about 5 μm, which is much less than the thickness of the polarizers, and the color filters have high flexibility, thereby reducing a whole thickness of the OLED display panels and being beneficial for the development of the dynamic bending products.

[0005] Further, in order to realize a narrow bezel design of the OLED display panels, bending areas of the OLED display panels are usually bent to a back

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surface of the OLED display panels, thereby reducing a width of bezels. However, bending of the bending areas of the OLED display panels is prone to cause circuit lines in the OLED display panels to break. In order to prevent breakage of the circuit lines caused by bending, the bending areas of the OLED display panels are usually covered by UV glues, so bending stresses in the bending areas of the OLED display panels can be relieved.

[0006] However, a thickness of the UV glues is about 95 μm, and since thicknesses of the color filters and optical adhesives are both thin, when coverplates are attached to the color filters by the optical adhesives, the coverplates will squeeze the UV glues, thereby causing the OLED display panels to have a risk of cracking.

[0007] Technical problem: the present disclosure provides a display device to solve a problem of current OLED display panels having the risk of cracking.

SUMMARY OF INVENTION

[0008] The present disclosure provides a display device, which includes:

[0009] a flexible screen body including a planar area and a bending area connected to the planar area;

[0010] a color filter disposed on the flexible screen body and at least covering the planar area;

[0011] a protective layer disposed on the flexible screen body and at least covering a part of the bending area; and

[0012] a coverplate disposed on the color filter and at least covering the planar area;

[0013] wherein, in an overlapping area of the protective layer and the coverplate, a distance between the protective layer and the coverplate is greater than or equal to a default value.

[0014] In some embodiments, the protective layer is disposed on a surface of the flexible screen body, and a thickness of the protective layer on the surface of the flexible screen body is less than or equal to a distance between one side of the coverplate adjacent to the flexible screen body and one side of the flexible screen body adjacent to the coverplate.

[0015] In some embodiments, the display device further includes a touch control layer disposed between the flexible screen body and the color filter and

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an insulating layer disposed between the touch control layer and the color filter; wherein, the protective layer is disposed on a surface of the insulating layer, and a thickness of the protective layer on the surface of the insulating layer is less than or equal to a distance between one side of the coverplate adjacent to the insulating layer and one side of the insulating layer adjacent to the coverplate.

[0016] In some embodiments, the protective layer is further disposed on a surface of the color filter, and the thickness of the protective layer on the surface of the color filter is less than or equal to a distance between one side of the coverplate adjacent to the color filter and one side of the color filter adjacent to the coverplate.

[0017] In some embodiments, the bending area includes a transitional bending sub-area, a bending sub-area, and an extending bending sub-area connected to the planar area and defined in sequence, and the transitional bending sub-area is flush with the planar area;

[0018] the protective layer completely covers the bending sub-area and covers at least a part of the transitional bending sub-area; and

[0019] the coverplate is connected to the color filter by an optical adhesive, and the coverplate completely covers the planar area and covers at least the part of the transitional bending sub-area.

[0020] In some embodiments, wherein a thickness of the optical adhesive is greater than a maximum thickness of the protective layer on the transitional bending sub-area.

[0021] In some embodiments, the protective layer further covers at least a part of the extending bending sub-area.

[0022] In some embodiments, the protective layer is a UV glue.

[0023] In some embodiments, the display device further includes a support layer, wherein, one side of the support layer supports the planar area and the transitional bending sub-area, and another side of the support layer away from the planar area supports the extending bending sub-area.

[0024] In some embodiments, the support layer includes a first backplate disposed on one side of the planar area and the transitional bending sub-area away from the coverplate and a second backplate disposed on one side of the

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transitional bending sub-area away from the protective layer.

[0025] In some embodiments, foam is disposed between the first backplate and the second backplate.

[0026] In some embodiments, a stiffener plate is disposed between the foam and the second backplate.

[0027] In some embodiments, a heat dissipation layer is disposed between the foam and the stiffener plate.

[0028] In some embodiments, the default value is greater than 0.

[0029] In some embodiments, a distance between one side end of the protective layer adjacent to the planar area and an initial bending position of the flexible screen body is greater than a first default value, wherein, the first default value is greater than or equal to 0, and the initial bending position is a jointed position of the bending sub-area and the transitional bending sub-area.

[0030] In some embodiments, a distance between one side end of the protective layer adjacent to the extending bending sub-area and a terminal bending position of the flexible screen body is greater than a second default value, wherein, the second default value is greater than or equal to 0.

[0031] In some embodiments, the planar area includes a plurality of red sub-pixel units, green sub-pixel units, and blue sub-pixel units, the color filter includes a plurality of color resists and a black matrix disposed among the color resists, and the color resists include red color resists, green color resists, and blue color resists; and wherein, the red color resists are disposed corresponding to the red sub-pixel units, the green color resists are disposed corresponding to the green sub-pixel units, and the blue color resists are disposed corresponding to the blue sub-pixel units.

[0032] In some embodiments, the optical adhesive is an optically clear adhesive (OCA).

[0033] In some embodiments, a material of the heat dissipation layer is a metal material or graphite, and the metal material includes one or more combinations of copper foil, aluminum foil, or stainless steel foil.

[0034] In some embodiments, the display device further includes a driving unit disposed on one surface of the extending bending sub-area away from the support layer.

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[0035] Beneficial effect: the display device provided by the present disclosure allows the distance between the protective layer and the coverplate to be greater than or equal to the default value in the overlapping area of the protective layer and the coverplate, so the coverplate will not squeeze the protective layer, thereby preventing a risk of cracking the display device.

DESCRIPTION OF DRAWINGS

[0036] FIG. 1 is a schematic structural diagram of a display device according to an embodiment of the present disclosure.

[0037] FIG. 2 is a schematic structural diagram of the display device according to another embodiment of the present disclosure.

[0038] FIG. 3 is a schematic structural diagram of the display device according to yet another embodiment of the present disclosure.

[0039] FIG. 4 is a schematic structural diagram of the display device according to still another embodiment of the present disclosure.

[0040] FIG. 5 is a flowchart of a manufacturing method of the display device according to an embodiment of the present disclosure.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0041] In order to make the purpose, technical solutions, and effects of the present disclosure clearer and more definite, the following further describes the present disclosure in detail with reference to the drawings and embodiments. It should be understood that the specific embodiments described herein are only used to explain the disclosure, and are not used to limit the disclosure.

[0042] An embodiment of the present disclosure provides a display device, which may be wearable devices, such as smart bracelets, smart watches, or virtual reality (VR) devices, may be mobile phones, e-books, e-newspapers, TVs, or personal laptops, and may also be bendable and foldable flexible OLED displays or lighting devices. The embodiment of the present disclosure does not specifically limit a specific form of the display device.

[0043] FIG. 1 is a schematic structural diagram of the display device according to an embodiment of the present disclosure. As shown in FIG. 1, the

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display device includes a flexible screen body 10, a color filter 50, a protective layer 30, and a coverplate 40. Optionally, the display device can also include a support layer 20 and an optical adhesive 60. The following describes the flexible screen body 10, the support layer 20, the protective layer 30, the coverplate 40, the color filter 50, and the optical adhesive 60 in detail, respectively.

[0044] The flexible screen body 10 means a highly flexible screen that can be bent and folded. The flexible screen body 10 can be divided into a planar area AA and a bending area extending from the planar area AA, the planar area AA means an area for displaying, and the bending area means an area that cannot display. The bending area may include a transitional bending sub-area B1, a bending sub-area B2, and an extending bending sub-area B3. Wherein, two opposite ends of the transitional bending sub-area B1 are connected to the planar area AA and the bending sub-area B2, respectively, and two opposite ends of the bending sub-area B2 are connected to the transitional bending sub-area B1 and the extending bending sub-area B3, respectively. Wherein, the transitional bending sub-area B1 is flush with the planar area AA, that is, the transitional bending sub-area B1 and the planar area AA are positioned on a same plane. Both the bending sub-area B2 and the extending bending sub-area B3 are not flush with the planar area AA, that is, the bending sub-area B2 and the planar area AA are positioned on different planes, and the extending bending sub-area B3 and the planar area AA are positioned on different planes.

[0045] Specifically, the flexible screen body 10 includes a flexible substrate. The flexible substrate is a substrate made of a flexible material, which is preferably polyimide (PI). The flexible substrate can be divided into a first area and a second area extending from the first area.

[0046] A display layer can be integrated in the first area of the flexible substrate and can include a plurality of display components for displaying pictures, so the first area of the flexible substrate and the display layer can together form the planar area AA of the flexible screen body 10. The display layer may include different display components, such as thin film transistors, gate electrode lines, data lines, capacitors, anodes, cathodes, and

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light-emitting layers. A structure of the planar area AA itself of the flexible screen body 10 in this embodiment has not been improved, and a commonly used structure of the planar area AA in this field may be used, which is not specifically limited in the embodiment.

[0047] The second area of the flexible substrate is provided with an integrated circuit configured to achieve signal transmissions and drive picture displays, thereby allowing the second area of the flexible substrate and the integrated circuit to together form the bending area of the flexible screen body 10. A structure of the bending area itself of the flexible screen body 10 in this embodiment has not been improved, and a commonly used structure of the bending area in this field may be used, which is not specifically limited in the embodiment.

[0048] In order to realize a narrow bezel design of the display device, the bending area of the flexible screen body 10 is usually bent. As shown in FIG. 1, specifically, the bending sub-area B2 of the flexible screen body 10 is bent by 180°, thereby allowing an entire body consisting of the planar area AA and the transitional bending sub-area B1 to be opposite to and in parallel to the extending bending sub-area B3. At this time, the bending sub-area B2 is semi-circular arc shaped, the planar area AA, the transitional bending sub-area B1, the bending sub-area B2, and the extending bending sub-area B3 form a receiving groove, and the support layer 20 is disposed in the receiving groove.

[0049] It should be noted that in one aspect, since the bending area of the flexible screen body 10 includes the transitional bending sub-area B1 defined between the planar area AA and the bending sub-area B2, an initial bending position of the flexible screen body 10 is a jointed position of the bending sub-area B2 and the transitional bending sub-area B1. That is, the initial bending position of the flexible screen body 10 departs from a jointed position of the planar area AA and the bending area, and both sides of the initial bending position are in the bending area, thereby effectively relieving stress concentration caused by different structures on both sides of the initial bending position of the flexible screen body 10 and realizing protection of the initial bending position of the flexible screen body 10. In another aspect, since the bending sub-area B2 is not directly adjacent to the planar area AA and the

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transitional bending sub-area B1 is defined between them, stresses acting on the planar area AA is reduced when the bending sub-area B2 is bent, thereby protecting the planar area AA, for example, preventing the planar area AA from cracking.

[0050] One side of the support layer 20 supports the planar area AA and the transitional bending sub-area B1 of the flexible screen body 10, and another side of the support layer 20 away from the planar area AA supports the extending bending sub-area B3 of the flexible screen body 10. That is, the planar area AA and the transitional bending sub-area B1 of the flexible screen body 10 are disposed on a same side of the support layer 20, and the extending bending sub-area B3 of the flexible screen body 10 is disposed on another side of the support layer 20 away from the planar area AA.

[0051] It should be noted that the support layer 20 is mainly configured to fix and support the flexible screen body 10, thereby preventing the bending sub-area B2 of the flexible screen body 10 from breaking due to an overly large degree of bending. The support layer 20 may be a material having both hardness and elasticity, so it can not only support the flexible screen body 10, but can also damp the flexible screen body 10. The support layer 20 may be one layer or a multi-layered structure, and is not specifically limited in the embodiment.

[0052] The protective layer 30 is disposed on one side of the flexible screen body 10 away from the support layer 20 and covers at least a part of the bending area. The protective layer 30 shown in FIG. 1 completely covers the bending sub-area B2 of the flexible screen body 10 and covers at least a part of the transitional bending sub-area B1 of the flexible screen body 10. Wherein, the protective layer 30 shown in FIG. 1 completely covers the bending sub-area B2 and the transitional bending sub-area B1 of the flexible screen body 10. Of course, in other embodiments, the protective layer 30 may also completely cover the bending sub-area B2 of the flexible screen body 10 and covers the part of the transitional bending sub-area B1.

[0053] It should be noted that the protective layer 30 completely covers the bending sub-area B2 of the flexible screen body 10, thereby relieving bending stresses of the bending sub-area B2. The protective layer 30 covers at least

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the part of the transitional bending sub-area B1 of the flexible screen body 10, thereby allowing the protective layer 30 to better relieve bending stresses of the initial bending position of the flexible screen body 10 from one side of the initial bending position of the flexible screen body 10 adjacent to the planar area AA. It should be noted that a distance between one side end of the protective layer 30 adjacent to the planar area AA and the initial bending position of the flexible screen body 10 may be greater than a first default value. Wherein, the first default value is a value greater than or equal to 0 and may be flexibly adjusted according to actual needs, and is not specifically limited in the embodiment.

[0054] The planar area AA of the flexible screen body 10 includes red sub-pixel units, green sub-pixel units, and blue sub-pixel units. Wherein, the red sub-pixel units are configured to emit red light, the green sub-pixel units are configured to emit green light, and the blue sub-pixel units are configured to emit blue light.

[0055] The color filter 50 is disposed on the side of the flexible screen body 10 away from the support layer 20 and at least covers the planar area AA. The color filter 50 is configured to replace polarizers and is responsible for preventing light leakage of the display device and reducing reflectivity of the display device.

[0056] Specifically, the color filter 50 includes a plurality of color resists and a black matrix disposed among the color resists, and the color resists include red color resists, green color resists, and blue color resists. Wherein, the red color resists are disposed corresponding to the red sub-pixel units and are responsible for light extraction of the red sub-pixel units; the green color resists are disposed corresponding to the green sub-pixel units and are responsible for light extraction of the green sub-pixel units; the blue color resists are disposed corresponding to the blue sub-pixel units and are responsible for light extraction of the blue sub-pixel units; and the black matrix is mainly responsible for preventing the light leakage of the display device and reducing the reflectivity of the display device.

[0057] The coverplate 40 is disposed on one side of the color filter 50 away from the flexible screen body 10 and at least covers the planar area AA. The

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coverplate 40 shown in FIG. 1 is connected to the color filter 50 by the optical adhesive 60. The optical adhesive 60 is configured to bond optical elements and may be an optically clear adhesive (OCA) that has characteristics of transparency, light transmittance above 90%, good bonding strength, ability to be cured at room temperature or a moderate temperature, and small curing shrinkage. In this embodiment, the optical adhesive 60 is configured to bond the coverplate 40 and the color filter 50. The coverplate 40 is configured to protect the flexible screen body 10, thereby preventing it from being damaged by external impact.

[0058] In an overlapping area of the protective layer 30 and the coverplate 40 of the display device provided by the embodiment of the present disclosure, a distance between the protective layer 30 and the coverplate 40 is greater than or equal to a default value. It should be noted that the default value is a value greater than 0 and may be flexibly adjusted according to actual needs, and is not specifically limited in the embodiment. Therefore, the coverplate 40 will not squeeze the protective layer 30, thereby preventing a risk of cracking the display device.

[0059] Based on the above embodiments, referring to FIG. 2, the protective layer 30 is disposed only on a surface of the flexible screen body 10, and a thickness of the protective layer 30 on the surface of the flexible screen body 10 is less than or equal to a distance between one side of the coverplate 40 adjacent to the flexible screen body 10 and one side of the flexible screen body 10 adjacent to the coverplate 40.

[0060] Based on the above embodiments, referring to FIG. 3, the display device further includes a touch control layer 70 disposed between the flexible screen body 10 and the color filter 50 and an insulating layer 80 disposed between the touch control layer 70 and the color filter 50. The protective layer 30 is disposed only on a surface of the insulating layer 80, and the thickness of the protective layer 30 on the surface of the insulating layer 80 is less than or equal to a distance between one side of the coverplate 40 adjacent to the insulating layer 80 and one side of the insulating layer 80 adjacent to the coverplate 40.

[0061] Based on the above embodiments, referring to FIGs. 1 and 4, the

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protective layer 30 is further disposed on a surface of the color filter 50, and the thickness of the protective layer 30 on the surface of the color filter 50 is less than or equal to a distance between one side of the coverplate 40 adjacent to the color filter 50 and one side of the color filter 50 adjacent to the coverplate 40.

[0062] Based on the above embodiments, in this embodiment, a thickness of the optical adhesive 60 is greater than a maximum thickness of the protective layer 30 on the transitional bending sub-area B1 of the flexible screen body 10. Therefore, it can ensure that a predetermined spacing is between the coverplate 40 covering the transitional bending sub-area B1 of the flexible screen body 10 and the protective layer 30 covering the transitional bending sub-area B1 of the flexible screen body 10. Therefore, the coverplate 40 will not squeeze the protective layer 30, thereby preventing the risk of cracking the display device.

[0063] Based on the above embodiments, the display device of the embodiment will be further described. The protective layer 30 further covers at least a part of the extending bending sub-area B3 of the flexible screen body 10, thereby better relieving bending stresses of a terminal bending position of the flexible screen body 10. It should be noted that a distance between one side end of the protective layer 30 adjacent to the extending bending sub-area B3 and the terminal bending position of the flexible screen body 10 may also be greater than a second default value. Wherein, the second default value is a value greater than or equal to 0 and may be flexibly adjusted according to actual needs, and is not specifically limited in the embodiment. Wherein, the protective layer 30 shown in FIG. 1 covers the part of the extending bending sub-area B3 of the flexible screen body 10. Of course, in other embodiments, the protective layer 30 may also completely cover the extending bending sub-area B3 of the flexible screen body 10.

[0064] Based on the above embodiments, in some embodiments, the protective layer 30 is a UV glue. Of course, in other embodiments, the protective layer 30 is not limited to the UV glue and may also be thermal curing adhesives or other kinds of photo curing adhesives, and is not specifically limited in the embodiment. It should be noted that in a case that the distance

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between the coverplate 40 and the protective layer 30 is greater than 0, a skilled person in the art can set a suitable thickness for the protective layer 30 according to a size and type of the flexible screen body 10, a bending radius of the bending sub-area B2, flexibility and an ability to relieve stresses of the protective layer 30, and is not specifically limited in the embodiment.

[0065] Based on the above embodiments, the display device of the embodiment will be further described. The support layer 20 includes a first backplate 201 disposed on one side of the planar area AA and the transitional bending sub-area B1 of the flexible screen body 10 that are away from the cover plate 40, and a second backplate 202 disposed on one side of the extending bending sub-area B3 of the flexible screen body 10 that is away from the protective layer 30. Wherein, the extending bending sub-area B3 may be fixed onto the second backplate 202 by gluing or physical methods.

[0066] The first backplate 201 is configured to support and protect the planar area AA and the transitional bending sub-area B1 of the flexible screen body 10, thereby preventing them from being damaged by the external impact. The second backplate 202 is configured to support and protect the extending bending sub-area B3 of the flexible screen body 10, thereby preventing it from being damaged by the external impact. Materials of the first backplate 201 and the second backplate 202 may be polyethylene terephthalate (PET) material. Since the PET material has advantages of low elastic modulus and not easily expanding when heated, the first backplate 201 and the second backplate 202 manufactured using the PET material will not deform with changes of an environment temperature, which reduces a probability of peeling between the first backplate 201 and film layers that are connected thereto and reduces a probability of peeling between the second backplate 202 and film layers that are connected thereto, thereby improving yields and reliability of the display device.

[0067] Further, in order to prevent the first backplate 201 and the second backplate 202 from affecting bending of the bending sub-area B2 of the flexible screen body 10, it must be ensured that the first backplate 201 and the second backplate 202 both avoid the bending sub-area B2. Preferably, in order to better support the planar area AA and the transitional bending sub-area B1 of

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the flexible screen body 10, an edge of the first backplate 201 coincides with the initial bending position of the flexible screen body 10. Similarly, in order to better support the extending bending sub-area B3 of the flexible screen body 10, an edge of the second backplate 202 coincides with the terminal bending position of the flexible screen body 10.

[0068] Based on the above embodiments, in some embodiments, the support layer 20 further includes a height-increased block disposed between the first backplate 201 and the second backplate 202. A height of the height-increased block may be adjusted according to a width of the bending sub-area B2 of the flexible screen body 10, and is not specifically limited in the embodiment. The height-increased block may be a material, such as silica gel, and may have certain elasticity and hardness. The height-increased block has certain hardness to prevent the flexible screen body 10 from being squeezed and deformed, and has certain elasticity to prevent the flexible screen body 10 from being damaged by local stresses.

[0069] Specifically, the height-increased block is disposed avoiding the bending sub-area B2 of the flexible screen body 10. Of course, in other embodiments, one surface of one end of the height-increased block adjacent to the bending sub-area B2 of the flexible screen body 10 matches a shape of the bending sub-area B2 after bending, which allows one side surface of the bending sub-area B2 adjacent to the height-increased block to fit with the surface of the height-increased block, thereby having a certain supporting effect on the bending sub-area B2 and being uneasy to deform and to be damaged. It can be understood that in other embodiments, a distance between the planar area AA and the extending bending sub-area B3 of the flexible screen body 10 can be ensured by increasing thicknesses of the first backplate 201 and the second backplate 202 or adding other supporting structures.

[0070] Based on the above embodiments, in some embodiments, a foam 203 is disposed between the first backplate 201 and the second backplate 202. It should be noted that the foam 203 is a foamed material of plastic particles, and it can play a role of buffering and shielding light.

[0071] Based on the above embodiments, in some embodiments, a stiffener plate 204 is disposed between the foam 203 and the second backplate 202. It

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should be noted that the stiffener plate 204 is configured to improve strength of the flexible screen body 10. Wherein, the stiffener plate 204 may be a polyimide layer or a graphite layer. Wherein, an outer surface of the graphite layer may also be covered using polyimide, and is not specifically limited in the embodiment.

[0072] Based on the above embodiments, in some embodiments, a heat dissipation layer 205 is disposed between the foam 203 and the stiffener plate 204. Wherein, the heat dissipation layer 205 plays a role of shielding and heat dissipating, and a material of the heat dissipation layer 205 is a heat dissipating material and specifically may be a metal material or graphite. Wherein, the metal material may be copper foil, aluminum foil, or stainless steel foil, and it is not specifically limited in the embodiment.

[0073] Based on the above embodiments, in some embodiments, the display device further includes a driving unit disposed on the extending bending sub-area B3. Specifically, the driving unit is disposed on a surface of the extending bending sub-area B3 of the flexible screen body 10 away from the support layer 20. The driving unit includes a driving chip and a flexible circuit board. Wherein, the driving chip and the flexible circuit board are both disposed on the surface of the extending bending sub-area B3 of the flexible screen body 10 away from the support layer 20, and a distance between the flexible circuit board and the driving chip is greater than 0.

[0074] Based on the above embodiments, in some embodiments, the planar area AA of the flexible screen body 10 includes the flexible substrate, the thin film transistors, display components, and an encapsulation layer. Wherein, the flexible substrate is disposed on the first backplate 201, the thin film transistors are disposed on the flexible substrate, the display components are disposed on the thin film transistors, and the encapsulation layer is disposed on the display components.

[0075] The flexible substrate is the substrate made of the flexible material, which is preferably polyimide (PI).

[0076] The display components are configured to emit light and usually include the anodes disposed on the thin film transistors, hole injection layers (HILs) disposed on the anodes, hole transport layers (HTLs) disposed on the

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hole injection layers, light-emitting layers (emission layers, EMLs) disposed on the hole transport layers, electron transport layers (ETLs) disposed on the light-emitting layers, electron injection layers (EILs) disposed on the electron transport layers, and the cathodes disposed on the electron injection layers. Optionally, hole blocking layers (HBLs), electron blocking layers (EBLs), and capping layers (CPLs) may also be disposed in the display components.

[0077] The light-emitting layers include the red sub-pixel units, the green sub-pixel units, and the blue sub-pixel units. Wherein, the red sub-pixel units are configured to emit the red light, the green sub-pixel units are configured to emit the green light, and the blue sub-pixel units are configured to emit the blue light.

[0078] The color filter 50 is configured to replace the polarizers and is responsible for preventing the light leakage of the display device and reducing the reflectivity of the display device. Specifically, the color filter 50 includes the plurality of color resists and the black matrix disposed among the color resists, and the color resists include the red color resists, the green color resists, and the blue color resists. Wherein, the red color resists are disposed corresponding to the red sub-pixel units and are responsible for the light extraction of the red sub-pixel units; the green color resists are disposed corresponding to the green sub-pixel units and are responsible for the light extraction of the green sub-pixel units; the blue color resists are disposed corresponding to the blue sub-pixel units and are responsible for the light extraction of the blue sub-pixel units; and the black matrix is mainly responsible for preventing the light leakage of the display device and reducing the reflectivity of the display device.

[0079] The encapsulation layer is configured to isolate external water and oxygen for the display device, thereby ensuring the yields of the display devices. The encapsulation layer is usually a sandwich structure composed of an organic layer, an inorganic layer, and another organic layer.

[0080] Based on the above embodiments, a manufacturing method of the display device mentioned above in the embodiments is described in this embodiment. FIG. 5 is a flowchart of the manufacturing method of the display device according to an embodiment of the present disclosure. As shown in

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FIG. 5, the manufacturing method includes following steps.

[0081] S1: manufacturing the flexible screen body 10 on a glass substrate.

[0082] The flexible screen body 10 means the highly flexible screen that can be bent and folded. The flexible screen body 10 can be divided into the planar area AA and the bending area extending from the planar area AA, the planar area AA means the area for displaying, and the bending area means the area that cannot display. The bending area includes the transitional bending sub-area B1, the bending sub-area B2, and the extending bending sub-area B3. Wherein, the two opposite ends of the transitional bending sub-area B1 are connected to the planar area AA and the bending sub-area B2, respectively, and the two opposite ends of the bending sub-area B2 are connected to the transitional bending sub-area B1 and the extending bending sub-area B3, respectively. Wherein, the transitional bending sub-area B1 is flush with the planar area AA, that is, the transitional bending sub-area B1 and the planar area AA are positioned on the same plane. Both the bending sub-area B2 and the extending bending sub-area B3 are not flush with the planar area AA, that is, the bending sub-area B2 and the planar area AA are positioned on different planes, and the extending bending sub-area B3 and the planar area AA are positioned on different planes.

[0083] S2: manufacturing the color filter 50 on the flexible screen body 10.

[0084] Specifically, the planar area AA of the flexible screen body 10 includes the red sub-pixel units, the green sub-pixel units, and the blue sub-pixel units. The color filter 50 includes the plurality of color resists and the black matrix disposed among the color resists, and the color resists include the red color resists, the green color resists, and the blue color resists. The red color resists are disposed corresponding to the red sub-pixel units, the green color resists are disposed corresponding to the green sub-pixel units, and the blue color resists are disposed corresponding to the blue sub-pixel units. It should be noted that in some embodiments, a planarization layer may be manufactured on the color filter 50 to planarize the color filter 50.

[0085] S3: bonding the driving chip and the flexible circuit board on the bending area of the flexible screen body 10 and covering the UV glue on the bending area of the flexible screen body 10.

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[0086] Specifically, the driving chip and the flexible circuit board are both disposed on the surface of the extending bending sub-area B3 of the flexible screen body 10 away from the support layer 20, and the distance between the flexible circuit board and the driving chip is greater than 0. The bending area of the flexible screen body 10 is covered by the UV glue to allow the UV glue to completely cover the bending sub-area B2 and to cover at least the part of the transitional bending sub-area B1.

[0087] S4: stripping off the glass substrate and attaching the support layer 20 to the flexible screen body 10.

[0088] Specifically, the side of the support layer 20 supports the planar area AA and the transitional bending sub-area B1 of the flexible screen body 10, and the another side of the support layer 20 away from the planar area AA supports the extending bending sub-area B3 of the flexible screen body 10. That is, the planar area AA and the transitional bending sub-area B1 of the flexible screen body 10 are disposed on the same side of the support layer 20, and the extending bending sub-area B3 of the flexible screen body 10 is disposed on the another side of the support layer 20 away from the planar area AA. It should be noted that the support layer 20 is mainly configured to fix and support the flexible screen body 10, thereby preventing the bending sub-area B2 of the flexible screen body 10 from breaking due to the overly large degree of bending. The support layer 20 may be the material having both hardness and elasticity, so it can not only support the flexible screen body 10, but can also damp the flexible screen body 10. The support layer 20 may be one layer or the multi-layered structure, and is not specifically limited in the embodiment.

[0089] S5: attaching the coverplate 40 to the color filter 50 by the optical adhesive 60, wherein, the thickness of the optical adhesive 60 is greater than the maximum thickness of the UV glue.

[0090] Specifically, the coverplate 40 is attached to the color filter 50 using the optical adhesive 60 to allow the coverplate 40 to completely cover the planar area AA of the flexible screen body 10 and to cover at least the part of the transitional bending sub-area B1 of the flexible screen body 10. Since the thickness of the optical adhesive 60 is greater than the maximum thickness of the UV glue, the coverplate 40 will not generate pressures on the UV glue

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during a bonding process of the coverplate 40 and the color filter 50, thereby reducing a module processing risk of the display device.

[0091] It should be noted that the numbers of the above steps do not strictly represent the order of executing the steps. In some embodiments, the corresponding steps can be executed strictly according to the order of the numbers of the above steps. Of course, in other embodiments, some steps may be executed at a same time or executed in a reverse order, which is not specifically limited in the embodiment of the present disclosure.

[0092] It can be understood that for a person of ordinary skill in the art, equivalent replacements or changes can be made according to the technical solution of the present disclosure and its inventive concept, and all these changes or replacements should fall within the protection scope of the claims attached to the present disclosure.

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What is claimed is:

1. A display device, comprising:

a flexible screen body comprising a planar area and a bending area connected to the planar area;

a color filter disposed on the flexible screen body and at least covering the planar area;

a protective layer disposed on the flexible screen body and at least covering a part of the bending area; and

a coverplate disposed on the color filter and at least covering the planar area;

wherein in an overlapping area of the protective layer and the coverplate, a distance between the protective layer and the coverplate is greater than or equal to a default value.

2. The display device according to claim 1, wherein the protective layer is disposed on a surface of the flexible screen body, and a thickness of the protective layer on the surface of the flexible screen body is less than or equal to a distance between one side of the coverplate adjacent to the flexible screen body and one side of the flexible screen body adjacent to the coverplate.

3. The display device according to claim 1, further comprising a touch control layer disposed between the flexible screen body and the color filter and an insulating layer disposed between the touch control layer and the color filter;

wherein the protective layer is disposed on a surface of the insulating layer, and a thickness of the protective layer on the surface of the insulating layer is less than or equal to a distance between one side of the coverplate adjacent to the insulating layer and one side of the insulating layer adjacent to the coverplate.

4. The display device according to claim 2, wherein the protective layer is further disposed on a surface of the color filter, and a thickness of the protective layer on the surface of the color filter is less than or equal to a distance between one side of the coverplate adjacent to the color filter and one side of the color filter adjacent to the coverplate.

5. The display device according to claim 1, wherein the bending area comprises a transitional bending sub-area, a bending sub-area, and an

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extending bending sub-area connected to the planar area and defined in sequence, and the transitional bending sub-area is flush with the planar area;

the protective layer completely covers the bending sub-area and covers at least a part of the transitional bending sub-area; and

the coverplate is connected to the color filter by an optical adhesive, and the coverplate completely covers the planar area and covers at least the part of the transitional bending sub-area.

6. The display device according to claim 5, wherein a thickness of the optical adhesive is greater than a maximum thickness of the protective layer on the transitional bending sub-area.

7. The display device according to claim 5, wherein the protective layer further covers at least a part of the extending bending sub-area.

8. The display device according to claim 5, wherein the protective layer is a UV glue.

9. The display device according to claim 5, further comprising:

a support layer, wherein one side of the support layer supports the planar area and the transitional bending sub-area, and another side of the support layer away from the planar area supports the extending bending sub-area.

10. The display device according to claim 9, wherein the support layer comprises a first backplate disposed on one side of the planar area and the transitional bending sub-area away from the coverplate and a second backplate disposed on one side of the transitional bending sub-area away from the protective layer.

11. The display device according to claim 10, wherein a foam is disposed between the first backplate and the second backplate.

12. The display device according to claim 11, wherein a stiffener plate is disposed between the foam and the second backplate.

13. The display device according to claim 12, wherein a heat dissipation layer is disposed between the foam and the stiffener plate.

14. The display device according to claim 1, wherein the default value is greater than 0.

15. The display device according to claim 5, wherein a distance between one side end of the protective layer adjacent to the planar area and an initial bending position of the flexible screen body is greater than a first default value,

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wherein the first default value is greater than or equal to 0, and the initial bending position is a jointed position of the bending sub-area and the transitional bending sub-area.

16. The display device according to claim 5, wherein a distance between one side end of the protective layer adjacent to the extending bending sub-area and a terminal bending position of the flexible screen body is greater than a second default value, wherein the second default value is greater than or equal to 0.

17. The display device according to claim 1, wherein the planar area comprises a plurality of red sub-pixel units, green sub-pixel units, and blue sub-pixel units, the color filter comprises a plurality of color resists and a black matrix disposed among the color resists, and the color resists comprise red color resists, green color resists, and blue color resists; and

wherein the red color resists are disposed corresponding to the red sub-pixel units, the green color resists are disposed corresponding to the green sub-pixel units, and the blue color resists are disposed corresponding to the blue sub-pixel units.

18. The display device according to claim 5, wherein the optical adhesive is an optically clear adhesive (OCA).

19. The display device according to claim 13, wherein a material of the heat dissipation layer is a metal material or graphite, and the metal material comprises one or more combinations of copper foil, aluminum foil, or stainless steel foil.

20. The display device according to claim 9, further comprising a driving unit disposed on one surface of the extending bending sub-area away from the support layer.

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ABSTRACT

A display device is provided. The present disclosure allows a distance between a protective layer and a coverplate to be greater than or equal to a default value in an overlapping area of the protective layer and the coverplate, so the coverplate will not squeeze the protective layer, thereby preventing a risk of cracking the display device.

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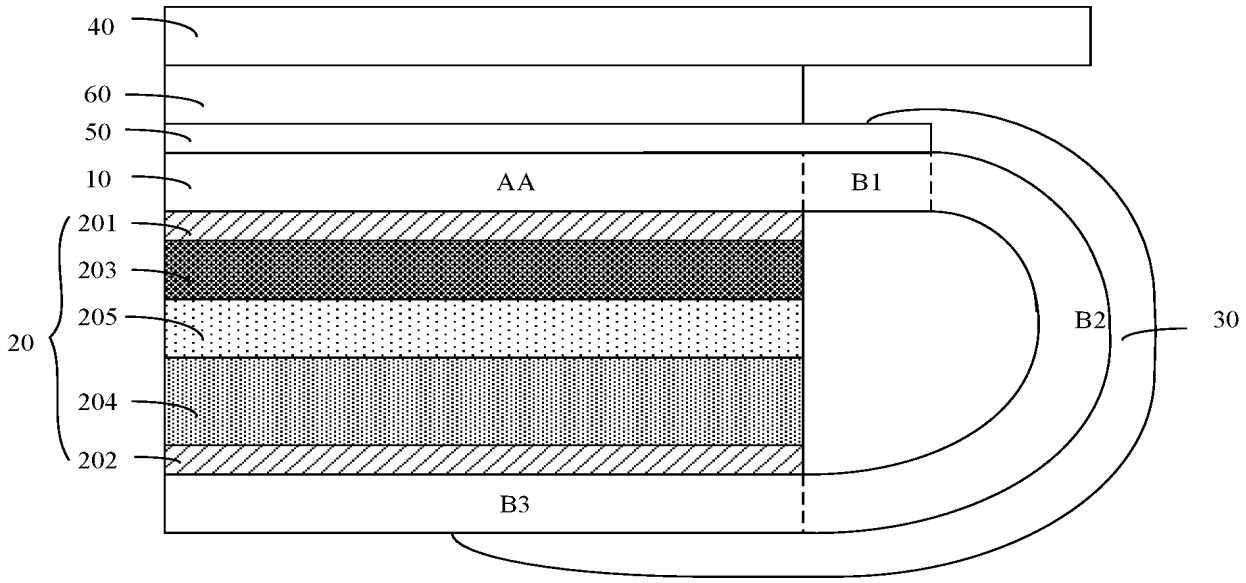

40
60
50
10
AA
B1
201
203
205
20
B2
30
204
202
B3

FIG. 1

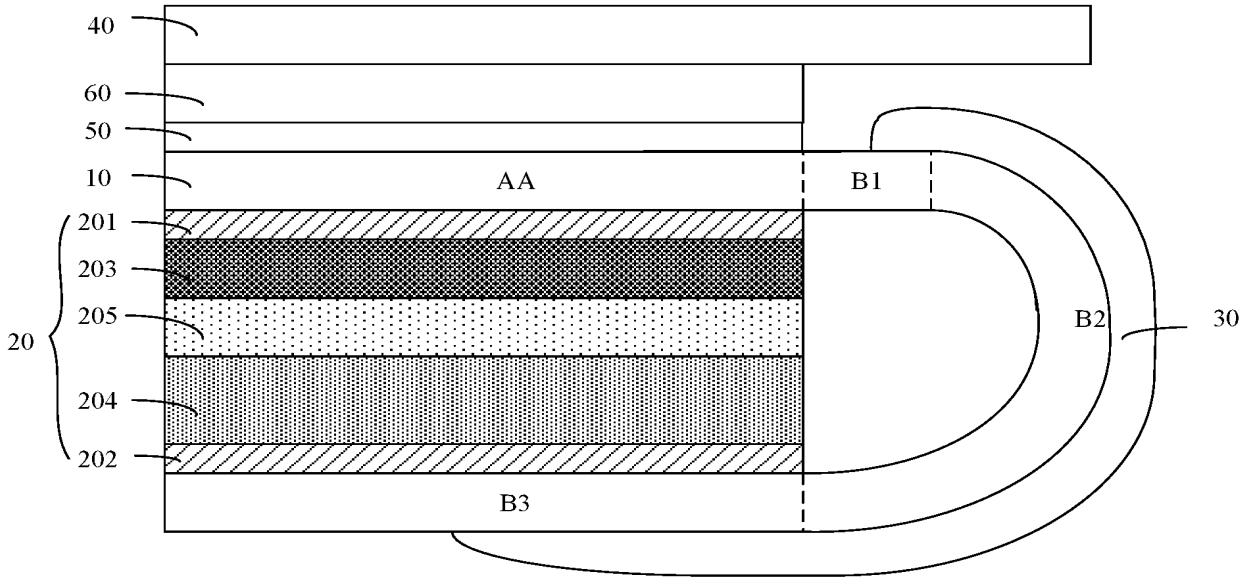

40
60
50
10
AA
B1
201
203
205
20
B2
30
204
202
B3

FIG. 2

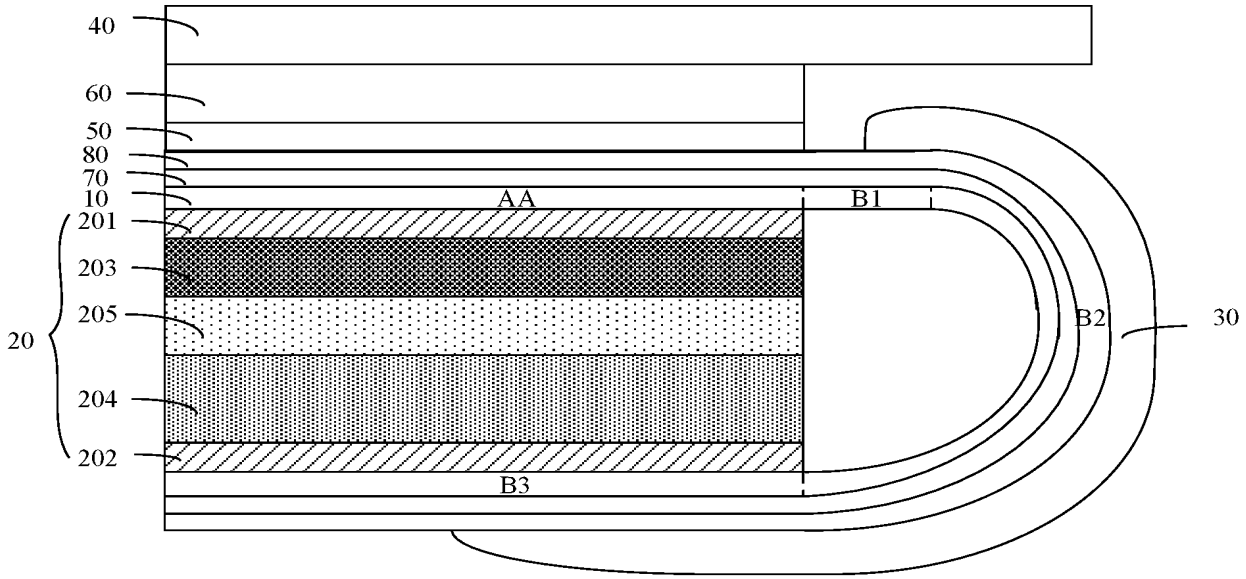

40
60
50
80
70
10
201
203
205
204
202
20
AA
B1
B2
B3
30

FIG. 3

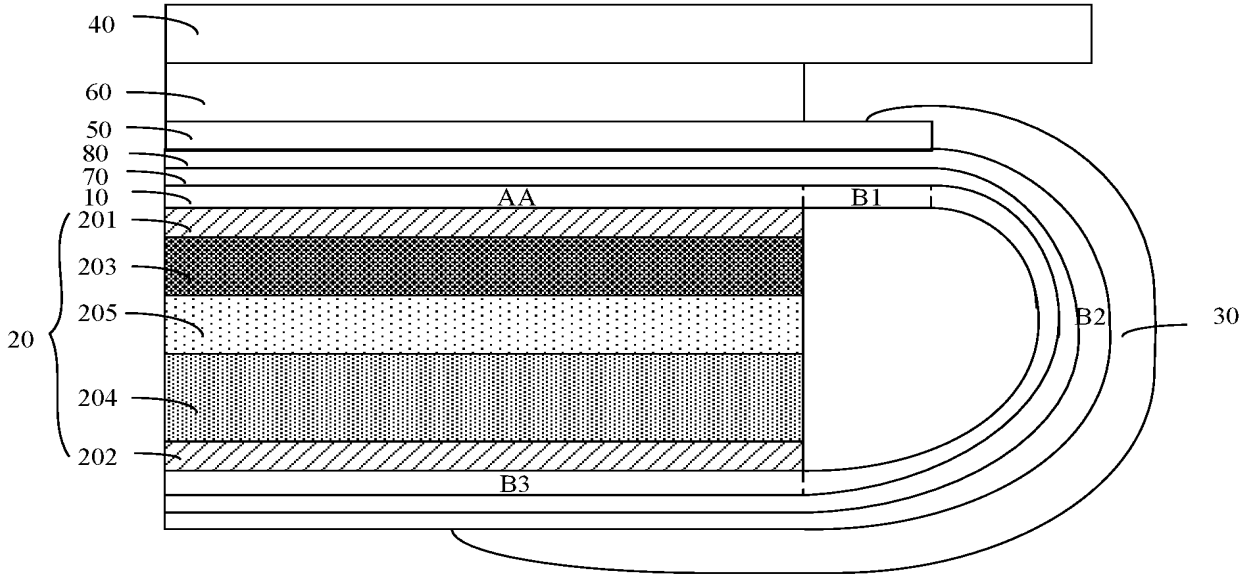

40
60
50
80
70
10
201
203
205
204
202
20
AA
B1
B2
B3
30

FIG. 4

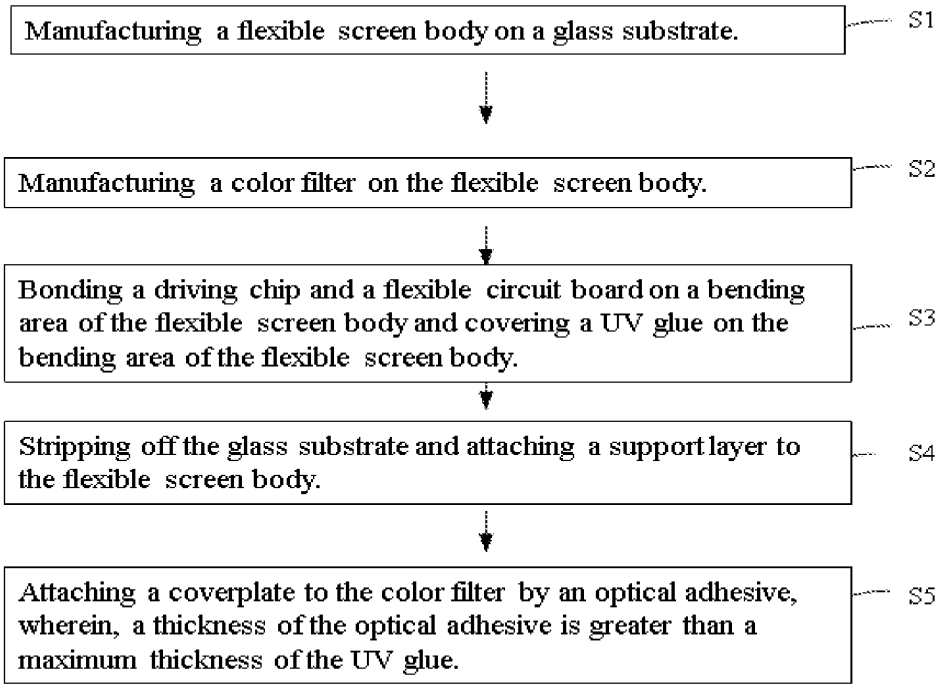

Manufacturing a flexible screen body on a glass substrate.
S1
Manufacturing a color filter on the flexible screen body.
S2
Bonding a driving chip and a flexible circuit board on a bending area of the flexible screen body and covering a UV glue on the bending area of the flexible screen body.
S3
Stripping off the glass substrate and attaching a support layer to the flexible screen body.
S4
Attaching a coverplate to the color filter by an optical adhesive, wherein, a thickness of the optical adhesive is greater than a maximum thickness of the UV glue.
S5

FIG. 5

ASSIGNMENT AND DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION	Attorney Docket Number	
	First Named Inventor	ZHOU, Jing

DISPLAY DEVICE

(Title of the Invention)

As a below named inventor, I hereby declare that:

This assignment and declaration is directed to:

☐ The attached application

OR

☒ United States Application Number or PCT International application number PCT/CN2021/097527 filed on 05/31/2021 (MM/DD/YYYY)

The above-identified application was made or authorized to be made by me.

I believe I am the original or an original joint inventor of the claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

As a below named inventor, I hereby sell, assign and transfer unto to WUHAN CHINA STAR OPTOELECTRONICS SEMICONDUCTOR DISPLAY TECHNOLOGY CO., LTD., a corporation of China, herein referred to as "Assignee", whose mailing address is 305 Room, Building C5, Biolake of Optics Valley, No.666 Gaoxin Avenue, Wuhan East Lake High-tech Development Zone, Wuhan, Hubei, 430079 China, the full and exclusive right to the said invention in the United States and the entire right, title and interest in and to any and all Patents which may be granted therefor in the United States. I hereby authorize and request the Commissioner of Patents and Trademarks to issue said United States Patent, the entire right, title, and interest in and to the same, for the Assignee's sole use and benefit; and for the use and benefit of the Assignee's legal representatives, to the full end of the term for which said Patent may be granted, as fully and entirely as the same would have been held by me had this assignment and sale not been made.

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ASSIGNMENT AND DECLARATION — Utility or Design Patent Application

LEGAL NAME OF SOLE OR FIRST INVENTOR:

Given Name (first and middle [if any])	Family Name or Surname
Jing	ZHOU

Inventor's Signature	Date (Optional)
Jing ZHOU	Feb. 1, 2021

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City	State	Zip	Country
Wuhan	Hubei	430079	China

LEGAL NAME OF SECOND INVENTOR:

Given Name (first and middle [if any])	Family Name or Surname

Inventor's Signature	Date (Optional)

Residence: City	State	Country

Mailing Address

City	State	Zip	Country

LEGAL NAME OF THIRD INVENTOR:

Given Name (first and middle [if any])	Family Name or Surname

Inventor's Signature	Date (Optional)

Residence: City	State	Country

Mailing Address

City	State	Zip	Country

☐ Additional inventors are being named on the ___ supplemental sheet(s) attached hereto.

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2021105489052

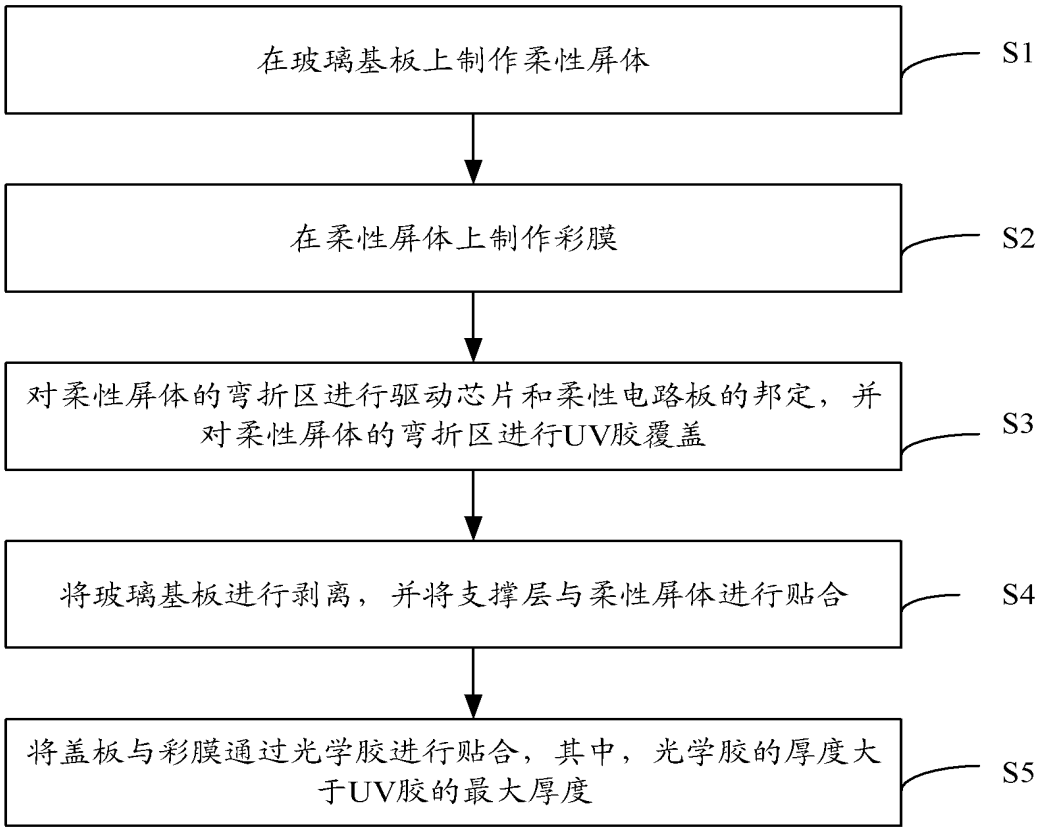


图 5

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2021105489052

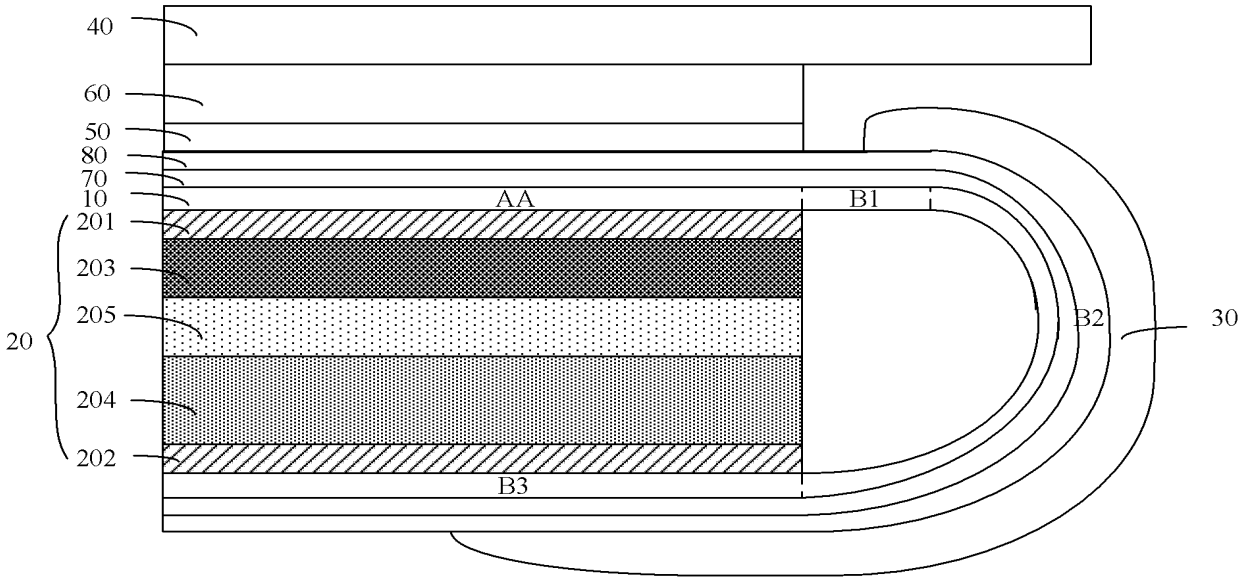


图 3

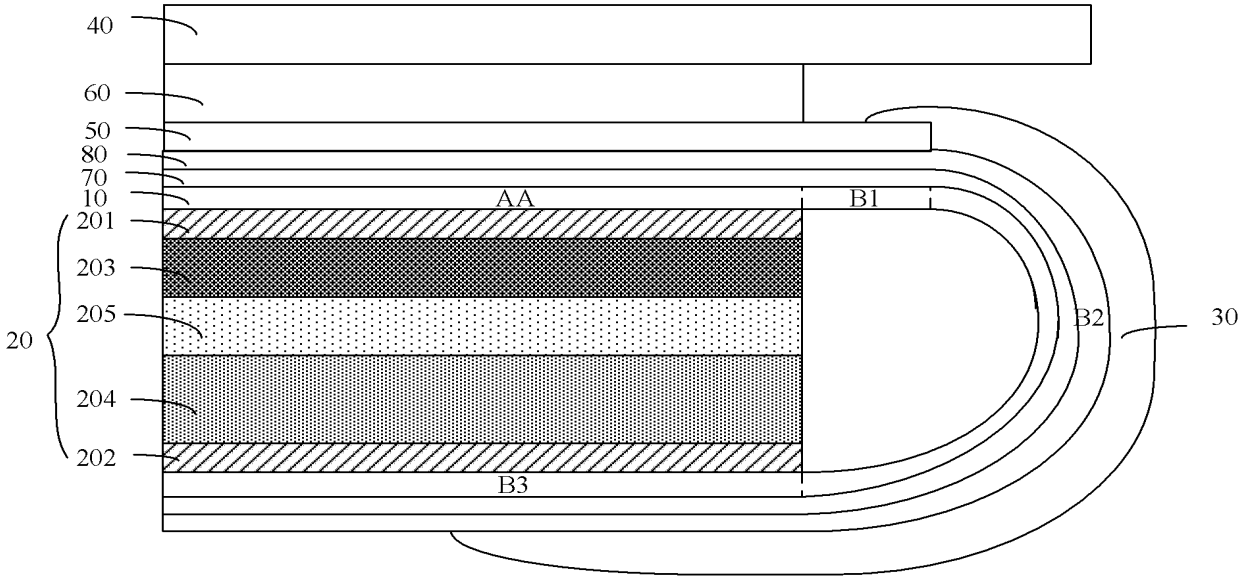


图 4

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2021105489052

说 明 书 附 图

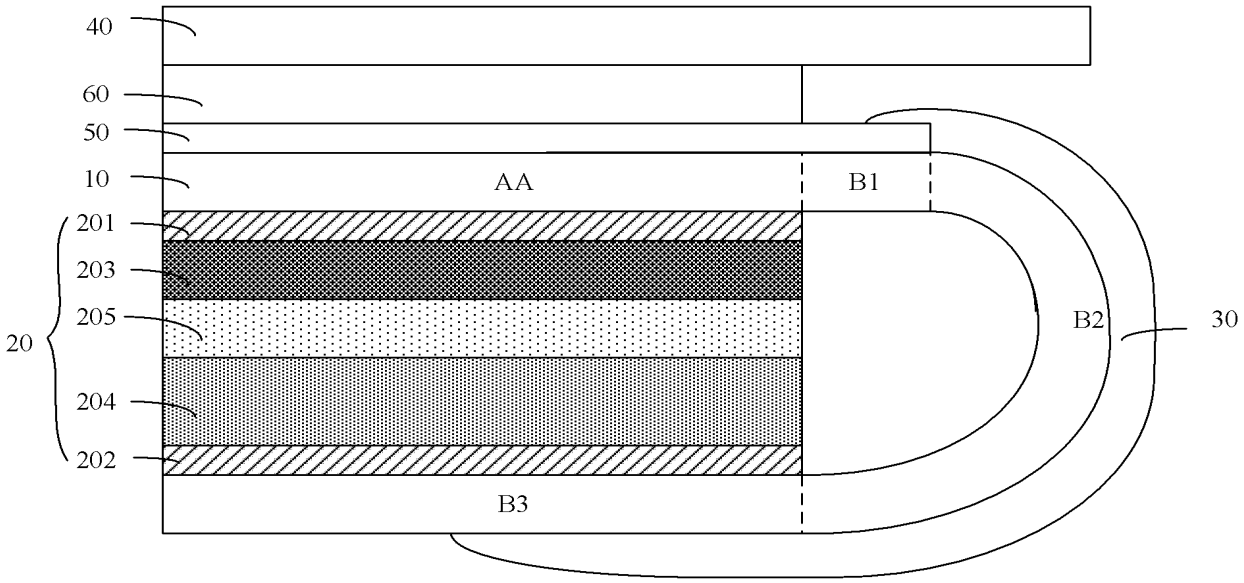


图 1

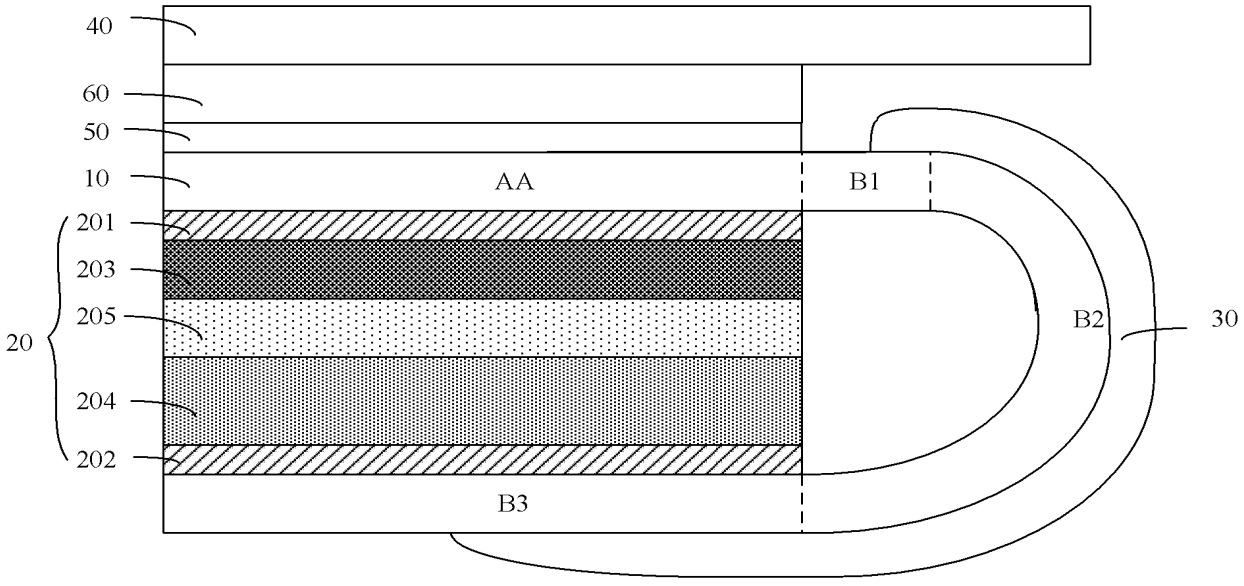


图 2

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的贴合过程中，盖板 40 不会对 UV 胶产生压力，降低了显示装置的模组制程风险。

需要说明的是，上述步骤的标号并不严格代表步骤的执行顺序，在一些实施例中，可以严格按照上述步骤的标号顺序执行对应的步骤，当然，在另一些实施例中，某些步骤可以同时执行，或者调换顺序执行，本发明实施例对此不作具体限定。

最后应说明的是：以上实施例仅用以说明本发明的技术方案，而非对其限制；尽管参照前述实施例对本发明进行了详细的说明，本领域的普通技术人员应当理解：其依然可以对前述各实施例所记载的技术方案进行修改，或者对其中部分技术特征进行等同替换；而这些修改或者替换，并不使相应技术方案的本质脱离本发明各实施例技术方案的精神和范围。

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区 B2 和弯折延伸子区 B3 均不与平面区 AA 平齐，也即弯折子区 B2 与平面区 AA 位于不同平面，弯折延伸子区 B3 与平面区 AA 位于不同平面。

S2，在柔性屏体 10 上制作彩膜 50。

具体而言，柔性屏体 10 的平面区 AA 包括红色子像素单元、绿色子像素单元和蓝色子像素单元，彩膜 50 包括多个彩色色阻以及设置在不同的彩色色阻之间的黑色矩阵，多个彩色色阻包括红色色阻、绿色色阻和蓝色色阻，红色色阻对应红色子像素单元设置，绿色色阻对应绿色子像素单元设置，蓝色色阻对应蓝色子像素单元设置。需要说明的是，在一些实施例中，还可以在彩膜 50 上制作平坦层以对彩膜 50 进行平坦化。

S3，对柔性屏体 10 的弯折区进行驱动芯片和柔性电路板的邦定，并对柔性屏体 10 的弯折区进行 UV 胶覆盖。

具体而言，将驱动芯片和柔性电路板均设置在柔性屏体 10 的弯折延伸子区 B3 远离支撑层 20 的表面，并使柔性电路板与驱动芯片之间的距离大于 0。对柔性屏体 10 的弯折区进行 UV 胶覆盖，使得 UV 胶完全覆盖弯折子区 B2，并至少覆盖部分弯折过渡子区 B1。

S4，将玻璃基板进行剥离，并将支撑层 20 与柔性屏体 10 进行贴合。

具体而言，支撑层 20 的一侧支撑柔性屏体 10 的平面区 AA 和弯折过渡子区 B1，支撑层 20 远离平面区 AA 的一侧支撑柔性屏体 10 的弯折延伸子区 B3，即柔性屏体 10 的平面区 AA 和弯折过渡子区 B1 设置在支撑层 20 的同一侧，柔性屏体 10 的弯折延伸子区 B3 设置在支撑层 20 远离平面区 AA 的另一侧。需要说明的是，支撑层 20 主要用于固定并支撑柔性屏体 10，防止柔性屏体 10 的弯折子区 B2 由于弯折程度过大而折断。支撑层 20 可以为兼具硬度和弹性的材料，从而既可以对柔性屏体 10 进行支撑，又可以对柔性屏体 10 进行减震。支撑层 20 可以为一层，也可以为多层结构，本发明实施例对此不作具体限定。

S5，将盖板 40 与彩膜 50 通过光学胶 60 进行贴合，其中，光学胶 60 的厚度大于 UV 胶的最大厚度。

具体而言，使用光学胶 60 将盖板 40 与彩膜 50 进行贴合，使盖板 40 完全覆盖柔性屏体 10 的平面区 AA，并至少覆盖部分柔性屏体 10 的弯折过渡子区 B1。由于光学胶 60 的厚度大于 UV 胶的最大厚度，因此在盖板 40 与彩膜 50

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在空穴注入层上的空穴传输层（Hole Tranport Layer，HTL）、设置在空穴传输层上的发光层（Emission layer，EML）、设置在发光层上的电子传输层（Electron Transport Layer，ETL)、设置在电子传输层上的电子注入层（Electron Injection Layer，EIL）以及设置在电子传输层上的阴极（Cathode）。可选地，显示器件中还可设置有空穴阻挡层（Hole Block Layer，HBL），电子阻挡层(Electron Block Layer，EBL）和封盖层（Capping Layer，CPL）。

发光层包括红色子像素单元、绿色子像素单元和蓝色子像素单元，其中，红色子像素单元用于发出红色的光，绿色子像素单元用于发出绿色的光，蓝色子像素单元用于发出蓝色的光。

彩膜 50 用于替代偏光片，承担着防止显示装置的漏光以及降低显示装置的反射率的作用。具体而言，彩膜 50 包括多个彩色色阻以及设置在不同的彩色色阻之间的黑色矩阵，多个彩色色阻包括红色色阻、绿色色阻和蓝色色阻，其中，红色色阻对应红色子像素单元设置，红色色阻承担着红色子像素单元的出光；绿色色阻对应绿色子像素单元设置，绿色色阻承担着绿色子像素单元的出光；蓝色色阻对应蓝色子像素单元设置，蓝色色阻承担着蓝色子像素单元的出光；黑色矩阵主要承担着防止显示装置漏光以及降低显示装置的反射率的作用。

封装层用于为显示装置隔绝外界的水和氧气，保证显示装置的良率。封装层通常为有机层、无机层和有机层构成的三明治结构。

基于上述实施例，本发明实施例对上述显示装置的制作方法进行说明。图 5 为本发明实施例提供的显示装置的制作方法流程图，如图 5 所示，制作方法包括：

S1，在玻璃基板上制作柔性屏体 10。

柔性屏体 10 指的是能够进行弯曲和折叠的柔韧性高的屏幕，柔性屏体 10 可以划分为平面区 AA 和自平面区 AA 延伸的弯折区，平面区 AA 指的是能够进行显示的区域，弯折区指的是不能够进行显示的区域。弯折区包括依次设置的弯折过渡子区 B1、弯折子区 B2 和弯折延伸子区 B3，其中，弯折过渡子区 B1 的相对两端分别与平面区 AA 和弯折子区 B2 连接，弯折子区 B2 的相对两端分别与弯折过渡子区 B1 和弯折延伸子区 B3 连接。其中，弯折过渡子区 B1 与平面区 AA 平齐，也即弯折过渡子区 B1 与平面区 AA 位于同一平面，弯折子

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施例中，垫高块靠近柔性屏体 10 的弯折子区 B2 的一端的表面与弯折子区 B2 弯折后的形状匹配，以使得弯折子区 B2 靠近垫高块一侧的表面与垫高块的表面相贴合，进而对弯折子区 B2 具有一定的支撑作用，且不易变形损坏。可以理解的是，在其他实施例中，还可以通过增加第一背板 201 和第二背板 202 的厚度，或增加其他支撑结构，以确保柔性屏体 10 的平面区 AA 和弯折延伸子区 B3 之间的距离。

基于上述实施例，在一些实施例中，第一背板 201 和第二背板 202 之间设置有泡棉 203。需要说明的是，泡棉 203 是塑料粒子发泡过的材料，其既能起到缓冲作用，也能起到遮光作用。

基于上述实施例，在一些实施例中，泡棉 203 和第二背板 202 之间设置有补强板 204。需要说明的是，补强板 204 用于提高柔性屏体 10 的强度。其中，补强板 204 可以为聚酰亚胺层，也可以为石墨层，其中，石墨层的外表面还可用聚酰亚胺包覆，本发明实施例对此不作具体限定。

基于上述实施例，在一些实施例中，泡棉 203 和补强板 204 之间设置有散热层 205。其中，散热层 205 起到屏蔽和散热作用，散热层 205 的材料为散热材料，具体可以为金属材料或石墨等，其中，金属可以为铜箔、铝箔或不锈钢箔等，本发明实施例对此不作具体限定。

基于上述实施例，在一些实施例中，显示装置还包括设置在所述弯折延伸子区 B3 的驱动单元。具体而言，驱动单元设置在柔性屏体 10 的弯折延伸子区 B3 远离支撑层 20 的表面。驱动单元包括驱动芯片和柔性电路板，其中，驱动芯片和柔性电路板均设置在柔性屏体 10 的弯折延伸子区 B3 远离支撑层 20 的表面，柔性电路板与驱动芯片之间的距离大于 0。

基于上述实施例，在一些实施例中，柔性屏体 10 的平面区 AA 包括柔性衬底、薄膜晶体管、显示器件和封装层，其中，柔性衬底设置在第一背板 201 上，薄膜晶体管设置在柔性衬底上，显示器件设置在薄膜晶体管上，封装层设置在显示器件上。

柔性衬底为由柔性材料制作而成的衬底，柔性材料优选为聚酰亚胺（PI）。

显示器件用于进行发光，显示器件通常包括设置在薄膜晶体管上的阳极（Anode）、设置在阳极上的空穴注入层（Hole Injection Layer，HIL）、设置

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之间的距离大于 0 的情况下，本领域技术人员可以根据柔性屏体 10 的大小、种类、弯折子区 B2 的弯折半径、保护层 30 的柔韧性以及缓解应力的能力为保护层 30 设置合适的厚度，本发明实施例对其不作具体限定。

基于上述实施例，本发明实施例对显示装置进行进一步说明，支撑层 20 包括设置在柔性屏体 10 的平面区 AA 和弯折过渡子区 B1 远离盖板 40 的一侧的第一背板 201，以及设置在柔性屏体 10 的弯折延伸子区 B3 远离保护层 30 的一侧的第二背板 202。其中，弯折延伸子区 B3 可以通过胶粘或者物理方法固定于第二背板 202 上。

需要说明的是，第一背板 201 用于支撑和保护柔性屏体 10 的平面区 AA 和弯折过渡子区 B1，避免其受到外界的冲击力而损伤，第二背板 202 用于支撑和保护柔性屏体 10 的弯折延伸子区 B3，避免其受到外界的冲击力而损伤。第一背板 201 和第二背板 202 的材料可以为聚对苯二甲酸乙二醇酯（Polyethylene terephthalate，PET）材料，由于 PET 材料具有弹性模量低和受热不易膨胀的优点，因此采用 PET 材料制作而成的第一背板 201 和第二背板 202 不会因为环境温度的变化而变形，降低了第一背板 201 与其连接的膜层剥离的可能性以及第二背板 202 与其连接的膜层剥离的可能性，从而提高了显示装置的良率和可靠性。

进一步地，为了防止第一背板201和第二背板202影响柔性屏体10的弯折子区B2的弯折，必须确保第一背板201和第二背板202均避开弯折子区B2。优选地，为了更好的支撑柔性屏体10的平面区AA和弯折过渡子区B1，第一背板201的边缘与柔性屏体10的初始弯折位置重合，同理，为了更好的支撑柔性屏体10的弯折延伸子区B3，第二背板202的边缘与柔性屏体10的末端弯折位置重合。

基于上述实施例，在一些实施例中，支撑层 20 还包括设置在第一背板 201 和第二背板 202 之间的垫高块，垫高块的高度还可以根据柔性屏体 10 的弯折子区 B2 的宽度进行调整，本发明实施例对其不作具体限定。垫高块可以为硅胶等材料，垫高块可以具有一定弹性和硬度，垫高块具有一定硬度以避免所述柔性屏体 10 被挤压变形，垫高块具有一定弹性以避免所述柔性屏体 10 由于受到局部应力而损坏。

具体而言，垫高块避开柔性屏体 10 的弯折子区 B2 设置。当然，在其他实

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护层 30 与盖板 40 之间的距离大于或等于预设值，需要说明的是，预设值为大于 0 的值，预设值可以根据实际需求（例如制程精度）进行灵活调整，本发明实施例对此不作具体限定。如此，盖板 40 不会挤压保护层 30，消除了显示装置的开裂风险。

基于上述实施例，请参阅图 2，保护层 30 仅设置在柔性屏体 10 的表面，柔性屏体 10 的表面的保护层 30 的厚度小于或等于盖板 40 靠近柔性屏体 10 的一侧到柔性屏体 10 靠近盖板 40 的一侧之间的距离。

基于上述实施例，请参阅图 3，显示装置还包括设置在柔性屏体 10 与彩膜 50 之间的触控层 70，以及设置在触控层 70 与彩膜 50 之间的绝缘层 80，保护层 30 仅设置在绝缘层 80 的表面，绝缘层 80 的表面的保护层 30 的厚度小于或等于盖板 40 靠近绝缘层 80 的一侧到绝缘层 80 靠近盖板 40 的一侧之间的距离。

基于上述实施例，请参阅图 1 和图 4，保护层 30 还设置在彩膜 50 的表面，彩膜 50 的表面的保护层 30 的厚度小于或等于盖板 40 靠近彩膜 50 的一侧到彩膜 50 靠近盖板 40 的一侧之间的距离。

基于上述实施例，在本发明实施例中，光学胶60的厚度大于保护层30在柔性屏体10的弯折过渡子区B1的最大厚度，如此，即可保证覆盖柔性屏体10的弯折过渡子区B1的盖板40与覆盖柔性屏体10的弯折过渡子区B1的保护层30具有一定间隔，盖板40不会挤压保护层30，消除了显示装置的开裂风险。

基于上述实施例，本发明实施例对显示装置进行进一步说明，保护层 30 还至少覆盖部分柔性屏体 10 的弯折延伸子区 B3，以更好地缓解柔性屏体 10 的末端弯折位置的弯折应力。需要说明的是，保护层 30 靠近弯折延伸子区 B3 的侧边与柔性屏体 10 的末端弯折位置之间的距离还可以大于第二预设值，第二预设值为大于或等于 0 的值，第二预设值可以根据实际需求进行灵活调整，本发明实施例对此不作具体限定。其中，图 1 所示的保护层 30 覆盖部分柔性屏体 10 的弯折延伸子区 B3，当然，在其他实施例中，保护层 30 还可以完全覆盖柔性屏体 10 的弯折延伸子区 B3。

基于上述实施例，在一些实施例中，保护层 30 为 UV 胶，当然，在其他实施例中，保护层 30 不限于 UV 胶，还可以是热固化胶或其他种类的光固化胶，本发明实施例对此不作具体限定。需要说明的是，在满足盖板 40 与保护层 30

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覆盖柔性屏体 10 的弯折子区 B2 和弯折过渡子区 B1，当然，在其他实施例中，保护层 30 还可以完全覆盖柔性屏体 10 的弯折子区 B2 且覆盖部分弯折过渡子区 B1。

需要说明的是，保护层 30 完全覆盖柔性屏体 10 的弯折子区 B2，从而缓解弯折子区 B2 的弯折应力；保护层 30 至少覆盖部分柔性屏体 10 的弯折过渡子区 B1，从而使保护层 30 能够从柔性屏体 10 的初始弯折位置靠近平面区 AA 的一侧开始更好地缓解柔性屏体 10 的初始弯折位置的弯折应力，需要说明的是，保护层 30 靠近平面区 AA 的侧边与柔性屏体 10 的初始弯折位置之间的距离还可以大于第一预设值，第一预设值为大于或等于 0 的值，第一预设值可以根据实际需求进行灵活调整，本发明实施例对此不作具体限定。

柔性屏体 10 的平面区 AA 包括红色子像素单元、绿色子像素单元和蓝色子像素单元，其中，红色子像素单元用于发出红色的光，绿色子像素单元用于发出绿色的光，蓝色子像素单元用于发出蓝色的光。

彩膜 50 设置在柔性屏体 10 远离支撑层 20 的一侧，彩膜 50 至少覆盖平面区 AA，彩膜 50 用于替代偏光片，承担着防止显示装置的漏光以及降低显示装置的反射率的作用。

具体而言，彩膜 50 包括多个彩色色阻以及设置在不同的彩色色阻之间的黑色矩阵，多个彩色色阻包括红色色阻、绿色色阻和蓝色色阻，其中，红色色阻对应红色子像素单元设置，红色色阻承担着红色子像素单元的出光；绿色色阻对应绿色子像素单元设置，绿色色阻承担着绿色子像素单元的出光；蓝色色阻对应蓝色子像素单元设置，蓝色色阻承担着蓝色子像素单元的出光；黑色矩阵主要承担着防止显示装置漏光以及降低显示装置的反射率的作用。

盖板 40 设置在彩膜 50 远离柔性屏体 10 的一侧，盖板 40 至少覆盖平面区 AA，图 1 所示的盖板 40 通过光学胶 60 与彩膜 50 连接，其中，光学胶 60 用于胶结光学元件，光学胶 60 可以为具有无色透明、光透过率在 90%以上、胶结强度良好、可在室温或中温下固化且固化收缩小等特点的 OCA 光学胶，在本发明实施例中，光学胶 60 用于将盖板 40 与彩膜 50 进行胶结。盖板 40 用于保护柔性屏体 10 不受外界的冲击力而损伤。

本发明实施例提供的显示装置，在保护层 30 与盖板 40 重叠的区域内，保

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集成电路，从而使柔性衬底的第二区域与集成电路共同形成柔性屏体10的弯折区，本发明实施例对柔性屏体10的弯折区本身的结构并没有改进，采用本领域常用的结构即可，本发明实施例对其结构不作具体限定。

为了实现显示装置的窄边框设计，通常将柔性屏体10的弯折区进行弯折，如图1所示，本发明实施例具体将柔性屏体10的弯折子区B2进行180°弯折，使得平面区AA与弯折过渡子区B1所组成的整体与弯折延伸子区B3相对且相互平行，此时，弯折子区B2呈半圆弧状，平面区AA、弯折过渡子区B1、弯折子区B2和弯折延伸子区B3形成一个容纳槽，支撑层20位于该容纳槽内。

需要说明的是，一方面，由于柔性屏体10的弯折区包括设置在平面区AA和弯折子区B2之间的弯折过渡子区B1，因此使得柔性屏体10的初始弯折位置为弯折子区B2和弯折过渡子区B1衔接的位置，即柔性屏体10的初始弯折位置偏离平面区AA和弯折区衔接的位置，初始弯折位置的两侧均为弯折区域，有效缓解了柔性屏体10的初始弯折位置因其两侧区域的结构不同而导致的应力集中的现象，实现对柔性屏体10的弯折起始位置的保护；另一方面，由于弯折子区B2和平面区AA不直接相邻，两者之间设置有弯折过渡子区B1，因此减小了弯折子区B2弯折时作用于平面区AA上的应力，从而对平面区AA进行保护，例如防止平面区AA开裂。

支撑层20的一侧支撑柔性屏体10的平面区AA和弯折过渡子区B1，支撑层20远离平面区AA的一侧支撑柔性屏体10的弯折延伸子区B3，即柔性屏体10的平面区AA和弯折过渡子区B1设置在支撑层20的同一侧，柔性屏体10的弯折延伸子区B3设置在支撑层20远离平面区AA的另一侧。

需要说明的是，支撑层20主要用于固定并支撑柔性屏体10，防止柔性屏体10的弯折子区B2由于弯折程度过大而折断。支撑层20可以为兼具硬度和弹性的材料，从而既可以对柔性屏体10进行支撑，又可以对柔性屏体10进行减震。支撑层20可以为一层，也可以为多层结构，本发明实施例对此不作具体限定。

保护层30设置在柔性屏体10远离支撑层20的一侧，保护层30至少覆盖部分弯折区，图1所示的保护层30完全覆盖柔性屏体10的弯折子区B2，并至少覆盖部分柔性屏体10的弯折过渡子区B1。其中，图1所示的保护层30完全

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动前提下所获得的所有其他实施例，都属于本发明保护的范围。

本发明实施例提供一种显示装置，显示装置可以为可穿戴设备，例如智能手环、智能手表或虚拟现实（Virtual Reality，VR）等设备，也可以为移动电话机、电子书、电子报纸、电视机或个人便携电脑，还可以为可弯曲和可折叠的柔性OLED显示或照明设备，本发明实施例对显示装置的具体形式不作具体限定。

图1为本发明实施例提供的显示装置的结构示意图，如图1所示，显示装置包括柔性屏体10、彩膜50、保护层30和盖板40，可选地，显示装置还可以包括支撑层20和光学胶60，以下分别对柔性屏体10、支撑层20、保护层30、盖板40、彩膜50和光学胶60进行具体说明。

柔性屏体10指的是能够进行弯曲和折叠的柔韧性高的屏幕，柔性屏体10可以划分为平面区AA和自平面区AA延伸的弯折区，平面区AA指的是能够进行显示的区域，弯折区指的是不能够进行显示的区域。弯折区可以包括依次设置的弯折过渡子区B1、弯折子区B2和弯折延伸子区B3，其中，弯折过渡子区B1的相对两端分别与平面区AA和弯折子区B2连接，弯折子区B2的相对两端分别与弯折过渡子区B1和弯折延伸子区B3连接。其中，弯折过渡子区B1与平面区AA平齐，也即弯折过渡子区B1与平面区AA位于同一平面，弯折子区B2和弯折延伸子区B3均不与平面区AA平齐，也即弯折子区B2与平面区AA位于不同平面，弯折延伸子区B3与平面区AA位于不同平面。

具体而言，柔性屏体10包括柔性衬底，柔性衬底为由柔性材料制作而成的衬底，柔性材料优选为聚酰亚胺（PI），柔性衬底可以划分为第一区域和自第一区域延伸的第二区域。

柔性衬底的第一区域上可以集成显示层，显示层可以包括多个用于显示图像的显示部件，从而使柔性衬底的第一区域与显示层共同形成柔性屏体10的平面区AA。显示层可以包括诸如薄膜晶体管、栅极线、数据线、电容、阳极、阴极和发光层等不同的显示部件，本发明实施例对柔性屏体10的平面区AA本身的结构并没有改进，采用本领域常用的结构即可，本发明实施例对其结构不作具体限定。

柔性衬底的第二区域上设置有用于实现信号传输和驱动图像显示等功能的

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的最大厚度。

在一些实施例中，所述保护层还至少覆盖部分所述弯折延伸子区。

在一些实施例中，所述保护层为 UV 胶。

在一些实施例中，所述显示装置还包括:

支撑层，所述支撑层的一侧支撑所述平面区和所述弯折过渡子区，所述支撑层远离所述平面区的一侧支撑所述弯折延伸子区。

在一些实施例中，所述支撑层包括设置在所述平面区和所述弯折过渡子区远离所述盖板的一侧的第一背板以及设置在所述弯折过渡子区远离所述保护层的一侧的第二背板；所述第一背板和所述第二背板之间设置有泡棉；所述泡棉和所述第二背板之间设置有补强板;所述泡棉和所述补强板之间设置有散热层。

本发明实施例提供的显示装置，通过在保护层与盖板重叠的区域内，使保护层与盖板之间的距离大于或等于预设值，如此，盖板不会挤压保护层，消除了显示装置的开裂风险。

附图说明

为了更清楚地说明本发明实施例中的技术方案，下面将对实施例描述中所需要使用的附图作简单地介绍，显而易见地，下面描述中的附图仅仅是本发明的一些实施例，对于本领域技术人员来讲，在不付出创造性劳动的前提下，还可以根据这些附图获得其他的附图。

图 1 为本发明实施例提供的显示装置的结构示意图;

图 2 为本发明另一实施例提供的显示装置的结构示意图;

图 3 为本发明再一实施例提供的显示装置的结构示意图;

图 4 为本发明又一实施例提供的显示装置的结构示意图;

图 5 为本发明实施例提供的显示装置的制作方法流程图。

具体实施方式

下面将结合本发明实施例中的附图，对本发明实施例中的技术方案进行清楚、完整地描述。显然，所描述的实施例是本发明一部分实施例，而不是全部的实施例。基于本发明中的实施例，本领域普通技术人员在没有做出创造性劳

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裂风险。

发明内容

因此，有必要提供一种显示装置，用以解决现有的OLED显示面板存在开裂风险的问题。

本发明实施例提供一种显示装置，所述显示装置包括:

柔性屏体，包括平面区以及与所述平面区连接的弯折区;

彩膜，设置在所述柔性屏体上且至少覆盖所述平面区;

保护层，设置在所述柔性屏体上且至少覆盖部分所述弯折区;

盖板，设置在所述彩膜上且至少覆盖所述平面区;

其中，在所述保护层与所述盖板重叠的区域内，所述保护层与所述盖板之间的距离大于或等于预设值。

在一些实施例中，所述保护层仅设置在所述柔性屏体的表面，所述柔性屏体的表面的所述保护层的厚度小于或等于所述盖板靠近所述柔性屏体的一侧到所述柔性屏体靠近所述盖板的一侧之间的距离。

在一些实施例中，所述显示装置还包括设置在所述柔性屏体与所述彩膜之间的触控层，以及设置在所述触控层与所述彩膜之间的绝缘层，所述保护层仅设置在所述绝缘层的表面，所述绝缘层的表面的所述保护层的厚度小于或等于所述盖板靠近所述绝缘层的一侧到所述绝缘层靠近所述盖板的一侧之间的距离。

在一些实施例中，所述保护层还设置在所述彩膜的表面，所述彩膜的表面的所述保护层的厚度小于或等于所述盖板靠近所述彩膜的一侧到所述彩膜靠近所述盖板的一侧之间的距离。

在一些实施例中，所述弯折区包括与所述平面区连接并依次设置的弯折过渡子区、弯折子区以及弯折延伸子区，所述弯折过渡子区与所述平面区平齐;

所述保护层完全覆盖所述弯折子区，并至少覆盖部分所述弯折过渡子区;

盖板，所述盖板通过光学胶与所述彩膜连接，所述盖板完全覆盖所述平面区，并至少覆盖部分所述弯折过渡子区。

在一些实施例中，所述光学胶的厚度大于所述保护层在所述弯折过渡子区

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说　明　书

显示装置

技术领域

本发明实施例涉及显示技术领域，尤其涉及一种显示装置。

背景技术

对于有机发光二极管（Organic Light-Emitting Diode，OLED）显示面板而言，偏光片能够有效降低强光下OLED显示面板的反射率，却导致OLED显示面板损失了将近58%的出光，这极大地增加了OLED显示面板的使用寿命负担，并且，偏光片的厚度约为100μm，其厚度较大且材质脆，不利于动态弯折产品的开发。

为了开发基于OLED显示面板的动态弯折产品，通常采用无偏光片（POL-less）技术制作OLED显示面板，POL-less技术指的是采用彩膜（Color Filter，CF）替代偏光片的技术。其中，彩膜由红色色阻、绿色色阻、蓝色色阻和黑色矩阵（Black Matrix，BM）组成，在OLED显示面板中，红色色阻、绿色色阻和蓝色色阻分别承担着红色子像素单元、绿色子像素单元和蓝色子像素单元的出光，黑色矩阵主要承担着防止OLED显示面板漏光以及降低OLED显示面板的反射率的作用。彩膜不仅能够在一定程度上降低强光下OLED显示面板的反射率，还能够将OLED显示面板的出光率从42%提高到60%，并且，彩膜的厚度约为5μm，其远小于偏光片的厚度且柔韧性高，能够降低OLED显示面板的整体厚度，有利于动态弯折产品的开发。

进一步地，为了实现OLED显示面板的窄边框设计，通常将OLED显示面板的弯折区弯折到OLED显示面板的背面，从而减小边框的宽度。然而，OLED显示面板的弯折区的弯折容易导致OLED显示面板内的线路断裂，为了防止弯折导致的线路断裂，通常将UV胶覆盖于OLED显示面板的弯折区，缓解OLED显示面板的弯折区的弯折应力。

然而，UV胶的厚度约为95μm，当盖板与彩膜通过光学胶粘接时，由于彩膜与光学胶的厚度均较薄，因此盖板会挤压UV胶，导致OLED显示面板存在开

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部分所述弯折延伸子区。

8、根据权利要求5所述的显示装置，其特征在于，所述保护层为UV胶。

9、根据权利要求5所述的显示装置，其特征在于，所述显示装置还包括：

支撑层，所述支撑层的一侧支撑所述平面区和所述弯折过渡子区，所述支撑层远离所述平面区的一侧支撑所述弯折延伸子区。

10、根据权利要求9所述的显示装置，其特征在于，所述支撑层包括设置在所述平面区和所述弯折过渡子区远离所述盖板的一侧的第一背板以及设置在所述弯折过渡子区远离所述保护层的一侧的第二背板；所述第一背板和所述第二背板之间设置有泡棉；所述泡棉和所述第二背板之间设置有补强板；所述泡棉和所述补强板之间设置有散热层。

Petitioner Samsung Ex-1004, 0097

2021105489052

权　利　要　求　书

1、一种显示装置，其特征在于，所述显示装置包括:

柔性屏体，包括平面区以及与所述平面区连接的弯折区;

彩膜，设置在所述柔性屏体上且至少覆盖所述平面区;

保护层，设置在所述柔性屏体上且至少覆盖部分所述弯折区;

盖板，设置在所述彩膜上且至少覆盖所述平面区;

其中，在所述保护层与所述盖板重叠的区域内，所述保护层与所述盖板之间的距离大于或等于预设值。

2、根据权利要求1所述的显示装置，其特征在于，所述保护层仅设置在所述柔性屏体的表面，所述柔性屏体的表面的所述保护层的厚度小于或等于所述盖板靠近所述柔性屏体的一侧到所述柔性屏体靠近所述盖板的一侧之间的距离。

3、根据权利要求1所述的显示装置，其特征在于，所述显示装置还包括设置在所述柔性屏体与所述彩膜之间的触控层，以及设置在所述触控层与所述彩膜之间的绝缘层，所述保护层仅设置在所述绝缘层的表面，所述绝缘层的表面的所述保护层的厚度小于或等于所述盖板靠近所述绝缘层的一侧到所述绝缘层靠近所述盖板的一侧之间的距离。

4、根据权利要求2或3所述的显示装置，其特征在于，所述保护层还设置在所述彩膜的表面，所述彩膜的表面的所述保护层的厚度小于或等于所述盖板靠近所述彩膜的一侧到所述彩膜靠近所述盖板的一侧之间的距离。

5、根据权利要求1所述的显示装置，其特征在于，所述弯折区包括与所述平面区连接并依次设置的弯折过渡子区、弯折子区以及弯折延伸子区，所述弯折过渡子区与所述平面区平齐;

所述保护层完全覆盖所述弯折子区，并至少覆盖部分所述弯折过渡子区;

盖板，所述盖板通过光学胶与所述彩膜连接，所述盖板完全覆盖所述平面区，并至少覆盖部分所述弯折过渡子区。

6、根据权利要求5所述的显示装置，其特征在于，所述光学胶的厚度大于所述保护层在所述弯折过渡子区的最大厚度。

7、根据权利要求5所述的显示装置，其特征在于，所述保护层还至少覆盖

Petitioner Samsung Ex-1004, 0098

国家知识产权局

NATIONAL INTELLECTUAL PROPERTY ADMINISTRATION, PRC

证　　明

本证明之附件是向本局提交的下列专利申请文件副本。

申　　请　　号：202110548905.2

申　请　类　型：发明专利

发明 创造 名称：显示装置

申　　请　　日：2021 年 05 月 20 日

申　　请　　人：武汉华星光电半导体显示技术有限公司

发明人或设计人：周菁

局长

申长雨

2021 年 06 月 03 日

Petitioner Samsung Ex-1004, 0099

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International application number:		**PCT/CN2021/097527**
International filing date:		**31 May 2021 (31.05.2021)**
Document type:		**Certified copy of priority document**
Document details:	Country/Office:	**CN**
	Number:	**202110548905.2**
	Filing date:	**20 May 2021 (20.05.2021)**
Date of receipt at the International Bureau:		**16 June 2021 (16.06.2021)**

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a),(b) or (b-*bis*)

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Petitioner Samsung Ex-1004, 0101

PCT请求书

打印件(原件为电子形式)

0	由受理局填写	
0-1	国际申请号	PCT/CN2021/097527
0-2	国际申请日	2021年 5月 31日 (31.05.2021)
0-3	受理局名称和“PCT国际申请”	RO/CN

0-4	PCT/RO/101表 PCT请求书	
0-4-1	软件版本	CEPCT 版本 10.25.41(20201201) MT/FOP 20140331/0.20.5.21
0-5	请求 下列签字人请求按照专利合作条约的规定处理本国际申请	
0-6	申请人指定的受理局	中华人民共和国国家知识产权局 (RO/CN)
0-7	申请人或代理人的档案号	WH201336PCT
I	发明名称	显示装置
II	申请人	
II-1	该人是	申请人 (applicant only)
II-2	是对下列国家的申请人	所有指定国 (all designated States)
II-4zh	名称	武汉华星光电半导体显示技术有限公司
II-4en	Name:	WUHAN CHINA STAR OPTOELECTRONICS SEMICONDUCTOR DISPLAY TECHNOLOGY CO., LTD.
II-5zh	地址	中国湖北省武汉市 东湖新技术开发区高新大道666号光谷生物创新园C5栋305室 430079
II-5en	Address	305 Room,Building C5,Biolake of Optics Valley,No.666 Gaoxin Avenue,Wuhan East Lake High-tech Development Zone, Wuhan, Hubei 430079 China
II-6	国籍	中国 CN
II-7	居所	中国 CN
II-8	电话号码	86-0755-83066895
II-9	传真号码	86-0755-83066895
II-10	电子邮址	wipo@purplevineip.com
II-10(a)	电子邮件授权 授权受理局、国际检索单位、国际局和国际初步审查单位，如果其愿意，使用本电子邮件地址发送有关本国际申请的通知书：	作为随后纸件通知书的预送本
II-11	申请人在专利局的登记号	

PCT请求书

打印件(原件为电子形式)

III-1	申请人和/或发明人	
III-1-1	该人是	发明人 (inventor only)
III-1-3	对下列国家的发明人	
III-1-4 zh	姓名:	周 菁
III-1-4 en	Name (LAST, First):	ZHOU, Jing
III-1-5 zh	地址	中国湖北省武汉市 东湖新技术开发区高新大道666号光谷生物创新园C5栋305室 430079
III-1-5 en	Address	305 Room,Building C5,Biolake of Optics Valley,No.666 Gaoxin Avenue,Wuhan East Lake High-tech Development Zone, Wuhan, Hubei 430079 China
IV-1	代理人,共同代表或通信地址 下列人员被委托/已经被委托为代表申请人在主管国际单位办理事务的	代理人 (agent)
IV-1-1zh	名称	深圳紫藤知识产权代理有限公司
IV-1-1en	Name:	PURPLEVINE INTELLECTUAL PROPERTY (SHENZHEN) CO., LTD.
IV-1-2zh	地址	中国广东省深圳市 南山区粤海街道大冲社区华润置地大厦C座2901 518052
IV-1-2en	Address:	2901 Block C, China Resources Land Building,Dachong Community, Yuehai Street, Nanshan District Shenzhen, Guangdong 518052 China
IV-1-3	电话号码	86-0755-83066895
IV-1-4	传真号码	86-0755-83066895
IV-1-5	电子邮址	wipo@purplevineip.com
IV-1-5(a)	电子邮件授权 授权受理局、国际检索单位、国际局和国际初步审查单位，如果其愿意，使用本电子邮件地址发送有关本国际申请的通知书: 	作为随后纸件通知书的预送本
IV-1-6	代理人登记号	44570
V	国家的指定	
V-1	根据细则4.9(a)，提交本请求书即为，指定在国际申请日受PCT约束的所有成员国，以要求获得可以获得的所有保护类型，适用情况下，要求获得地区专利和国家专利。	
V-2	V-2栏只可用于（不可悔改地）排除对有关国家的指定，如果本国际申请在提交时或者在根据细则26之二.1的后续程序中，第VI栏包含有对在该有关国家提出的在先国家申请的优先权要求，以避免被要求优先权的该在先国家申请因国家法律而停止效力。	

PCT请求书

打印件(原件为电子形式)

VI-1	**要求在先国家申请的优先权**		
VI-1-1	申请日	2021年 5月 20日 (20.05.2021)	
VI-1-2	号码	202110548905.2	
VI-1-3	国家	中国 CN	
VI-2	**优先权文件请求** 请国际局从数字图书馆获取上面指明的在先申请的证明副本，查询码为：	VI-1 查询码：0135	
VI-3	**援引加入 ：** 如果条约11（1）（iii）（d）或（e）规定的国际申请的某一项目，或者细则20.5(a)规定的说明书，权利要求书或附图的某一部分不包含在本国际申请中，但是全部包含在一个在先申请中，并且在受理局首次收到条约11（1）(iii)规定的一个或多个项目之日要求了该在先申请的优先权，则该项目或该部分可以依据细则20.6确认，为细则20.6的目的援引加入到该国际申请中。		
VII-1	**选定的国际检索单位**	中华人民共和国国家知识产权局 (ISA/CN)	
VIII	**声明**	声明数目	
VIII-1	关于发明人身份的声明	–	
VIII-2	关于申请人在国际申请日有权申请和被授予专利的声明	–	
VIII-3	关于申请人在国际申请日有权要求在先申请的优先权的说明	–	
VIII-4	发明人资格声明(仅为指定美国目的)	–	
VIII-5	关于不影响新颖性的公开或缺乏新颖性的例外的声明	–	
IX	**清单**	页数	附以电子文档
IX-1	请求书(包括声明页)	4	✓
IX-2	说明书	12	✓
IX-3	权利要求	3	✓
IX-4	摘要	1	✓
IX-5	附图	3	✓
IX-7	共计	23	
	附件	附以纸件	附以电子文档
IX-8	费用计算页	–	✓
IX-9	单独委托书原件	–	✓
IX-18	PCT-SAFE 物理载体	–	–
IX-20	**应与摘要一起公布的附图图号**	1	
IX-21	**国际申请所用语言**	中文	
X-1	**申请人，代理人或共同代表的签字**	/深圳紫藤知识产权代理有限公司/	
X-1-1	姓名：	深圳紫藤知识产权代理有限公司	
X-1-2	签字人姓名	深圳紫藤知识产权代理有限公司	
X-1-3	还要注明此人是以什么名义签字的	代理人	

PCT请求书

打印件(原件为电子形式)

由受理局填写

10-1	据称的国际申请文件的实际收到日期	2021年 5月 31日 (31.05.2021)
10-2	附图:	
10-2-1	收到	
10-2-2	未收到	
10-3	由于随后在期限内收到补充国际申请的文件或附图,更改的实际收到日期	
10-4	在期限内收到根据PCT第11(2)条所进行的改正的日期	
10-5	国际检索单位	ISA/CN
10-6	检索本的传送推迟到缴纳检索费后	

由国际局填写

11-1	国际局收到登记本的日期	

(12) 按照专利合作条约所公布的国际申请

(19) 世界知识产权组织
国 际 局

(43) 国际公布日
2022 年 11 月 24 日 (24.11.2022)

WIPO | PCT

(10) 国际公布号
WO 2022/241838 A1

(51) 国际专利分类号:
G09F 9/30 (2006.01) *H01L 27/32* (2006.01)
G09F 9/33 (2006.01) *G06F 3/041* (2006.01)

(21) 国际申请号: PCT/CN2021/097527

(22) 国际申请日: 2021 年 5 月 31 日 (31.05.2021)

(25) 申请语言: 中文

(26) 公布语言: 中文

(30) 优先权:
202110548905.2 2021年5月20日 (20.05.2021) CN

(71) 申请人: 武汉华星光电半导体显示技术有限公司 (**WUHAN CHINA STAR OPTOELECTRONICS SEMICONDUCTOR DISPLAY TECHNOLOGY CO., LTD.**) [CN/CN]; 中国湖北省武汉市东湖新技术开发区高新大道666号光谷生物创新园C5栋305室, Hubei 430079 (CN)。

(72) 发明人: 周菁 (**ZHOU, Jing**); 中国湖北省武汉市东湖新技术开发区高新大道666号光谷生物创新园C5栋305室, Hubei 430079 (CN)。

(74) 代理人: 深圳紫藤知识产权代理有限公司 (**PURPLEVINE INTELLECTUAL PROPERTY (SHENZHEN) CO., LTD.**); 中国广东省深圳市南山区粤海街道大冲社区华润置地大厦C座2901, Guangdong 518052 (CN)。

(81) 指定国 (除另有指明，要求每一种可提供的国家保护): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, IT, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW。

(84) 指定国 (除另有指明，要求每一种可提供的地区保护): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), 欧亚 (AM, AZ, BY, KG, KZ, RU, TJ, TM), 欧洲 (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG)。

本国际公布:
— 包括国际检索报告 (条约第21条(3))。

(54) **Title:** DISPLAY DEVICE

(54) 发明名称: 显示装置

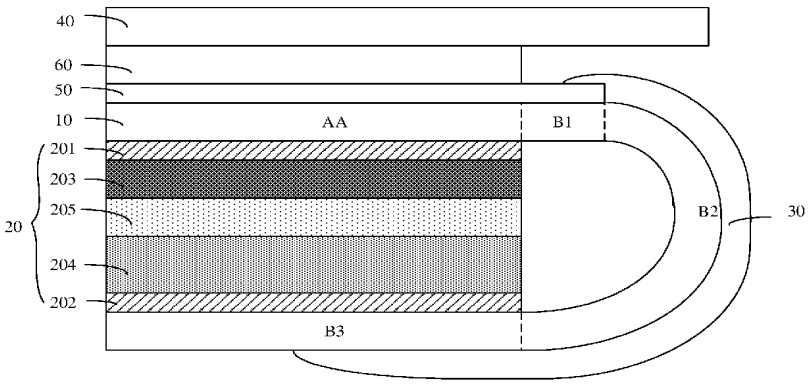


图 1

(57) **Abstract:** The present application provides a display device. The distance between a protective layer and a cover plate is greater than or equal to a preset value in a region where the protective layer overlaps with the cover plate, such that the cover plate does not extrude the protective layer, thereby eliminating the cracking risk of the display device.

(57) 摘要: 本申请提供一种显示装置，通过在保护层与盖板重叠的区域内，使保护层与盖板之间的距离大于或等于预设值，如此，盖板不会挤压保护层，消除了显示装置的开裂风险。

WO 2022/241838 A1

Petitioner Samsung Ex-1004, 0106

显示装置

技术领域

[0001] 本申请涉及显示技术领域，尤其涉及一种显示装置。

背景技术

[0002] 对于有机发光二极管（Organic Light-Emitting Diode，OLED）显示面板而言，偏光片能够有效降低强光下OLED显示面板的反射率，却导致OLED显示面板损失了将近58%的出光，这极大地增加了OLED显示面板的使用寿命负担，并且，偏光片的厚度约为100μm，其厚度较大且材质脆，不利于动态弯折产品的开发。

[0003] 为了开发基于OLED显示面板的动态弯折产品，通常采用无偏光片（POL-less）技术制作OLED显示面板，POL-less技术指的是采用彩膜（Color Filter，CF）替代偏光片的技术。其中，彩膜由红色色阻、绿色色阻、蓝色色阻和黑色矩阵（Black Matrix，BM）组成，在OLED显示面板中，红色色阻、绿色色阻和蓝色色阻分别承担着红色子像素单元、绿色子像素单元和蓝色子像素单元的出光，黑色矩阵主要承担着防止OLED显示面板漏光以及降低OLED显示面板的反射率的作用。彩膜不仅能够在一定程度上降低强光下OLED显示面板的反射率，还能够将OLED显示面板的出光率从42%提高到60%，并且，彩膜的厚度约为5μm，其远小于偏光片的厚度且柔韧性高，能够降低OLED显示面板的整体厚度，有利于动态弯折产品的开发。

[0004] 进一步地，为了实现OLED显示面板的窄边框设计，通常将OLED显示面板的弯折区弯折到OLED显示面板的背面，从而减小边框的宽度。然而，OLED显示面板的弯折区的弯折容易导致OLED显示面板内的线路断裂，为了防止弯折导致的线路断裂，通常将UV胶覆盖于OLED显示面板的弯折区，缓解OLED显示面板的弯折区的弯折应力。

[0005] 然而，UV胶的厚度约为95μm，当盖板与彩膜通过光学胶粘接时，由于彩膜与光学胶的厚度均较薄，因此盖板会挤压UV胶，导致OLED显示面板存在开裂风险。

Petitioner Samsung Ex-1004, 0107

发明概述

技术问题

[0006] 本申请提供一种显示装置，以解决现有的OLED显示面板存在开裂风险的问题。

问题的解决方案

技术解决方案

[0007] 本申请提供一种显示装置，其中，所述显示装置包括：

[0008] 柔性屏体，包括平面区以及与所述平面区连接的弯折区；

[0009] 彩膜，设置在所述柔性屏体上且至少覆盖所述平面区；

[0010] 保护层，设置在所述柔性屏体上且至少覆盖部分所述弯折区；

[0011] 盖板，设置在所述彩膜上且至少覆盖所述平面区；

[0012] 其中，在所述保护层与所述盖板重叠的区域内，所述保护层与所述盖板之间的距离大于或等于预设值。

[0013] 在一些实施例中，所述保护层仅设置在所述柔性屏体的表面，所述柔性屏体的表面的所述保护层的厚度小于或等于所述盖板靠近所述柔性屏体的一侧到所述柔性屏体靠近所述盖板的一侧之间的距离。

[0014] 在一些实施例中，所述显示装置还包括设置在所述柔性屏体与所述彩膜之间的触控层，以及设置在所述触控层与所述彩膜之间的绝缘层，所述保护层仅设置在所述绝缘层的表面，所述绝缘层的表面的所述保护层的厚度小于或等于所述盖板靠近所述绝缘层的一侧到所述绝缘层靠近所述盖板的一侧之间的距离。

[0015] 在一些实施例中，所述保护层还设置在所述彩膜的表面，所述彩膜的表面的所述保护层的厚度小于或等于所述盖板靠近所述彩膜的一侧到所述彩膜靠近所述盖板的一侧之间的距离。

[0016] 在一些实施例中，所述弯折区包括与所述平面区连接并依次设置的弯折过渡子区、弯折子区以及弯折延伸子区，所述弯折过渡子区与所述平面区平齐；

[0017] 所述保护层完全覆盖所述弯折子区，并至少覆盖部分所述弯折过渡子区；

[0018] 盖板，所述盖板通过光学胶与所述彩膜连接，所述盖板完全覆盖所述平面区，并至少覆盖部分所述弯折过渡子区。

[0019] 在一些实施例中，所述光学胶的厚度大于所述保护层在所述弯折过渡子区的最

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大厚度。

[0020] 在一些实施例中，所述保护层还至少覆盖部分所述弯折延伸子区。

[0021] 在一些实施例中，所述保护层为UV胶。

[0022] 在一些实施例中，所述显示装置还包括：

[0023] 支撑层，所述支撑层的一侧支撑所述平面区和所述弯折过渡子区，所述支撑层远离所述平面区的一侧支撑所述弯折延伸子区。

[0024] 在一些实施例中，所述支撑层包括设置在所述平面区和所述弯折过渡子区远离所述盖板的一侧的第一背板以及设置在所述弯折过渡子区远离所述保护层的一侧的第二背板。

[0025] 在一些实施例中，所述第一背板和所述第二背板之间设置有泡棉。

[0026] 在一些实施例中，所述泡棉和所述第二背板之间设置有补强板。

[0027] 在一些实施例中，所述泡棉和所述补强板之间设置有散热层。

[0028] 在一些实施例中，所述预设值大于0。

[0029] 在一些实施例中，所述保护层靠近所述平面区的侧边与所述柔性屏体的初始弯折位置之间的距离大于第一预设值，所述第一预设值大于或等于0，其中，所述初始弯折位置为所述弯折子区和所述弯折过渡子区衔接的位置。

[0030] 在一些实施例中，所述保护层靠近所述弯折延伸子区的侧边与所述柔性屏体的末端弯折位置之间的距离大于第二预设值，所述第二预设值大于或等于0。

[0031] 在一些实施例中，所述平面区包括红色子像素单元、绿色子像素单元和蓝色子像素单元，所述彩膜包括多个彩色色阻以及设置在不同的所述彩色色阻之间的黑色矩阵，多个所述彩色色阻包括红色色阻、绿色色阻和蓝色色阻，所述红色色阻对应所述红色子像素单元设置，所述绿色色阻对应所述绿色子像素单元设置，所述蓝色色阻对应所述蓝色子像素单元设置。

[0032] 在一些实施例中，所述光学胶为OCA光学胶。

[0033] 在一些实施例中，所述散热层的材料为金属材料或石墨，其中，所述金属材料包括铜箔、铝箔和不锈钢箔中的任意一种或多种的组合。

[0034] 在一些实施例中，所述显示装置还包括驱动单元，所述驱动单元设置在所述弯折延伸子区远离所述支撑层的表面。

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发明的有益效果

有益效果

[0035] 本申请提供的显示装置，通过在保护层与盖板重叠的区域内，使保护层与盖板之间的距离大于或等于预设值，如此，盖板不会挤压保护层，消除了显示装置的开裂风险。

对附图的简要说明

附图说明

[0036] 图1为本申请实施例提供的显示装置的结构示意图。

[0037] 图2为本申请另一实施例提供的显示装置的结构示意图。

[0038] 图3为本申请再一实施例提供的显示装置的结构示意图。

[0039] 图4为本申请又一实施例提供的显示装置的结构示意图。

[0040] 图5为本申请实施例提供的显示装置的制作方法流程图。

发明实施例

本发明的实施方式

[0041] 为使本申请的目的、技术方案及效果更加清楚、明确，以下参照附图并举实施例对本申请进一步详细说明。应当理解，此处所描述的具体实施例仅用以解释本申请，并不用于限定本申请。

[0042] 本申请实施例提供一种显示装置，显示装置可以为可穿戴设备，例如智能手环、智能手表或虚拟现实（Virtual Reality，VR）等设备，也可以为移动电话机、电子书、电子报纸、电视机或个人便携电脑，还可以为可弯曲和可折叠的柔性OLED显示或照明设备，本申请实施例对显示装置的具体形式不作具体限定。

[0043] 图1为本申请实施例提供的显示装置的结构示意图，如图1所示，显示装置包括柔性屏体10、彩膜50、保护层30和盖板40，可选地，显示装置还可以包括支撑层20和光学胶60，以下分别对柔性屏体10、支撑层20、保护层30、盖板40、彩膜50和光学胶60进行具体说明。

[0044] 柔性屏体10指的是能够进行弯曲和折叠的柔韧性高的屏幕，柔性屏体10可以划分为平面区AA和自平面区AA延伸的弯折区，平面区AA指的是能够进行显示的区

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域，弯折区指的是不能够进行显示的区域。弯折区可以包括依次设置的弯折过渡子区B1、弯折子区B2和弯折延伸子区B3，其中，弯折过渡子区B1的相对两端分别与平面区AA和弯折子区B2连接，弯折子区B2的相对两端分别与弯折过渡子区B1和弯折延伸子区B3连接。其中，弯折过渡子区B1与平面区AA平齐，也即弯折过渡子区B1与平面区AA位于同一平面，弯折子区B2和弯折延伸子区B3均不与平面区AA平齐，也即弯折子区B2与平面区AA位于不同平面，弯折延伸子区B3与平面区AA位于不同平面。

[0045] 具体而言，柔性屏体10包括柔性衬底，柔性衬底为由柔性材料制作而成的衬底，柔性材料优选为聚酰亚胺（PI），柔性衬底可以划分为第一区域和自第一区域延伸的第二区域。

[0046] 柔性衬底的第一区域上可以集成显示层，显示层可以包括多个用于显示图像的显示部件，从而使柔性衬底的第一区域与显示层共同形成柔性屏体10的平面区AA。显示层可以包括诸如薄膜晶体管、栅极线、数据线、电容、阳极、阴极和发光层等不同的显示部件，本申请实施例对柔性屏体10的平面区AA本身的结构并没有改进，采用本领域常用的结构即可，本申请实施例对其结构不作具体限定。

[0047] 柔性衬底的第二区域上设置有用于实现信号传输和驱动图像显示等功能的集成电路，从而使柔性衬底的第二区域与集成电路共同形成柔性屏体10的弯折区，本申请实施例对柔性屏体10的弯折区本身的结构并没有改进，采用本领域常用的结构即可，本申请实施例对其结构不作具体限定。

[0048] 为了实现显示装置的窄边框设计，通常将柔性屏体10的弯折区进行弯折，如图1所示，本申请实施例具体将柔性屏体10的弯折子区B2进行180°弯折，使得平面区AA与弯折过渡子区B1所组成的整体与弯折延伸子区B3相对且相互平行，此时，弯折子区B2呈半圆弧状，平面区AA、弯折过渡子区B1、弯折子区B2和弯折延伸子区B3形成一个容纳槽，支撑层20位于该容纳槽内。

[0049] 需要说明的是，一方面，由于柔性屏体10的弯折区包括设置在平面区AA和弯折子区B2之间的弯折过渡子区B1，因此使得柔性屏体10的初始弯折位置为弯折子区B2和弯折过渡子区B1衔接的位置，即柔性屏体10的初始弯折位置偏离平面区A

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A和弯折区衔接的位置，初始弯折位置的两侧均为弯折区域，有效缓解了柔性屏体10的初始弯折位置因其两侧区域的结构不同而导致的应力集中的现象，实现对柔性屏体10的弯折起始位置的保护；另一方面，由于弯折子区B2和平面区AA不直接相邻，两者之间设置有弯折过渡子区B1，因此减小了弯折子区B2弯折时作用于平面区AA上的应力，从而对平面区AA进行保护，例如防止平面区AA开裂。

[0050] 支撑层20的一侧支撑柔性屏体10的平面区AA和弯折过渡子区B1，支撑层20远离平面区AA的一侧支撑柔性屏体10的弯折延伸子区B3，即柔性屏体10的平面区AA和弯折过渡子区B1设置在支撑层20的同一侧，柔性屏体10的弯折延伸子区B3设置在支撑层20远离平面区AA的另一侧。

[0051] 需要说明的是，支撑层20主要用于固定并支撑柔性屏体10，防止柔性屏体10的弯折子区B2由于弯折程度过大而折断。支撑层20可以为兼具硬度和弹性的材料，从而既可以对柔性屏体10进行支撑，又可以对柔性屏体10进行减震。支撑层20可以为一层，也可以为多层结构，本申请实施例对此不作具体限定。

[0052] 保护层30设置在柔性屏体10远离支撑层20的一侧，保护层30至少覆盖部分弯折区，图1所示的保护层30完全覆盖柔性屏体10的弯折子区B2，并至少覆盖部分柔性屏体10的弯折过渡子区B1。其中，图1所示的保护层30完全覆盖柔性屏体10的弯折子区B2和弯折过渡子区B1，当然，在其他实施例中，保护层30还可以完全覆盖柔性屏体10的弯折子区B2且覆盖部分弯折过渡子区B1。

[0053] 需要说明的是，保护层30完全覆盖柔性屏体10的弯折子区B2，从而缓解弯折子区B2的弯折应力；保护层30至少覆盖部分柔性屏体10的弯折过渡子区B1，从而使保护层30能够从柔性屏体10的初始弯折位置靠近平面区AA的一侧开始更好地缓解柔性屏体10的初始弯折位置的弯折应力，需要说明的是，保护层30靠近平面区AA的侧边与柔性屏体10的初始弯折位置之间的距离还可以大于第一预设值，第一预设值为大于或等于0的值，第一预设值可以根据实际需求进行灵活调整，本申请实施例对此不作具体限定。

[0054] 柔性屏体10的平面区AA包括红色子像素单元、绿色子像素单元和蓝色子像素单元，其中，红色子像素单元用于发出红色的光，绿色子像素单元用于发出绿色

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的光，蓝色子像素单元用于发出蓝色的光。

[0055] 彩膜50设置在柔性屏体10远离支撑层20的一侧，彩膜50至少覆盖平面区AA，彩膜50用于替代偏光片，承担着防止显示装置的漏光以及降低显示装置的反射率的作用。

[0056] 具体而言，彩膜50包括多个彩色色阻以及设置在不同的彩色色阻之间的黑色矩阵，多个彩色色阻包括红色色阻、绿色色阻和蓝色色阻，其中，红色色阻对应红色子像素单元设置，红色色阻承担着红色子像素单元的出光；绿色色阻对应绿色子像素单元设置，绿色色阻承担着绿色子像素单元的出光；蓝色色阻对应蓝色子像素单元设置，蓝色色阻承担着蓝色子像素单元的出光；黑色矩阵主要承担着防止显示装置漏光以及降低显示装置的反射率的作用。

[0057] 盖板40设置在彩膜50远离柔性屏体10的一侧，盖板40至少覆盖平面区AA，图1所示的盖板40通过光学胶60与彩膜50连接，其中，光学胶60用于胶结光学元件，光学胶60可以为具有无色透明、光透过率在90%以上、胶结强度良好、可在室温或中温下固化且固化收缩小等特点的OCA光学胶，在本申请实施例中，光学胶60用于将盖板40与彩膜50进行胶结。盖板40用于保护柔性屏体10不受外界的冲击力而损伤。

[0058] 本申请实施例提供的显示装置，在保护层30与盖板40重叠的区域内，保护层30与盖板40之间的距离大于或等于预设值，需要说明的是，预设值为大于0的值，预设值可以根据实际需求（例如制程精度）进行灵活调整，本申请实施例对此不作具体限定。如此，盖板40不会挤压保护层30，消除了显示装置的开裂风险。

[0059] 基于上述实施例，请参阅图2，保护层30仅设置在柔性屏体10的表面，柔性屏体10的表面的保护层30的厚度小于或等于盖板40靠近柔性屏体10的一侧到柔性屏体10靠近盖板40的一侧之间的距离。

[0060] 基于上述实施例，请参阅图3，显示装置还包括设置在柔性屏体10与彩膜50之间的触控层70，以及设置在触控层70与彩膜50之间的绝缘层80，保护层30仅设置在绝缘层80的表面，绝缘层80的表面的保护层30的厚度小于或等于盖板40靠近绝缘层80的一侧到绝缘层80靠近盖板40的一侧之间的距离。

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[0061] 基于上述实施例，请参阅图1和图4，保护层30还设置在彩膜50的表面，彩膜50的表面的保护层30的厚度小于或等于盖板40靠近彩膜50的一侧到彩膜50靠近盖板40的一侧之间的距离。

[0062] 基于上述实施例，在本申请实施例中，光学胶60的厚度大于保护层30在柔性屏体10的弯折过渡子区B1的最大厚度，如此，即可保证覆盖柔性屏体10的弯折过渡子区B1的盖板40与覆盖柔性屏体10的弯折过渡子区B1的保护层30具有一定间隔，盖板40不会挤压保护层30，消除了显示装置的开裂风险。

[0063] 基于上述实施例，本申请实施例对显示装置进行进一步说明，保护层30还至少覆盖部分柔性屏体10的弯折延伸子区B3，以更好地缓解柔性屏体10的末端弯折位置的弯折应力。需要说明的是，保护层30靠近弯折延伸子区B3的侧边与柔性屏体10的末端弯折位置之间的距离还可以大于第二预设值，第二预设值为大于或等于0的值，第二预设值可以根据实际需求进行灵活调整，本申请实施例对此不作具体限定。其中，图1所示的保护层30覆盖部分柔性屏体10的弯折延伸子区B3，当然，在其他实施例中，保护层30还可以完全覆盖柔性屏体10的弯折延伸子区B3。

[0064] 基于上述实施例，在一些实施例中，保护层30为UV胶，当然，在其他实施例中，保护层30不限于UV胶，还可以是热固化胶或其他种类的光固化胶，本申请实施例对此不作具体限定。需要说明的是，在满足盖板40与保护层30之间的距离大于0的情况下，本领域技术人员可以根据柔性屏体10的大小、种类、弯折子区B2的弯折半径、保护层30的柔韧性以及缓解应力的能力为保护层30设置合适的厚度，本申请实施例对其不作具体限定。

[0065] 基于上述实施例，本申请实施例对显示装置进行进一步说明，支撑层20包括设置在柔性屏体10的平面区AA和弯折过渡子区B1远离盖板40的一侧的第一背板201，以及设置在柔性屏体10的弯折延伸子区B3远离保护层30的一侧的第二背板202。其中，弯折延伸子区B3可以通过胶粘或者物理方法固定于第二背板202上。

[0066] 需要说明的是，第一背板201用于支撑和保护柔性屏体10的平面区AA和弯折过渡子区B1，避免其受到外界的冲击力而损伤，第二背板202用于支撑和保护柔性屏体10的弯折延伸子区B3，避免其受到外界的冲击力而损伤。第一背板201和第

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二背板202的材料可以为聚对苯二甲酸乙二醇酯（Polyethylene terephthalate，PET）材料，由于PET材料具有弹性模量低和受热不易膨胀的优点，因此采用PET材料制作而成的第一背板201和第二背板202不会因为环境温度的变化而变形，降低了第一背板201与其连接的膜层剥离的可能性以及第二背板202与其连接的膜层剥离的可能性，从而提高了显示装置的良率和可靠性。

[0067] 进一步地，为了防止第一背板201和第二背板202影响柔性屏体10的弯折子区B2的弯折，必须确保第一背板201和第二背板202均避开弯折子区B2。优选地，为了更好的支撑柔性屏体10的平面区AA和弯折过渡子区B1，第一背板201的边缘与柔性屏体10的初始弯折位置重合，同理，为了更好的支撑柔性屏体10的弯折延伸子区B3，第二背板202的边缘与柔性屏体10的末端弯折位置重合。

[0068] 基于上述实施例，在一些实施例中，支撑层20还包括设置在第一背板201和第二背板202之间的垫高块，垫高块的高度还可以根据柔性屏体10的弯折子区B2的宽度进行调整，本申请实施例对其不作具体限定。垫高块可以为硅胶等材料，垫高块可以具有一定弹性和硬度，垫高块具有一定硬度以避免所述柔性屏体10被挤压变形，垫高块具有一定弹性以避免所述柔性屏体10由于受到局部应力而损坏。

[0069] 具体而言，垫高块避开柔性屏体10的弯折子区B2设置。当然，在其他实施例中，垫高块靠近柔性屏体10的弯折子区B2的一端的表面与弯折子区B2弯折后的形状匹配，以使得弯折子区B2靠近垫高块一侧的表面与垫高块的表面相贴合，进而对弯折子区B2具有一定的支撑作用，且不易变形损坏。可以理解的是，在其他实施例中，还可以通过增加第一背板201和第二背板202的厚度，或增加其他支撑结构，以确保柔性屏体10的平面区AA和弯折延伸子区B3之间的距离。

[0070] 基于上述实施例，在一些实施例中，第一背板201和第二背板202之间设置有泡棉203。需要说明的是，泡棉203是塑料粒子发泡过的材料，其既能起到缓冲作用，也能起到遮光作用。

[0071] 基于上述实施例，在一些实施例中，泡棉203和第二背板202之间设置有补强板204。需要说明的是，补强板204用于提高柔性屏体10的强度。其中，补强板204可以为聚酰亚胺层，也可以为石墨层，其中，石墨层的外表面还可用聚酰亚胺

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包覆，本申请实施例对此不作具体限定。

[0072] 基于上述实施例，在一些实施例中，泡棉203和补强板204之间设置有散热层205。其中，散热层205起到屏蔽和散热作用，散热层205的材料为散热材料，具体可以为金属材料或石墨等，其中，金属可以为铜箔、铝箔或不锈钢箔等，本申请实施例对此不作具体限定。

[0073] 基于上述实施例，在一些实施例中，显示装置还包括设置在所述弯折延伸子区B3的驱动单元。具体而言，驱动单元设置在柔性屏体10的弯折延伸子区B3远离支撑层20的表面。驱动单元包括驱动芯片和柔性电路板，其中，驱动芯片和柔性电路板均设置在柔性屏体10的弯折延伸子区B3远离支撑层20的表面，柔性电路板与驱动芯片之间的距离大于0。

[0074] 基于上述实施例，在一些实施例中，柔性屏体10的平面区AA包括柔性衬底、薄膜晶体管、显示器件和封装层，其中，柔性衬底设置在第一背板201上，薄膜晶体管设置在柔性衬底上，显示器件设置在薄膜晶体管上，封装层设置在显示器件上。

[0075] 柔性衬底为由柔性材料制作而成的衬底，柔性材料优选为聚酰亚胺（PI）。

[0076] 显示器件用于进行发光，显示器件通常包括设置在薄膜晶体管上的阳极（Anode）、设置在阳极上的空穴注入层（Hole Injection Layer，HIL）、设置在空穴注入层上的空穴传输层（Hole Tranport Layer，HTL）、设置在空穴传输层上的发光层（Emission layer，EML）、设置在发光层上的电子传输层（Electron Transport Layer，ETL)、设置在电子传输层上的电子注入层（Electron Injection Layer，EIL）以及设置在电子传输层上的阴极（Cathode）。可选地，显示器件中还可设置有空穴阻挡层（Hole Block Layer，HBL），电子阻挡层(Electron Block Layer，EBL）和封盖层（Capping Layer，CPL）。

[0077] 发光层包括红色子像素单元、绿色子像素单元和蓝色子像素单元，其中，红色子像素单元用于发出红色的光，绿色子像素单元用于发出绿色的光，蓝色子像素单元用于发出蓝色的光。

[0078] 彩膜50用于替代偏光片，承担着防止显示装置的漏光以及降低显示装置的反射

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率的作用。具体而言，彩膜50包括多个彩色色阻以及设置在不同的彩色色阻之间的黑色矩阵，多个彩色色阻包括红色色阻、绿色色阻和蓝色色阻，其中，红色色阻对应红色子像素单元设置，红色色阻承担着红色子像素单元的出光；绿色色阻对应绿色子像素单元设置，绿色色阻承担着绿色子像素单元的出光；蓝色色阻对应蓝色子像素单元设置，蓝色色阻承担着蓝色子像素单元的出光；黑色矩阵主要承担着防止显示装置漏光以及降低显示装置的反射率的作用。

[0079] 封装层用于为显示装置隔绝外界的水和氧气，保证显示装置的良率。封装层通常为有机层、无机层和有机层构成的三明治结构。

[0080] 基于上述实施例，本申请实施例对上述显示装置的制作方法进行说明。图5为本申请实施例提供的显示装置的制作方法流程图，如图5所示，制作方法包括：

[0081] S1，在玻璃基板上制作柔性屏体10。

[0082] 柔性屏体10指的是能够进行弯曲和折叠的柔韧性高的屏幕，柔性屏体10可以划分为平面区AA和自平面区AA延伸的弯折区，平面区AA指的是能够进行显示的区域，弯折区指的是不能够进行显示的区域。弯折区包括依次设置的弯折过渡子区B1、弯折子区B2和弯折延伸子区B3，其中，弯折过渡子区B1的相对两端分别与平面区AA和弯折子区B2连接，弯折子区B2的相对两端分别与弯折过渡子区B1和弯折延伸子区B3连接。其中，弯折过渡子区B1与平面区AA平齐，也即弯折过渡子区B1与平面区AA位于同一平面，弯折子区B2和弯折延伸子区B3均不与平面区AA平齐，也即弯折子区B2与平面区AA位于不同平面，弯折延伸子区B3与平面区AA位于不同平面。

[0083] S2，在柔性屏体10上制作彩膜50。

[0084] 具体而言，柔性屏体10的平面区AA包括红色子像素单元、绿色子像素单元和蓝色子像素单元，彩膜50包括多个彩色色阻以及设置在不同的彩色色阻之间的黑色矩阵，多个彩色色阻包括红色色阻、绿色色阻和蓝色色阻，红色色阻对应红色子像素单元设置，绿色色阻对应绿色子像素单元设置，蓝色色阻对应蓝色子像素单元设置。需要说明的是，在一些实施例中，还可以在彩膜50上制作平坦层以对彩膜50进行平坦化。

[0085] S3，对柔性屏体10的弯折区进行驱动芯片和柔性电路板的邦定，并对柔性屏体

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10的弯折区进行UV胶覆盖。

[0086] 具体而言，将驱动芯片和柔性电路板均设置在柔性屏体10的弯折延伸子区B3远离支撑层20的表面，并使柔性电路板与驱动芯片之间的距离大于0。对柔性屏体10的弯折区进行UV胶覆盖，使得UV胶完全覆盖弯折子区B2，并至少覆盖部分弯折过渡子区B1。

[0087] S4，将玻璃基板进行剥离，并将支撑层20与柔性屏体10进行贴合。

[0088] 具体而言，支撑层20的一侧支撑柔性屏体10的平面区AA和弯折过渡子区B1，支撑层20远离平面区AA的一侧支撑柔性屏体10的弯折延伸子区B3，即柔性屏体10的平面区AA和弯折过渡子区B1设置在支撑层20的同一侧，柔性屏体10的弯折延伸子区B3设置在支撑层20远离平面区AA的另一侧。需要说明的是，支撑层20主要用于固定并支撑柔性屏体10，防止柔性屏体10的弯折子区B2由于弯折程度过大而折断。支撑层20可以为兼具硬度和弹性的材料，从而既可以对柔性屏体10进行支撑，又可以对柔性屏体10进行减震。支撑层20可以为一层，也可以为多层结构，本申请实施例对此不作具体限定。

[0089] S5，将盖板40与彩膜50通过光学胶60进行贴合，其中，光学胶60的厚度大于UV胶的最大厚度。

[0090] 具体而言，使用光学胶60将盖板40与彩膜50进行贴合，使盖板40完全覆盖柔性屏体10的平面区AA，并至少覆盖部分柔性屏体10的弯折过渡子区B1。由于光学胶60的厚度大于UV胶的最大厚度，因此在盖板40与彩膜50的贴合过程中，盖板40不会对UV胶产生压力，降低了显示装置的模组制程风险。

[0091] 需要说明的是，上述步骤的标号并不严格代表步骤的执行顺序，在一些实施例中，可以严格按照上述步骤的标号顺序执行对应的步骤，当然，在另一些实施例中，某些步骤可以同时执行，或者调换顺序执行，本申请实施例对此不作具体限定。

[0092] 可以理解的是，对本领域普通技术人员来说，可以根据本申请的技术方案及其申请构思加以等同替换或改变，而所有这些改变或替换都应属于本申请所附的权利要求的保护范围。

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权利要求书

[权利要求 1] 一种显示装置，其中，所述显示装置包括：

柔性屏体，包括平面区以及与所述平面区连接的弯折区；

彩膜，设置在所述柔性屏体上且至少覆盖所述平面区；

保护层，设置在所述柔性屏体上且至少覆盖部分所述弯折区；

盖板，设置在所述彩膜上且至少覆盖所述平面区；

其中，在所述保护层与所述盖板重叠的区域内，所述保护层与所述盖板之间的距离大于或等于预设值。

[权利要求 2] 根据权利要求1所述的显示装置，其中，所述保护层仅设置在所述柔性屏体的表面，所述柔性屏体的表面的所述保护层的厚度小于或等于所述盖板靠近所述柔性屏体的一侧到所述柔性屏体靠近所述盖板的一侧之间的距离。

[权利要求 3] 根据权利要求1所述的显示装置，其中，所述显示装置还包括设置在所述柔性屏体与所述彩膜之间的触控层，以及设置在所述触控层与所述彩膜之间的绝缘层，所述保护层仅设置在所述绝缘层的表面，所述绝缘层的表面的所述保护层的厚度小于或等于所述盖板靠近所述绝缘层的一侧到所述绝缘层靠近所述盖板的一侧之间的距离。

[权利要求 4] 根据权利要求2所述的显示装置，其中，所述保护层还设置在所述彩膜的表面，所述彩膜的表面的所述保护层的厚度小于或等于所述盖板靠近所述彩膜的一侧到所述彩膜靠近所述盖板的一侧之间的距离。

[权利要求 5] 根据权利要求1所述的显示装置，其中，所述弯折区包括与所述平面区连接并依次设置的弯折过渡子区、弯折子区以及弯折延伸子区，所述弯折过渡子区与所述平面区平齐；

所述保护层完全覆盖所述弯折子区，并至少覆盖部分所述弯折过渡子区；

盖板，所述盖板通过光学胶与所述彩膜连接，所述盖板完全覆盖所述平面区，并至少覆盖部分所述弯折过渡子区。

[权利要求 6] 根据权利要求5所述的显示装置，其中，所述光学胶的厚度大于所述

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保护层在所述弯折过渡子区的最大厚度。

[权利要求 7] 根据权利要求5所述的显示装置，其中，所述保护层还至少覆盖部分所述弯折延伸子区。

[权利要求 8] 根据权利要求5所述的显示装置，其中，所述保护层为UV胶。

[权利要求 9] 根据权利要求5所述的显示装置，其中，所述显示装置还包括：

支撑层，所述支撑层的一侧支撑所述平面区和所述弯折过渡子区，所述支撑层远离所述平面区的一侧支撑所述弯折延伸子区。

[权利要求 10] 根据权利要求9所述的显示装置，其中，所述支撑层包括设置在所述平面区和所述弯折过渡子区远离所述盖板的一侧的第一背板以及设置在所述弯折过渡子区远离所述保护层的一侧的第二背板。

[权利要求 11] 根据权利要求10所述的显示装置，其中，所述第一背板和所述第二背板之间设置有泡棉。

[权利要求 12] 根据权利要求11所述的显示装置，其中，所述泡棉和所述第二背板之间设置有补强板。

[权利要求 13] 根据权利要求12所述的显示装置，其中，所述泡棉和所述补强板之间设置有散热层。

[权利要求 14] 根据权利要求1所述的显示装置，其中，所述预设值大于0。

[权利要求 15] 根据权利要求5所述的显示装置，其中，所述保护层靠近所述平面区的侧边与所述柔性屏体的初始弯折位置之间的距离大于第一预设值，所述第一预设值大于或等于0，其中，所述初始弯折位置为所述弯折子区和所述弯折过渡子区衔接的位置。

[权利要求 16] 根据权利要求5所述的显示装置，其中，所述保护层靠近所述弯折延伸子区的侧边与所述柔性屏体的末端弯折位置之间的距离大于第二预设值，所述第二预设值大于或等于0。

[权利要求 17] 根据权利要求1所述的显示装置，其中，所述平面区包括红色子像素单元、绿色子像素单元和蓝色子像素单元，所述彩膜包括多个彩色色阻以及设置在不同的所述彩色色阻之间的黑色矩阵，多个所述彩色色阻包括红色色阻、绿色色阻和蓝色色阻，所述红色色阻对应所述红色

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子像素单元设置，所述绿色色阻对应所述绿色子像素单元设置，所述蓝色色阻对应所述蓝色子像素单元设置。

[权利要求 18] 根据权利要求5所述的显示装置，其中，所述光学胶为OCA光学胶。

[权利要求 19] 根据权利要求13所述的显示装置，其中，所述散热层的材料为金属材料或石墨，其中，所述金属材料包括铜箔、铝箔和不锈钢箔中的任意一种或多种的组合。

[权利要求 20] 根据权利要求9所述的显示装置，其中，所述显示装置还包括驱动单元，所述驱动单元设置在所述弯折延伸子区远离所述支撑层的表面。

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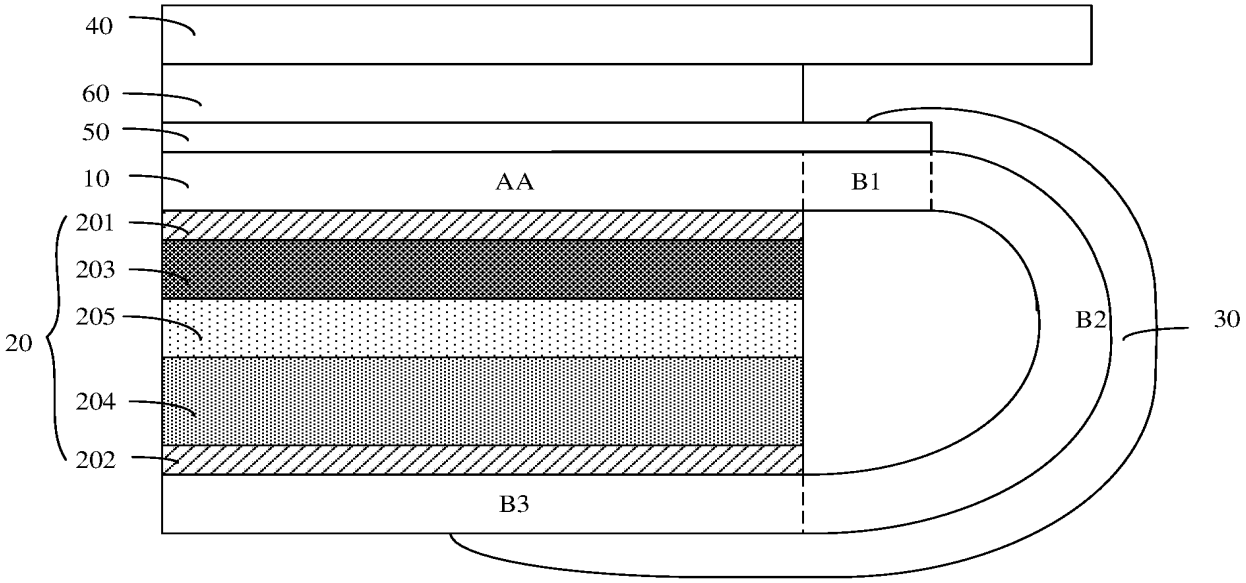


图 1

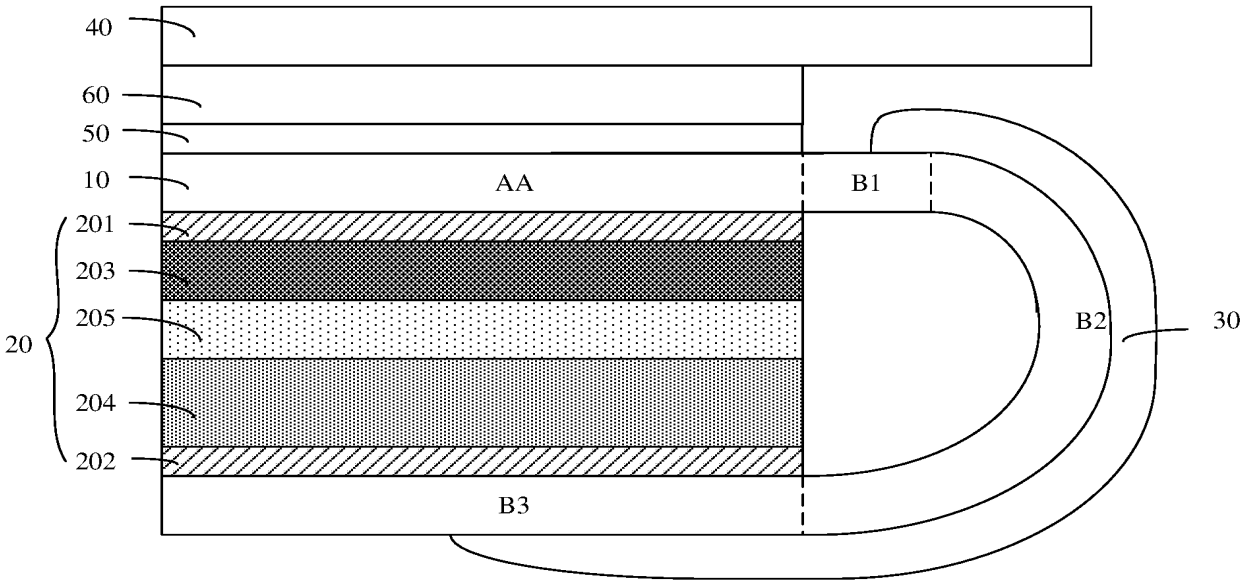


图 2

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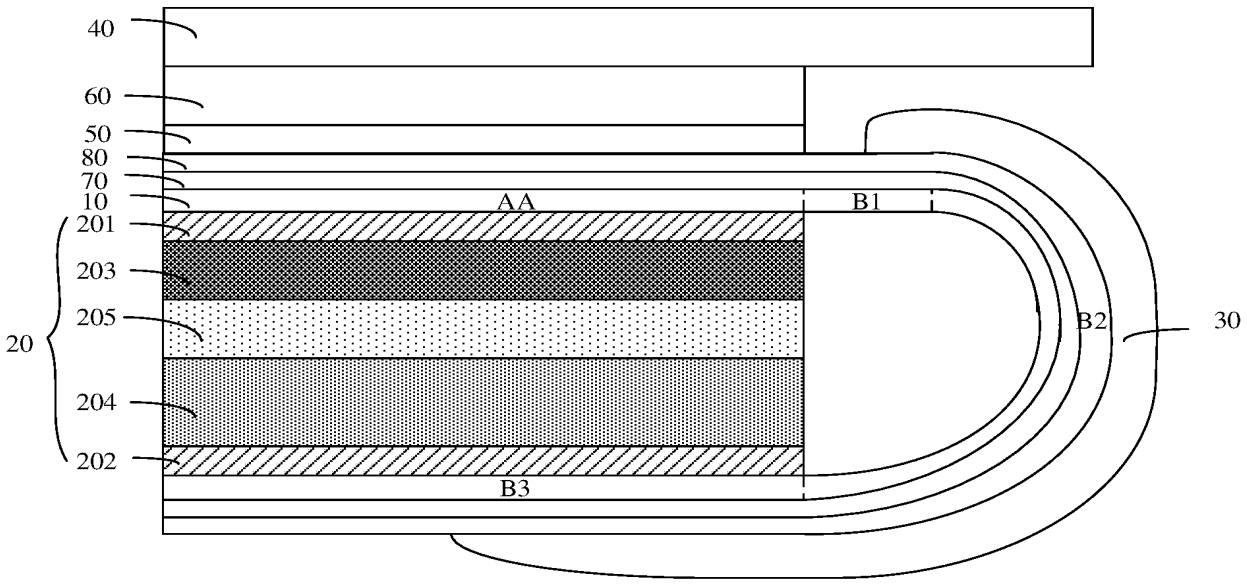


图 3

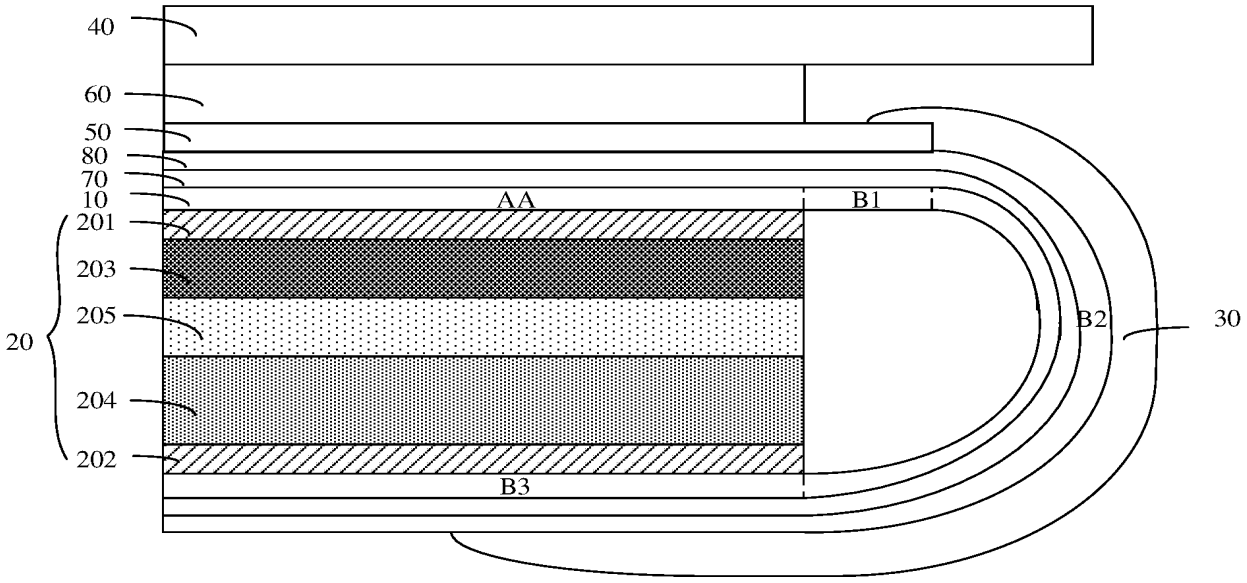


图 4

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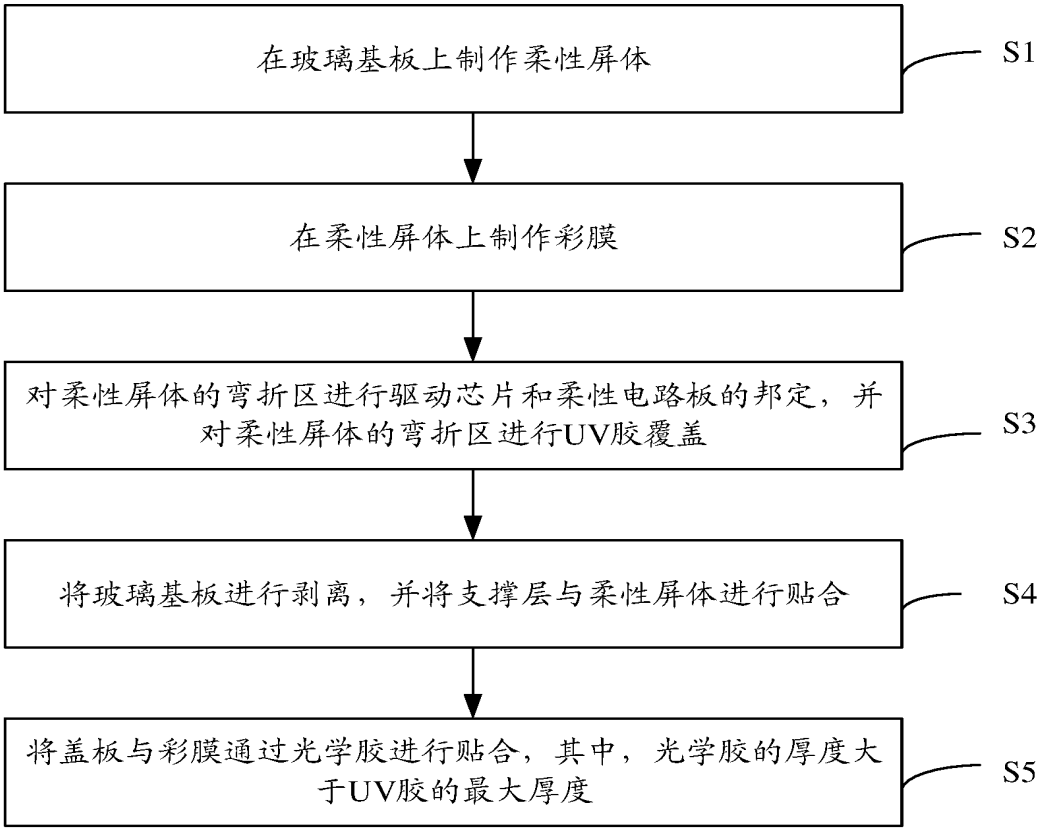


图 5

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(Not for submission under 37 CFR 1.99)

Application Number	17419713
Filing Date	2021-06-29
First Named Inventor	ZHOU, Jing
Art Unit	N/A
Examiner Name	N/A
Attorney Docket Number	TP204027-US

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	1	20190318689	A1	2019-10-17	KIM SUNG HOON	ALL

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	1	108682307	CN	A	2018-10-19	KUNSHAN GOVISIONOX OPTOELECTRONICS CO LTD	ALL	☒
	2	108877519	CN	A	2018-11-23	SHANGHAI TIANMA MICROELECTRONICS CO LTD	ALL	☒
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	4	109119453	CN	A	2019-01-01	WUHAN TIANMA MICRO ELECTRONICS CO LTD	ALL	☒
	5	109859642	CN	A	2019-06-07	SHANGHAI TIANMA MICROELECTRONICS CO LTD	ALL	☒
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	1	International Search Report in International application number: PCT/CN2021/097527, mailed on 11/29/2021	☒
	2	Written Opinion of the International Searching Authority in International application number: PCT/CN2021/097527, mailed on 11/29/2021	☒

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	3	Chinese Office Action in corresponding Chinese Patent Application No. 202110548905.2 dated January 07, 2022, pages 1-9	☒

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That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

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See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Wei Te Chung/	Date (YYYY-MM-DD)	2022-04-07
Name/Print	Wei Te Chung	Registration Number	43325

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Abstract of CN108682307 (A)
The present invention relates to a kind of display panels, including:Flexible screen body, including viewing area and non-display area;Non-display area includes bending transition region, bent area and the extension area set gradually, and the extension area and the viewing area are non-coplanar, and bending transition region and viewing area are coplanar;The side of supporting layer, the supporting layer supports viewing area and the bending transition region of the flexible screen body, and the side far from the viewing area of the supporting layer supports the extension area of the flexible screen body;Protective layer, is formed in the surface of the separate supporting layer of flexible screen body, and bent area, and at least partly covering bending transition region is completely covered in protective layer.Above-mentioned display panel; the both sides of the initial crooked place of flexible screen body are non-display area; therefore the protection of the bending initial position to flexible screen body the phenomenon that stress concentration, is realized in the bending initial position that flexible screen body has been effectively relieved caused by the structure difference of its two side areas.The invention further relates to a kind of display devices.

Description

Display panel and display device

Technical field

The present invention relates to display fields, more particularly to a kind of display panel and a kind of display device.

Background technology

With the development of information technology, the display devices such as mobile phone have become tool indispensable in people's life, and

" screen comprehensively " also becomes the pursuit of more and more users.Comprehensive screen display device that industry is declared is the display of superelevation screen accounting
Device.In order to make flexible screen body reach screen display effect comprehensively, the method for generally use non-display area bending is realized, i.e.,:It will be soft
Property screen body non-display area be folded into the back side of flexible screen body to reduce screen body border width, and then improve screen accounting.
However, flexible screen body non-display area is in bending, the initial crooked place of flexible screen body easy tos produce stress concentration The phenomenon that, it is serious, it is possible to create folding line, and then lead to the screen body at the position or cable fault failure.

Invention content
Based on this, it is necessary to provide a kind of stress concentration phenomenon for the initial crooked place that flexible screen body can be effectively relieved
Display panel.
A kind of display panel, including:
Flexible screen body, the flexible screen body includes viewing area and non-display area;The non-display area includes setting gradually
Transition region, bent area and extension area are bent, the bending transition region connects the bent area and viewing area, the extension area and institute
It is non-coplanar to state viewing area, and the bending transition region and the viewing area are coplanar;
The side of supporting layer, the supporting layer supports viewing area and the bending transition region of the flexible screen body, the support
The side far from the viewing area of layer supports the extension area of the flexible screen body;
Protective layer, is formed in the surface far from the supporting layer of

the flexible screen body, and institute is completely covered in the protective layer
Bent area is stated, and at least partly covers the bending transition region.
Above-mentioned display panel, the non-display area of flexible screen body include being set to bend transition region between viewing area and bent area,
The initial crooked place of flexible screen body is the position of bent area and bending transition region linking, the i.e. initial crooked place of flexible screen body
Deviate viewing area and the adjacent position of non-display area, the both sides of initial crooked place are non-display area, therefore are effectively relieved
It the phenomenon that stress concentration, is realized to flexibility caused by the structure difference of its two side areas the bending initial position of flexible screen body
Shield the protection of the bending initial position of body.
In one of the embodiments, the metal routing in the bending transition region and bent area be equipped with it is round or its
The hole of its shape.
The position of the bending transition region of the flexible screen body and bent area linking is described soft in one of the embodiments,
Property screen body bending initial position, the protective layer close to the viewing area side and the bending of the flexible screen body it is initial
The distance between position is more than 0.5mm.
The bending transition region is completely covered in the protective layer in one of the embodiments,.
The protective layer is UV glue-lines in one of the embodiments,.
The thickness of the protective layer is 0.05mm to 0.2mm in one of the embodiments,.
The width of the bending transition region is 0mm to 2mm in one of the embodiments,.
Further include the driving unit set on the extension area in one of the embodiments,.

The supporting layer includes set on the viewing area of the flexible screen body and bending transition region in one of the embodiments,
First support membrane at the back side and set on the extension area close to the second support membrane of a side surface of the viewing area.
The supporting layer further includes being set to first support membrane and second support membrane in one of the embodiments,
Between keel.
The present invention also provides a kind of display devices.
A kind of display device, including display panel provided by the invention.
Above-mentioned display device, including display panel provided by the invention, the non-display area of flexible screen body includes being set to display
Transition region is bent between area and bent area, the initial crooked place of flexible screen body is bent area and bends the position of transition region linking
It sets, i.e. the adjacent position in the initial crooked place deviation viewing area of flexible screen body and non-display area, the both sides of initial crooked place
It is non-display area, therefore the bending initial position of flexible screen body has been effectively relieved to cause because of the structure of its two side areas difference
Stress concentration the phenomenon that, realize to flexible screen body bending initial position protection.

Description of the drawings
Fig. 1 is the schematic cross-section for the display panel that one embodiment of the invention provides.

Specific implementation mode
In order to make the purpose , technical scheme and advantage of the

present invention be clearer, with reference to the accompanying drawings and embodiments, right
The present invention is further elaborated.It should be appreciated that the specific embodiments described herein are merely illustrative of the present invention, and
It is not used in the restriction present invention.
It should be noted that when element is referred to as " being set to " another element, it can be directly on another element
Or there may also be elements placed in the middle.When an element is considered as " connection " another element, it can be directly connected to
To another element or it may be simultaneously present centering elements.When an element be considered as with another element " abutting ", it
Can directly abut or may be simultaneously present centering elements with another element.Term as used herein " vertical ",
" horizontal ", "left", "right" and similar statement for illustrative purposes only, are not offered as being unique embodiment.
Unless otherwise defined, all of technologies and scientific terms used here by the article and belong to the technical field of the present invention
The normally understood meaning of technical staff is identical.Used term is intended merely to description tool in the description of the invention herein
The purpose of the embodiment of body, it is not intended that in the limitation present invention.Term " and or " used herein includes one or more phases
Any and all combinations of the Listed Items of pass.
As shown in Figure 1, one embodiment of the invention provide display panel 100 comprising flexible screen body, supporting layer 130, with
And protective layer 150.
Specifically, flexible screen body includes viewing area 111 and non-display area 113.Non-display area 113 is curved including setting gradually
Roll over transition region 1131, bent area 1133 and extension area

1135.Wherein bending transition region 1131 connects bent area 1133 and viewing area
111, extension area 1135 and viewing area 111 are non-coplanar, and bending transition region 1131 and viewing area 111 are coplanar.In other words, extension area
1135 are located at the side of the separate viewing area 111 of bent area 1133, viewing area 111, bending transition region 1131,1133 and of bent area
Extension area 1135 is set gradually.
Usually, flexible screen body includes flexible base board, can be divided into display area on flexible base board and prolong from display area
The non-display area stretched.
It specifically, can integrative display layer on the display area of flexible base board.Display layer may include multiple for display figure
The display unit of picture may include on display layer to make the display area of flexible base board form the viewing area 111 of flexible screen body
The different display unit such as thin film transistor (TFT), grid line, data line, capacitance, anode, cathode, organic luminous layer, color filter film
Part.Polaroid 120 can also be set on display layer, to increase the light transmission of display layer, and reduce external light reflection.Polaroid
The flexible cover plate 140 for protecting flexible screen body is additionally provided on 120.
It is provided on the non-display area of flexible base board and the integrating for functions such as show for realizing signal transmission, driving image
Circuit, to form the non-display area 113 of flexible screen body.
When being bent to flexible screen body, only the non-display area 113 of flexible screen body is bent, and is arranged and is showing
Polaroid, touch sensitive layer, flexible cover plate on layer etc. need not then be bent.
It should be noted that the application to the viewing area 111 of flexible screen body, non-display area 113 structure of itself not

It improves, using structure commonly used in the art.And a part of the transition region 1131 as non-display area 113 is bent, and it is adjacent
Bent area 1133 structure use identical design.
In the present embodiment, through-hole on the metal routing in the bent area 1133 of flexible screen body, to alleviate the curved of flexible screen body
The folding s tress that folding area 1133 generates when bending.Preferably, through-hole is rounded or diamond shape etc..It is highly preferred that flexible screen body is non-
Metal routing in viewing area 113 is all made of identical shape.In addition, the metal routing in the bent area 1133 of flexible screen body
Trend can also be straight line or curve.
It is considered that bending transition region 1131 and bent area 1133 collectively form design bent area, and bent area 1133 is non-
Practical bent area when viewing area 113 is bent bends transition region 1131 and does not bend.
Usually, the bent area 1133 after bending is in arc hook.Preferably, the bending angle after the bending of bent area 1133 is
180 degree, i.e., it is solid to after bent area 1133 is bent, can preferably support so that extension area 1135 is parallel with viewing area 111
Determine the extension area 1135 of flexible screen body, while also allowing for technique realization.In addition the sky that also effective less flexible screen body occupies
Between.
Supporting layer 130 side support flexible screen body viewing area 111 and bending transition region 1131, supporting layer 130 it is remote
The extension area 1135 of side support flexible screen body from viewing area 111.In other words, it the viewing area 111 of flexible screen body and is folded over
The same side that area 1131 is set to supporting layer 130 is crossed, the extension area 1135 of flexible screen body is set to the separate viewing area of supporting layer 130
111 other side.

Supporting layer 130 mainly supports flexible screen body to fixed, to prevent the bent area 1133 of flexible screen body due to bending
Degree is excessive and fractures.Supporting layer 130 may include multilayered structure.Further, supporting layer 130 can be to have both hardness and bullet
The material of property.Supporting layer 130 both can play the role of support to flexible screen body, can also play and play vibration damping to flexible screen body
Function.
Protective layer 150 is formed in the surface of the separate supporting layer 130 of flexible screen body.Bent area is completely covered in protective layer 150
1133, and at least partly covering bending transition region 1131.
The non-display area 113 of flexible screen body includes being set between viewing area 111 and bent area 1133 to bend transition region 1131,
The initial crooked place of flexible screen body is bent area 1133 and bends the position that transition region 1131 is connected, i.e., flexible screen body is initial
Crooked place deviates viewing area and the adjacent position of non-display area, and the both sides of initial crooked place are non-display area, therefore are had
The bending initial position for alleviating flexible screen body is imitated caused by the structure difference of its two side areas the phenomenon that stress concentration, it is real
Now to the protection of the bending initial position of flexible screen body.
In addition, bent area 1133 and viewing area 111 not direct neighbor, effectively reduce when bent area 1133 is bent and act on
Stress on viewing area 111.
In the present embodiment, between the side of the close viewing area 111 of protective layer 150 and the bending initial position of flexible screen body
Distance B1 be more than 0.5mm, to which protective layer 150 can be

simultaneously from the close viewing area of the initial crooked place of flexible screen body
Preferably alleviate the folding s tress of the initial crooked place of flexible screen body in 111 side.
It is understood that the folding s tress of the end crooked place in order to preferably alleviate flexible screen body, protective layer 150
Close extension area 1135 side and the distance between end crooked place B2 can be with also greater than 0.5mm or even protective layer 150
Extension area 1135 is completely covered.
In the present embodiment, bending transition region 1131 is completely covered in protective layer 150.Certainly, in a further embodiment, protect
Layer 150 can also part covering bending transition region 1131.In this way, protective layer 150 can be the case where not blocking viewing area 111
Under, alleviate the folding s tress of the initial crooked place of flexible screen body.
Certainly, in a further embodiment, there is also not display areas for the frame of the viewing area 111 of flexible screen body.Herein
In the case of kind, protective layer 150 can cover at least partly area of viewing area 111 not shown with covering part viewing area 111
Domain, to the viewing area 111 and the adjacent position of non-display area 113 of better protection flexible screen body.
In the present embodiment, protective layer 150 is UV glue-lines.Certainly, in a further embodiment, protective layer 150 is not limited to UV
Glue can also be the optic-solidified adhesive of heat-curable glue or other types.
Further, in this embodiment the thickness of protective layer 150 is 0.05mm to 0.2mm, to meet common flexible screen
The protection of the bent area of body.Those skilled in the art can according to the size of flexible screen body, type, bent area crooked process radius
And the ability of the alleviation stress of protective layer 150 selects the thickness of suitable protective layer 150.
Certainly, when the other materials except protective layer 150 is UV glue is

made, those skilled in the art can also be according to guarantor
The flexibility of sheath 150 specifically determines its thickness.
In general, the width of the design bent area of flexible screen body is 0mm to 2mm.Preferably, the width of transition region 1131 is bent
Degree is 0 to 2mm, in the initial crooked place deviation viewing area 111 and the adjacent position of non-display area 113 for making flexible screen body
Simultaneously, moreover it is possible to corresponding display device be made to obtain higher screen accounting.Certainly, the width of bending transition region 1131 is less than flexible screen
The width of the design bent area of body.
In the present embodiment, display panel 100 further includes the driving unit 170 set on extension area 1135.Specifically, this implementation
In example, driving unit is set to the surface of the separate supporting layer 130 of extension area 1135.I.e. in the present embodiment, flexible screen body uses
COP (Chip On Pi, chip-on-film) encapsulation technology.Certainly, according to the design needs, in a further embodiment, flexible screen
Driving unit 170 can also be not provided on the extension area of body.
Additionally, in other embodiments, flexible PCB can also be equipped in the extension area row of flexible screen body.
In the present embodiment, supporting layer 130 includes set on 1131 back side of the viewing area 111 of flexible screen body and bending transition region
First support membrane 131 and the second support membrane 133 of a side surface set on the close viewing area 111 of extension area 1135.
It is understood that the first support membrane 131 and the second support membrane 133 influence the bent area of flexible screen body in order to prevent
1133 bending, after must ensuring that bent area 1133 bends preceding and bending, the first support membrane 131 and the second support membrane 133 are avoided
Bent area 1133.

Preferably, in order to preferably support flexible screen body viewing area 111 and bending transition region 1131, the first support membrane 131 edge is overlapped with the initial crooked place of the flexible screen body after bending.Likewise, in order to preferably support flexible screen body
Extension area 1135, the edge of the second support membrane 133 are overlapped with the end crooked place of the flexible screen body after bending.
Preferably, in the present embodiment, the first support membrane 131 and the second support membrane 133 are the PET with supporting role (Polyethylene Terephthalate, polyethylene terephthalate) film.Preferably, the first support membrane 131 and
The thickness of two support membranes 133 is 0 to 0.2mm.
Extension area 1135 can be by being fixed on by gluing or physical method on the second support membrane 133.
Further, supporting layer 130 further includes the keel being set between the first support membrane 131 and the second support membrane 133
135.In general, the height perpendicular to the direction of the first support membrane 131 of keel 135 is 0.1mm to 1mm.Certainly, keel
135 height can also be according to the width row adjustment again of bent area 1133.
Keel 135 can be the materials such as silica gel.Keel 135 can have certain elasticity and hardness.Keel 135 has
There is certain degree of hardness to be deformed to avoid the flexible screen body.Keel 135 has certain elasticity to avoid the flexible screen
Body by local stress due to being damaged.
In the present embodiment, the bent area 1133 that keel 135 avoids flexible screen body is arranged.Certainly in other embodiment
In, the surface of one end of the bent area 1133 of the close flexible screen body of keel 135 is bent with the bent area 1133 of flexible screen body
Shape matching afterwards, so that the table on the surface and keel 135 of 135 side of close keel of the bent area 1133 of flexible screen body
Face fits, and then has certain supporting role to the bent area of flexible

screen body 1133, and is unlikely to deform damage.
Certainly, in a further embodiment, can also by increasing the first support membrane 131 and 133 thickness of the second support membrane,
Or increase other support constructions, to ensure the distance between viewing area 111 and extension area 1135.
One embodiment of the invention also provides a kind of display device, including display panel 100.Certainly, display device further includes
The other components such as shell.The present invention has no improvement to other component parts in addition to display panel 100 of display device, adopts
With the conventional techniques of this field.
Above-mentioned display device, including display panel provided by the invention, the non-display area of flexible screen body includes being set to display
Transition region is bent between area and bent area, the initial crooked place of flexible screen body is bent area and bends the position of transition region linking
It sets, i.e. the adjacent position in the initial crooked place deviation viewing area of flexible screen body and non-display area, flexible screen body has been effectively relieved
Bending initial position caused by the structure difference of its two side areas the phenomenon that stress concentration, realize to the curved of flexible screen body
Roll over the protection of initial position.
Above-mentioned display panel, the non-display area of flexible screen body include being set to bend transition region between viewing area and bent area,
The initial crooked place of flexible screen body is the position of bent area and bending transition region linking, the i.e. initial crooked place of flexible screen body
Deviate viewing area and the adjacent position of non-display area, the bending initial position of flexible screen body has been effectively relieved because of its two side areas

Caused by structure difference the phenomenon that stress concentration, the protection of the bending initial position to flexible screen body is realized.

Each technical characteristic of embodiment described above can be combined arbitrarily, to keep description succinct, not to above-mentioned reality

It applies all possible combination of each technical characteristic in example to be all described, as long as however, the combination of these technical characteristics is not deposited

In contradiction, it is all considered to be the range of this specification record.

Several embodiments of the invention above described embodiment only expresses, the description thereof is more specific and detailed, but simultaneously

It cannot therefore be construed as limiting the scope of the patent.It should be pointed out that coming for those of ordinary skill in the art

It says, without departing from the inventive concept of the premise, various modifications and improvements can be made, these belong to the protection of the present invention

Range.Therefore, the protection domain of patent of the present invention should be determined by the appended claims.

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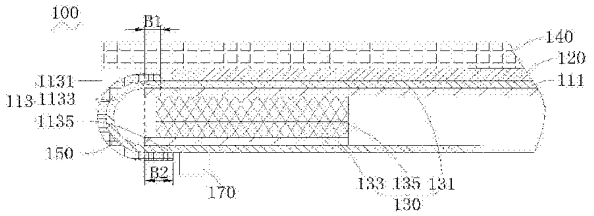
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(54)发明名称

显示面板及显示装置

(57)摘要

本发明涉及一种显示面板，包括：柔性屏体，包括显示区和非显示区；非显示区包括依次设置的弯折过渡区、弯折区和延伸区，所述延伸区与所述显示区不共面，且弯折过渡区与显示区共面；支撑层，所述支撑层的一侧支撑所述柔性屏体的显示区和弯折过渡区，所述支撑层的远离所述显示区的一侧支撑所述柔性屏体的延伸区；保护层，形成于柔性屏体的远离支撑层的表面，保护层完全覆盖弯折区，并至少部分覆盖弯折过渡区。上述显示面板，柔性屏体的初始弯折位置的两侧均为非显示区域，故有效缓解了柔性屏体的弯折起始位置因其两侧区域的结构不同而导致的应力集中的现象，实现对柔性屏体的弯折起始位置的保护。本发明还涉及一种显示装置。



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1.一种显示面板，其特征在于，包括：

柔性屏体，所述柔性屏体包括显示区和非显示区；所述非显示区包括依次设置的弯折过渡区、弯折区和延伸区，所述弯折过渡区连接所述弯折区与显示区，所述延伸区与所述显示区不共面，且所述弯折过渡区与所述显示区共面；

支撑层，所述支撑层的一侧支撑所述柔性屏体的显示区和弯折过渡区，所述支撑层的远离所述显示区的一侧支撑所述柔性屏体的延伸区；

保护层，形成于所述柔性屏体的远离所述支撑层的表面，所述保护层完全覆盖所述弯折区，并至少部分覆盖所述弯折过渡区。

2.根据权利要求1所述的显示面板，其特征在于，所述弯折过渡区以及弯折区内的金属走线上设有通孔；优选地，所述通孔呈圆形或菱形。

3.根据权利要求1所述的显示面板，其特征在于，所述柔性屏体的弯折过渡区和弯折区衔接的位置为所述柔性屏体的弯折初始位置，所述保护层的靠近所述显示区的侧边与所述柔性屏体的弯折初始位置之间的距离大于0.5mm。

4.根据权利要求3所述的显示面板，其特征在于，所述保护层完全覆盖所述弯折过渡区。

5.根据权利要求4所述的显示面板，其特征在于，所述保护层为UV胶层。

6.根据权利要求5所述的显示面板，其特征在于，所述保护层的厚度为0.05mm至0.2mm。

7.根据权利要求6所述的显示面板，其特征在于，所述弯折过渡区的宽度为0mm至2mm。

8.根据权利要求7所述的显示面板，其特征在于，还包括设于所述延伸区的驱动单元。

9.根据权利要求8所述的显示面板，其特征在于，所述支撑层包括设于所述柔性屏体的显示区和弯折过渡区背面的第一支撑膜、以及设于所述延伸区的靠近所述显示区的一侧表面的第二支撑膜。

10.根据权利要求9所述的显示面板，其特征在于，所述支撑层还包括设于所述第一支撑膜和所述第二支撑膜之间的垫高块。

11.一种显示装置，其特征在于，包括权利要求1至10任一项所述的显示面板。

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显示面板及显示装置

技术领域

[0001] 本发明涉及显示领域，特别是涉及一种显示面板及一种显示装置。

背景技术

[0002] 随着信息技术的发展，手机等显示装置已经成为人们生活中不可或缺的工具，而“全面屏”也成为越来越多用户的追求。业界宣称的全面屏显示装置只是超高屏占比的显示装置。为了使柔性屏体达到全面屏显示效果，通常采用非显示区弯折的办法实现，即：将柔性屏体的非显示区弯折到柔性屏体的背面从而缩小屏体边框宽度，进而提高屏占比。

[0003] 然而，柔性屏体非显示区在弯折时，柔性屏体的初始弯折位置容易产生应力集中的现象，严重的，可能产生折痕，进而导致该位置处的屏体或电缆损伤失效。

发明内容

[0004] 基于此，有必要提供一种可以有效缓解柔性屏体的初始弯折位置的应力集中现象的显示面板。

[0005] 一种显示面板，包括：

[0006] 柔性屏体，所述柔性屏体包括显示区和非显示区；所述非显示区包括依次设置的弯折过渡区、弯折区和延伸区，所述弯折过渡区连接所述弯折区与显示区，所述延伸区与所述显示区不共面，且所述弯折过渡区与所述显示区共面；

[0007] 支撑层，所述支撑层的一侧支撑所述柔性屏体的显示区和弯折过渡区，所述支撑层的远离所述显示区的一侧支撑所述柔性屏体的延伸区；

[0008] 保护层，形成于所述柔性屏体的远离所述支撑层的表面，所述保护层完全覆盖所述弯折区，并至少部分覆盖所述弯折过渡区。

[0009] 上述显示面板，柔性屏体的非显示区包括设于显示区和弯折区之间弯折过渡区，柔性屏体的初始弯折位置为弯折区和弯折过渡区衔接的位置，即柔性屏体的初始弯折位置偏离显示区和非显示区相邻的位置，初始弯折位置的两侧均为非显示区域，故有效缓解了柔性屏体的弯折起始位置因其两侧区域的结构不同而导致的应力集中的现象，实现对柔性屏体的弯折起始位置的保护。

[0010] 在其中一个实施例中，所述弯折过渡区以及弯折区内的金属走线上设有圆形或其它形状的孔。

[0011] 在其中一个实施例中，所述柔性屏体的弯折过渡区和弯折区衔接的位置为所述柔性屏体的弯折初始位置，所述保护层的靠近所述显示区的侧边与所述柔性屏体的弯折初始位置之间的距离大于0.5mm。

[0012] 在其中一个实施例中，所述保护层完全覆盖所述弯折过渡区。

[0013] 在其中一个实施例中，所述保护层为UV胶层。

[0014] 在其中一个实施例中，所述保护层的厚度为0.05mm至0.2mm。

[0015] 在其中一个实施例中，所述弯折过渡区的宽度为0mm至2mm。

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[0016] 在其中一个实施例中，还包括设于所述延伸区的驱动单元。

[0017] 在其中一个实施例中，所述支撑层包括设于所述柔性屏体的显示区和弯折过渡区背面的第一支撑膜、以及设于所述延伸区的靠近所述显示区的一侧表面的第二支撑膜。

[0018] 在其中一个实施例中，所述支撑层还包括设于所述第一支撑膜和所述第二支撑膜之间的垫高块。

[0019] 本发明还提供一种显示装置。

[0020] 一种显示装置，包括本发明提供的显示面板。

[0021] 上述显示装置，包含本发明提供的显示面板，柔性屏体的非显示区包括设于显示区和弯折区之间弯折过渡区，柔性屏体的初始弯折位置为弯折区和弯折过渡区衔接的位置，即柔性屏体的初始弯折位置偏离显示区和非显示区相邻的位置，初始弯折位置的两侧均为非显示区域，故有效缓解了柔性屏体的弯折起始位置因其两侧区域的结构不同而导致的应力集中的现象，实现对柔性屏体的弯折起始位置的保护。

附图说明

[0022] 图1为本发明一实施例提供的显示面板的截面示意图。

具体实施方式

[0023] 为了使本发明的目的、技术方案及优点更加清楚明白，以下结合附图及实施例，对本发明进行进一步详细说明。应当理解，此处所描述的具体实施例仅仅用以解释本发明，并不用于限定本发明。

[0024] 需要说明的是，当元件被称为“设置于”另一个元件，它可以直接在另一个元件上或者也可以存在居中的元件。当一个元件被认为是“连接”另一个元件，它可以是直接连接到另一个元件或者可能同时存在居中元件。当一个元件被认为是与另一个元件“抵接”，它可以是直接与另一个元件抵接或者可能同时存在居中元件。本文所使用的术语“垂直的”、“水平的”、“左”、“右”以及类似的表述只是为了说明的目的，并不表示是唯一的实施方式。

[0025] 除非另有定义，本文所使用的所有的技术和科学术语与属于本发明的技术领域的技术人员通常理解的含义相同。本文中在本发明的说明书中所使用的术语只是为了描述具体的实施例的目的，不是旨在于限制本发明。本文所使用的术语“及/或”包括一个或多个相关的所列项目的任意的和所有的组合。

[0026] 如图1所示，本发明一实施例提供的显示面板100，其包括柔性屏体、支撑层130、以及保护层150。

[0027] 具体地，柔性屏体包括显示区111和非显示区113。非显示区113包括依次设置的弯折过渡区1131、弯折区1133和延伸区1135。其中弯折过渡区1131连接弯折区1133与显示区111，延伸区1135与显示区111不共面，且弯折过渡区1131与显示区111共面。换言之，延伸区1135位于弯折区1133的远离显示区111的一侧，显示区111、弯折过渡区1131、弯折区1133和延伸区1135依次设置。

[0028] 一般地，柔性屏体包括柔性基板，柔性基板上可分为显示区域以及自显示区域延伸的非显示区域。

[0029] 具体地，柔性基板的显示区域上可集成显示层。显示层可以包括多个用于显示图

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像的显示部件，从而使柔性基板的显示区域形成柔性屏体的显示区111，显示层上可以包括诸如薄膜晶体管、栅线、数据线、电容、阳极、阴极、有机发光层、彩色滤光膜等不同的显示部件。显示层之上还可以设置偏光片120，以增加显示层的透光，以及减小外光反射。偏光片120上还设置有用于保护柔性屏体的柔性盖板140。

[0030] 柔性基板的非显示区域上设置有用于实现信号传输、驱动图像显示等功能的集成电路，从而形成柔性屏体的非显示区113。

[0031] 在对柔性屏体进行弯折时，只对柔性屏体的非显示区113进行弯折，而设置在显示层之上的偏光片、触摸敏感层、柔性盖板等则不需要进行弯折。

[0032] 需要说明的是，本申请对柔性屏体的显示区111、非显示区113本身的结构并没有改进，采用本领域常用的结构即可。而弯折过渡区1131作为非显示区113的一部分，与相邻的弯折区1133的结构采用相同的设计。

[0033] 本实施例中，，柔性屏体的弯折区1133内的金属走线上通孔，以缓解柔性屏体的弯折区1133弯折时产生的弯折应力。优选地，通孔呈圆形或菱形等。更优选地，柔性屏体的非显示区113内的金属走线均采用相同的形状。另外的，柔性屏体的弯折区1133内的金属走线的走向也可以是直线或曲线。

[0034] 可以认为弯折过渡区1131和弯折区1133共同构成设计弯折区，而弯折区1133为非显示区113弯折时的实际弯折区，即弯折过渡区1131不弯折。

[0035] 一般地，弯折后的弯折区1133呈弧勾状。优选地，弯折区1133弯折后的弯折角度为180度，即使得延伸区1135与显示区111平行，从而在弯折区1133弯折后，能够更好的支撑固定柔性屏体的延伸区1135，同时也便于工艺实现。另外还有效的较少了柔性屏体占用的空间。

[0036] 支撑层130的一侧支撑柔性屏体的显示区111和弯折过渡区1131，支撑层130的远离显示区111的一侧支撑柔性屏体的延伸区1135。换言之，柔性屏体的显示区111和弯折过渡区1131设于支撑层130的同一侧，柔性屏体的延伸区1135设于支撑层130的远离显示区111的另一侧。

[0037] 支撑层130主要用以固定支撑柔性屏体，以防止柔性屏体的弯折区1133由于弯曲程度过大而折断。支撑层130可以包括多层结构。进一步地，支撑层130可以为兼具硬度和弹性的材料。支撑层130既可以对柔性屏体起到支撑的作用，也可以起到对柔性屏体起到减振的功能。

[0038] 保护层150形成于柔性屏体的远离支撑层130的表面。保护层150完全覆盖弯折区1133，并至少部分覆盖弯折过渡区1131。

[0039] 柔性屏体的非显示区113包括设于显示区111和弯折区1133之间弯折过渡区1131，柔性屏体的初始弯折位置为弯折区1133和弯折过渡区1131衔接的位置，即柔性屏体的初始弯折位置偏离显示区和非显示区相邻的位置，初始弯折位置的两侧均为非显示区域，故有效缓解了柔性屏体的弯折起始位置因其两侧区域的结构不同而导致的应力集中的现象，实现对柔性屏体的弯折起始位置的保护。

[0040] 另外，弯折区1133与显示区111不直接相邻，有效减小了弯折区1133弯折时作用在显示区111上的应力。

[0041] 本实施例中，保护层150的靠近显示区111的侧边与柔性屏体的弯折初始位置之间

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的距离B1大于0.5mm，从而保护层150能够同时从柔性屏体的初始弯折位置的靠近显示区111的一侧更好地缓解柔性屏体的初始弯折位置的弯折应力。

[0042] 可以理解的是，为了更好的缓解柔性屏体的末端弯折位置的弯折应力，保护层150的靠近延伸区1135的侧边与末端弯折位置之间的距离B2也大于0.5mm，甚至保护层150可以完全覆盖延伸区1135。

[0043] 本实施例中，保护层150完全覆盖弯折过渡区1131。当然，在另外的实施例中，保护层150还可以部分覆盖弯折过渡区1131。如此，保护层150可以在不遮挡显示区111的情况下，缓解柔性屏体的初始弯折位置的弯折应力。

[0044] 当然，在另外的实施例中，柔性屏体的显示区111的边框也存在不显示区域。在此种情况下，保护层150还可以覆盖部分显示区111，即覆盖显示区111的不显示的至少部分区域，从而更好的保护柔性屏体的显示区111和非显示区113相邻的位置。

[0045] 本实施例中，保护层150为UV胶层。当然，在另外的实施例中，保护层150不限于UV胶，还可以是热固化胶，或其它种类的光固化胶。

[0046] 进一步地，本实施例中，保护层150的厚度为0.05mm至0.2mm，以满足常用的柔性屏体的弯折区的保护。本领域的技术人员可以根据柔性屏体的大小、种类、弯折区的弯折半径及保护层150缓解应力的能力选择合适的保护层150的厚度。

[0047] 当然，当保护层150为UV胶之外的其他材料制成时，本领域的技术人员还可根据保护层150的柔韧性具体确定其厚度。

[0048] 一般的，柔性屏体的设计弯折区的宽度为0mm至2mm。优选地，弯折过渡区1131的宽度为0至2mm，在使得柔性屏体的初始弯折位置偏离显示区111和非显示区113相邻的位置的同时，还能使相应的显示装置获得较高的屏占比。当然，弯折过渡区1131的宽度小于柔性屏体的设计弯折区的宽度。

[0049] 本实施例中，显示面板100还包括设于延伸区1135的驱动单元170。具体地，本实施例中，驱动单元设于延伸区1135的远离支撑层130的表面。即在本实施例中，柔性屏体采用COP(Chip On Pi，薄膜上芯片)封装技术。当然，根据设计需要，在另外的实施例中，柔性屏体的延伸区上还可以不设有驱动单元170。

[0050] 另外地，在其它的实施例中，还可以在柔性屏体的延伸区行设有柔性电路板。

[0051] 本实施例中，支撑层130包括设于柔性屏体的显示区111和弯折过渡区1131背面的第一支撑膜131、以及设于延伸区1135的靠近显示区111的一侧表面的第二支撑膜133。

[0052] 可以理解的是，为了防止第一支撑膜131和第二支撑膜133影响柔性屏体的弯折区1133的弯折，须确保弯折区1133弯折前和弯折后，第一支撑膜131和第二支撑膜133均避开弯折区1133。

[0053] 优选地，为了更好的支撑柔性屏体的显示区111和弯折过渡区1131，第一支撑膜131的边缘与弯折后的柔性屏体的初始弯折位置重合。同样的，为了更好的支撑柔性屏体的延伸区1135，第二支撑膜133的边缘与弯折后的柔性屏体的末端弯折位置重合。

[0054] 优选地，本实施例中，第一支撑膜131和第二支撑膜133均为具有支撑作用的PET(Polyethylene Terephthalate，聚对苯二甲酸乙二醇酯)膜。优选地，第一支撑膜131和第二支撑膜133的厚度为0至0.2mm。

[0055] 延伸区1135可以通过通过胶粘或者物理方法固定于第二支撑膜133上。

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[0056] 进一步地，支撑层130还包括设于第一支撑膜131和第二支撑膜133之间的垫高块135。一般的，垫高块135的垂直于第一支撑膜131的方向的高度为0.1mm至1mm。当然，垫高块135的高度还可以根据弯折区1133的宽度再行调整。

[0057] 垫高块135可以为硅胶等材料。垫高块135可以具有一定弹性和硬度。垫高块135具有一定硬度以避免所述柔性屏体被挤压变形。垫高块135具有一定弹性以避免所述柔性屏体由于受到局部应力而损坏。

[0058] 本实施例中，垫高块135避开柔性屏体的弯折区1133设置。当然在另外的实施例中，垫高块135的靠近柔性屏体的弯折区1133的一端的表面与柔性屏体的弯折区1133弯折后的形状匹配，以使柔性屏体的弯折区1133的靠近垫高块135一侧的表面与垫高块135的表面相贴合，进而对柔性屏体的弯折区1133具有一定的支撑作用，且不易变形损坏。

[0059] 当然，在另外的实施例中，还可以通过增加第一支撑膜131和第二支撑膜133厚度，或增加其他支撑结构，以确保显示区111和延伸区1135之间的距离。

[0060] 本发明一实施例还提供一种显示装置，包括显示面板100。当然，显示装置还包括壳体等其他组成部分。本发明对显示装置的除显示面板100外的其它组成部分并无改进，采用本领域的惯用技术手段即可。

[0061] 上述显示装置，包含本发明提供的显示面板，柔性屏体的非显示区包括设于显示区和弯折区之间弯折过渡区，柔性屏体的初始弯折位置为弯折区和弯折过渡区衔接的位置，即柔性屏体的初始弯折位置偏离显示区和非显示区相邻的位置，有效缓解了柔性屏体的弯折起始位置因其两侧区域的结构不同而导致的应力集中的现象，实现对柔性屏体的弯折起始位置的保护。

[0062] 上述显示面板，柔性屏体的非显示区包括设于显示区和弯折区之间弯折过渡区，柔性屏体的初始弯折位置为弯折区和弯折过渡区衔接的位置，即柔性屏体的初始弯折位置偏离显示区和非显示区相邻的位置，有效缓解了柔性屏体的弯折起始位置因其两侧区域的结构不同而导致的应力集中的现象，实现对柔性屏体的弯折起始位置的保护。

[0063] 以上所述实施例的各技术特征可以进行任意的组合，为使描述简洁，未对上述实施例中的各个技术特征所有可能的组合都进行描述，然而，只要这些技术特征的组合不存在矛盾，都应当认为是本说明书记载的范围。

[0064] 以上所述实施例仅表达了本发明的几种实施方式，其描述较为具体和详细，但并不能因此而理解为对发明专利范围的限制。应当指出的是，对于本领域的普通技术人员来说，在不脱离本发明构思的前提下，还可以做出若干变形和改进，这些都属于本发明的保护范围。因此，本发明专利的保护范围应以所附权利要求为准。

Petitioner Samsung Ex-1004, 0149

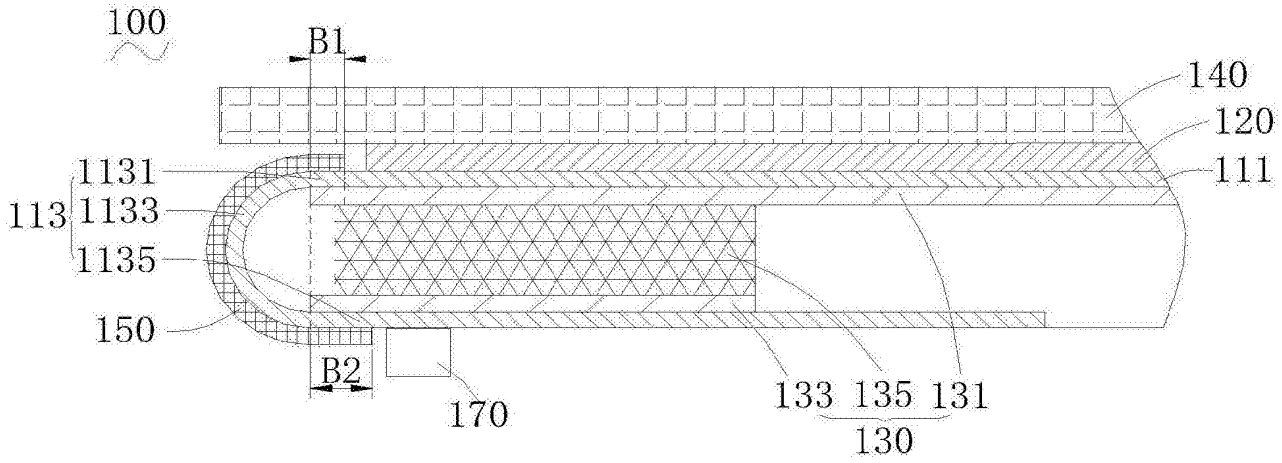


图1

Petitioner Samsung Ex-1004, 0150

Abstract of CN108877519 (A)
The invention discloses a kind of display devices, technical solution of the present invention passes through the bending characteristic of the corresponding a part of non-display area in bent area, bent area is bent towards first surface, the non-bent area of corresponding another part non-display area is fixed by compound adhesive tape, it is multiplexed the first functional layer and extends to the part of gap area as support member, for buffering bending stress, the bending amplitude of the bent area is controlled by the first functional layer of compound adhesive tape, without specific support member, the process for making of compound adhesive tape is simple, low manufacture cost.

Description

A kind of display device

Technical field

The present invention relates to technical field of electronic equipment, more specifically, being related to a kind of display device.

Background technique

With the continuous development of science and technology, more and more electronic equipments having a display function are widely used in
In daily life and work, huge convenience is brought for daily life and work, becomes current
The indispensable important tool of people.
Electronic equipment realizes that the main component of display function is display panel.The border width of display panel is reduced, is realized
The main trend that narrow frame, even realization Rimless are display panel.Reduce a kind of mode of the border width of display panel
It is that the bending of at least partly non-display area is fixed on to the

back side of flexible display panels using flexible display panels.
In existing flexible display panels, when fixing overleaf non-display area bending, specific support member is needed, is propped up
The process for making of support part part is complicated, and cost of manufacture is higher.

Summary of the invention
To solve the above-mentioned problems, in the display device that technical solution of the present invention provides, it is multiplexed the first function of compound adhesive tape
Ergosphere is as support member, and the process for making of compound adhesive tape is simple, low manufacture cost.
To achieve the goals above, the present invention provides following technical solutions:
A kind of display device, the display device include:
Flexible display panels, the flexible display panels include viewing area and non-display area, and the non-display area is divided into
Bent area and non-bent area, the bent area is between the non-bent area and the viewing area;The flexible display panels
With opposite first surface and second surface, the second surface is display surface;
First protective layer of the first surface is set, and first protective layer includes:Cover the of the viewing area
A part of protective layer and the second part protective layer of the covering non-bent area;First part's protective layer and described second
There is the gap area for exposing the bent area between partial protection layer;
Compound adhesive tape, the compound adhesive tape include the first functional layer and the second functional layer of stacking, first function
Layer is between the first surface and second functional layer;First functional layer attaches fixed first part's protection
The surface of layer, and extend to the gap area;Second functional layer is

located at least in the viewing area;
When the bent area is bent towards the compound adhesive tape, the non-bent area is fixed on the second functional layer table
Face, the part that first functional layer extends to the gap area are used to control the bending amplitude of the bent area.
Preferably, in above-mentioned display device, first functional layer includes:
First sublayer, first sublayer attach the surface of fixed first part's protective layer, and extend to it is described between
Gap region;
Second sublayer, second sublayer is fixedly attached to first sub-layer surface, and is located at the viewing area;
Third sublayer, the third sublayer is fixedly attached to second sub-layer surface, and is located at the viewing area;
Wherein, one of second sublayer and the third sublayer are the shielded layer for electromagnetic shielding, another one
For the even thermosphere for being distributed even heat.
Preferably, in above-mentioned display device, first sublayer is foamed cotton layer;
The shielded layer is layers of copper;
The even thermosphere is graphite linings.
Preferably, in above-mentioned display device, the part that first functional layer extends to the gap area passes through glue
Layer is fixedly attached to the gap area surface.
Preferably, in above-mentioned display device, first functional layer extends to the part covering of the gap area
The gap area of 20%-80%.
Preferably, in above-mentioned display device, second functional layer includes:Supporting layer, the supporting layer is described in
The surface of first functional layer is adhesively fixed by the first glue-line and first functional layer, and the supporting layer deviates from first function
The surface of ergosphere has the second glue-line, for the second part

protective layer to be adhesively fixed.
Preferably, in above-mentioned display device, the supporting layer is any in plastic plate, ceramic wafer and glass plate
Kind.
Preferably, in above-mentioned display device, further include:
In the second protective layer of the second surface, second protective layer is fixedly attached to the viewing area.
Preferably, in above-mentioned display device, second protective layer includes:
Polaroid and/or touch control electrode.
Preferably, in above-mentioned display device, the viewing area has array of display;
The non-display area has the display driver circuit connecting with the array of display and connects with the driving circuit
The FPC connect, the FPC with circuit main board for connecting.
As can be seen from the above description, in the display device that technical solution of the present invention provides, corresponding one by bent area
The bending characteristic for dividing non-display area bends bent area towards first surface, and it is non-aobvious to correspond to another part by compound adhesive tape
Show that the non-bent area in area is fixed, the first functional layer of multiplexing extends to the part of gap area as support member, is used for loop
Transverse stress controls the bending amplitude of the bent area by the first functional layer of compound adhesive tape, is not necessarily to specific support member, multiple
The process for making for closing adhesive tape is simple, low manufacture cost.

Detailed description of the invention
In order to more clearly explain the embodiment of the invention or the

technical proposal in the existing technology, to embodiment or will show below

There is attached drawing needed in technical description to be briefly described, it should be apparent that, the accompanying drawings in the following description is only this

The embodiment of invention for those of ordinary skill in the art without creative efforts, can also basis

The attached drawing of offer obtains other attached drawings.

Fig. 1 is a kind of narrow frame design schematic illustration of flexible display panels;

Fig. 2 is the schematic illustration that flexible display panels shown in Fig. 1 are bent contraposition under the conditions of no support member;

Fig. 3 is the principle signal that flexible display panels shown in Fig. 1 are formed by bending bit errors under the conditions of no support member Figure;

Fig. 4 is structural schematic diagram when a kind of display device provided in an embodiment of the present invention is not bent;

Fig. 5 is the structural schematic diagram after display device shown in Fig. 4 is bent;

Fig. 6 is a kind of hierarchical structure schematic diagram of display device provided in an embodiment of the present invention.

Specific embodiment

Following will be combined with the drawings in the embodiments of the present invention, and technical solution in the embodiment of the present invention carries out clear, complete

Site preparation description, it is clear that described embodiments are only a part of the embodiments of the present invention, instead of all the embodiments.It is based on

Embodiment in the present invention, it is obtained by those of ordinary skill in the art without making creative efforts every other

Embodiment shall fall within the protection scope of the present invention.

As stated in the background art, the back of flexible display panels can be fixed on by bending at least partly non-display area
Face reduces border width, realizes narrow frame, the even design of realization Rimless.And the thickness of flexible display panels is generally relatively thin,
To adapt to the lightening design of electronic equipment, therefore is realized using above-mentioned bending mode and reduce display floater frame width purpose, meeting
Cause the bending amplitude of flexible display panels larger.
With reference to Fig. 1, Fig. 1 is a kind of narrow frame design schematic illustration of flexible display panels, in order to avoid Flexible Displays
Local pressure is concentrated when panel is bent, as shown in Figure 1, the support member 16 using specific structure is needed, to support Flexible Displays
The bent area 121 of panel 12 buffers folding s tress, open circuit occurs to avoid route at bent area 121.
The non-display area of flexible display panels 12 includes bent area and non-bent area, and bent area 121 is shown towards flexibility
Non- bent area, can be folded to the back side of flexible display panels 12 by the back side bending for showing panel 12.Flexible display panels 12
The back side is located at the opposite surface of its display surface, and the back side is provided with lower protective layer 13, and lower protective layer 13 divides for 131 He of first part
Second part 132, the corresponding viewing area setting of first part 131, the corresponding non-bent area of second part 132 is arranged, between two parts
With gap area, for exposing bent area 121.The surface of the first part 131 of lower protective layer 13 is provided with functional layer 14.Branch
Support part part 16 is fixed by glue-line 15 and functional layer 14.Support member 16 has glue-line 17 away from the side of glue-line 15, for gluing
The non-bent area of non-display area after fold is carried out position and fixed by the second part 132 for tying fixed lower protective layer 13.Flexibility is aobvious

Show that 12 display surface of panel has up-protective layer 11, up-protective layer 11 is located at the viewing area of display surface, and the non-display area of display surface covers
It is stamped glue-line 18, for the backboard of display device and bend fixing to be adhesively fixed.The back side of non-bent area has flexible circuitry
Plate FPC, for being electrically connected flexible display panels with circuit main board.
When carrying out non-display area to bend fixed, need to apply pressure to display device by equipment 19, so that bending
Area is bent, and then non-bent area is folded to the reverse side of flexible display panels 12, in order to carry out non-bent area
Position is fixed.In the process of bending, non-bent area is folded to the back of flexible display panels 12 by a component F by non-bent area
Face side.
In order to avoid bent area stress raisers, needs to be arranged support member 16 and bent area contact surface is with spy
Determine the smooth surface of curvature, structure is complicated for support member 16, and the process for making that will lead to support member 16 in this way is complicated,
Cost of manufacture is higher, and then increases the cost of manufacture and technology difficulty of display device.
Referring to figs. 2 and 3, Fig. 2 is the principle that flexible display panels shown in Fig. 1 are bent contraposition under the conditions of no support member
Schematic diagram, Fig. 3 are the principle signal that flexible display panels shown in Fig. 1 are formed by bending bit errors under the conditions of no support member
Figure.
As shown in Fig. 2, two parts up and down if not using support member, in entire bending process, after fold
It is required to the position upper limit face for keeping intersecting with dotted line in Fig. 2, with exactitude position, guarantees after being fixed

by glue-line fitting, turns over
Upper limit two parts position exactitude position after folding.
But flexible display panels are bent bit errors easy to form under the conditions of no support member, inventor is by grinding
Study carefully, it was found that flexible display panels are formed by bending the principle of bit errors under the conditions of no support member.It is specific referring to FIG. 3,
Inventor discovery due to without support member cross-brace effect, due to bending control power mode exist separation F, will lead to compared with
Big bit errors □ x, and then stress is caused to concentrate on the bent area position adjacent with viewing area (in Fig. 3 shown in dashed circle
Region) so that the route of the position damages.
As can be seen from the above description, in conventional narrow frame design scheme, if using support member, due to support member
Structure is special, and complex manufacturing technology cost of manufacture is high, will lead to the complex manufacturing technology of display device, and cost of manufacture is high.And such as
Fruit does not use support member, will increase alignment process difficulty, and problem of stress concentration can occur during bending, and then causes to deposit
Route at the position of problem of stress concentration is damaged.
To solve the above-mentioned problems, it in display device provided in an embodiment of the present invention, is set at the back side of flexible display panels
Compound adhesive tape is set, compound adhesive tape passes through the first function of compound adhesive tape for the non-bent area after fold to be adhesively fixed
Ergosphere extends to the part of gap area as support member, for buffering bending stress, passes through the first function of compound adhesive tape
Layer controls the bending amplitude of the bent area, is not necessarily to specific support member, and the process for making of compound

adhesive tape is simple, production
It is at low cost.
In order to make the foregoing objectives, features and advantages of the present invention clearer and more comprehensible, with reference to the accompanying drawing and specific real
Applying mode, the present invention is described in further detail.
With reference to Fig. 4 and Fig. 5, Fig. 4 is that structure when a kind of display device provided in an embodiment of the present invention is not bent is shown
It is intended to, Fig. 5 is the structural schematic diagram after display device shown in Fig. 4 is bent, and display device described in the embodiment of the present invention includes:
Flexible display panels 22, the flexible display panels 22 include viewing area 222 and non-display area, and the non-display area is divided into curved
Folding area 221 and non-bent area 223, the bent area 221 is between the non-bent area 223 and the viewing area 222;It is described
Flexible display panels 22 have opposite first surface and second surface, and the second surface is display surface.
The display device further includes the first protective layer 23 that the first surface is arranged in, and first protective layer 23 wraps
It includes:Cover first part's protective layer 231 of the viewing area 222 and the second part protection of the covering non-bent area 223
Layer 232;Have between first part's protective layer 231 and the second part protective layer 232 and exposes the bent area 221
Gap area.First protective layer 23 does not cover the bent area 221, avoids when bent area is bent, the first protection
Warpage or stripping problem occur for layer 23 and the first surface of flexible display panels 22.
The display device further includes compound adhesive tape, and the compound adhesive tape includes the first functional layer 24 and second of stacking
Functional layer 20, first functional layer 24 is between the first surface and

second functional layer 20.
First functional layer 24 attaches the surface of fixed first part's protective layer 231, and extends to the gap
Region.The part that first functional layer 24 extends to the gap area passes through the bent area of flexible dielectric layer 30 and face
221 fittings are fixed.The flexible dielectric layer 30 can be flexible glue-line, bend deformation in order to bend region 222.
Second functional layer 20 is located at least in the viewing area 222, i.e., described second functional layer 20 can be fully located at
The viewing area 222 can also partially be located at the viewing area.When 20 part of the second functional layer is located at the viewing area
When 222, another part can extend to bent area, and second functional layer of part 20 is less than the model of first functional layer 24
It encloses.
It is described when the bent area 221 is bent towards the compound adhesive tape in display device described in the embodiment of the present invention
Non- bent area 223 is fixed on 20 surface of the second functional layer, and first functional layer 24 extends to the portion of the gap area
Divide the bending amplitude for controlling the bent area 221.
It, can be to bent area 221 since first functional layer 24 extends to the supporting role of the gap area part
A support force is generated, the bending amplitude of bent area 221 can be regulated and controled, the stress that can eliminate bent area 221 is concentrated
Problem avoids route from damaging.Since the effect of first functional layer 24 is aligned convenient for position, is kept away by the support force that it applies
Exempt from the effect due to component F so that display device is folded to back portion excessive tensile to the left, thus reduce bit errors □ x,
Alignment method is easy to operate, and aligning accuracy is high.
As shown in Figure 4 and Figure 5, first functional layer 24 includes:First sublayer 241, first sublayer 241 attach solid

The surface of fixed first part's protective layer 231, and extend to the gap area;Second sublayer 242, second sublayer
242 are fixedly attached to 241 surface of the first sublayer, and are located at the viewing area 222;Third sublayer 243, the third sublayer
243 are fixedly attached to 242 surface of the second sublayer, and are located at the viewing area 222;Wherein, second sublayer 242 and institute
Stating one of third sublayer 243 is shielded layer for electromagnetic shielding, another one be for so that even heat distribution it is even Thermosphere.
First functional layer 24 controls the bending amplitude of the bent area 221 by first sublayer 241, passes through institute
It states one of the second sublayer 242 and described third sublayer 243 and realizes electromagnetic shielding, another one realizes being uniformly distributed for heat.
Second sublayer 242 is set and third sublayer 243 is fully located at viewing area 222.In this way can to avoid shielded layer and
Even thermosphere extends to bent area 221 and produces fracture or warpage issues, ensures effectiveness and even thermal effect.
Since the driving circuit and signal wire of flexible display panels 22 are arranged in non-display area, pass through bent area
221 bendings, after the back side that non-bent area 223 is folded to display device is fixed, the drive of extraneous electromagnetic signals and non-display area
Electromagnetic signal in dynamic circuit and signal wire, which can generate the pixel unit of viewing area 222, to be interfered, and technical scheme
In, the compound adhesive tape has electromagnetic shielding action, can be very good to avoid the problem.
In addition, flexible display panels 22 are generally OLED display panel at present, pixel unit is OLED device.OLED is aobvious
Show that panel has many advantages, such as that frivolous, shatter-proof, visual angle is wide, be not easy fever and luminous efficiency is high, and is easy to make flexible screen.Driving

When circuit and signal wire work, heat, local 222 back side of viewing area caused by the reasons such as uneven of radiating of heat can be generated
Heat be unevenly distributed problem, the OLED performance that will lead to different temperatures region in OLED display panel is inconsistent, influence diagram
As display effect.And in display device described in technical scheme, the compound adhesive tape has the function of even heat distribution,
The problem is overcome, ensure that image display effect.
Optionally, in technical solution described in the embodiment of the present invention, first sublayer 241 is foam.On the one hand, foam has
There is certain mechanical strength moderate, can be bent, and bending property is weak with flexible display panels 22, in this way, when bent area 221 is curved
Qu Shi can be used for applying certain support force for bent area 221, avoid its local stress integrated.On the other hand, foam has
Preferable heat-blocking action can be avoided temperature when driving circuit and signal wire work to the OLED device of viewing area 222
Heat affecting.Foam material directly can be fixed on gap area by glue-line 30, and fixed effect is stablized, and will not occur in bending
Stripping problem, and foam material has preferable toughness, and in bending, breakage problem will not occur.
Optionally, the shielded layer can be the non-gold of metal layer metal alloy layer or other conductive energy
Belong to material layer.Being preferable to provide the shielded layer is layers of copper.On the one hand, layers of copper has excellent electric conductivity, can be preferable
Realize electromagnetic shielding action, on the other hand, layers of copper has preferable heating conduction, the quick transmitting of heat may be implemented, by office
The heat transfer of portion's high-temperature area is to elsewhere, being uniformly distributed and radiate convenient for heat.
Optionally, the even thermosphere is graphite linings.Graphite linings can

make even heat be distributed, and amount of localized heat is avoided to concentrate
The problem of.
In the embodiment of the present invention, the part that first functional layer 24 extends to the gap area is attached by glue-line 30
It is fixed on the gap area surface.Specifically, first sublayer 241 extend to the part of gap area by glue-line 30 with
Flexible display panels 22 are fixed.
First functional layer 24 extends to the gap area of the part covering 20%-80% of the gap area.
Specifically, 40% or 50% gap area can be covered.If the area for covering the gap area is smaller, bending
When area 221 is bent, it will cause support force and bearing area smaller, cannot realize that control bending amplitude is answered with buffering well
The effect of power, if it is larger to cover the gap area area, when bent area 221 is bent, it will lead to support force and branch
It is larger to support area, it will increase bending difficulty, be not easy to bend.Digital scope is covered described in the embodiment of the present invention, may be implemented
Optimal bending effect.
In general, even thermosphere and shielded layer are relatively thin membrane structures in the first functional layer 24.It is required that compound adhesive
Band has certain height to match bending amplitude, and the part that display device is folded to the back side is fixed.In the embodiment of the present invention,
Second functional layer 20 includes:Supporting layer 26, the supporting layer 26 pass through first towards the surface of first functional layer 24
Glue-line 25 is adhesively fixed with first functional layer 24, and the supporting layer 26 has the away from the surface of first functional layer 24
Two glue-lines 27, for the second part protective layer 232 to be adhesively

fixed, so that the part that display device is folded to the back side be consolidated
It is fixed.The compound adhesive tape adjusts thickness by the supporting layer 26 and is consolidated with adapting to bending amplitude to the part after bending
It is fixed.Optionally, the supporting layer 26 is any one of plastic plate, ceramic wafer and glass plate.
Display device described in the embodiment of the present invention further includes the second protective layer 21 that the second surface is arranged in, and described
Two protective layers 21 are fixedly attached to the viewing area 222.The region that the second surface corresponds to non-display area is also covered with glue-line
28, for the backboard of bend fixing to be adhesively fixed.Optionally, second protective layer 21 includes:Polaroid and/or touch-control electricity
Pole.
The viewing area 222 has array of display.If above-mentioned flexible display panels 22 are oled panel, array of display is
OLED array.The non-display area has the display driver circuit connecting with the array of display and connects with the driving circuit
The flexible circuit board FPC, the flexible circuit board FPC connect with circuit main board for connecting.
With reference to Fig. 6, Fig. 6 is a kind of hierarchical structure schematic diagram of display device provided in an embodiment of the present invention, is shown shown in Fig. 6
In showing device, flexible display panels 22 from top to bottom successively include flexible base board, buffer layer, for making tft array driving electricity
Low temperature polycrystalline silicon, OLED array, plural layers encapsulated layer, glue-line and the water oxygen barrier layer on road.Plural layers encapsulated layer includes
The alternatively distributed organic material layer of multilayer and

inorganic material layer.
Flexible display panels 22 are adhesively fixed with the first protective layer 23 by glue-line 23 towards the side of flexible base board, and first
Protective layer 23 is by the fixed compound adhesive tape of grid gluing knot, and compound adhesive tape structure is identical as aforesaid way, and Fig. 6 illustrates only first
The layers of copper as shielded layer in functional layer, the graphite linings as even thermosphere and as the first sublayer foamed cotton layer, are not shown
Two functional layers.
The second protective layer 21 is adhesively fixed by glue-line 62 away from the other side of flexible base board in flexible display panels 22.Second
Protective layer 21 includes touch control layer and polaroid.Second protective layer is fixed with cover board away from 64 by glue-line 63.
In display device described in the embodiment of the present invention, pressure is applied by equipment 29 and makes flexible display panels generation curved
It is bent.Under the action of component F, so that the part for being folded to the back side is moved to the left, due to the effect of the first functional layer 24, Ke Yiwei
Bent area 221 applies support force, and buffers stress, to reduce bit errors □ x, improves aligning accuracy, route is avoided to damage.
The foregoing description of the disclosed embodiments enables those skilled in the art to implement or use the present invention.
Various modifications to these embodiments will be readily apparent to those skilled in the art, as defined herein
General Principle can be realized in other embodiments without departing from the spirit or scope of the present invention.Therefore, of the invention
It is not intended to be limited to the embodiments shown herein, and is to fit to and the principles and novel features disclosed herein phase one
The widest scope of cause.

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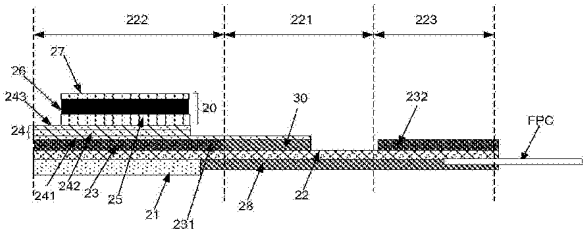
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(54)发明名称

一种显示装置

(57)摘要

本发明公开了一种显示装置，本发明技术方案通过弯折区对应的一部分非显示区的弯折特性，将弯折区朝向第一表面弯折，通过复合胶带将对应另一部分非显示区的非弯折区固定，复用第一功能层延伸至间隙区域的部分作为支撑部件，用于缓冲弯曲应力，通过复合胶带的第一功能层控制所述弯折区的弯曲幅度，无需特定的支撑部件，复合胶带的制作工艺方法简单，制作成本低。



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1.一种显示装置，其特征在于，所述显示装置包括：

柔性显示面板，所述柔性显示面板包括显示区以及非显示区，所述非显示区分为弯折区和非弯折区，所述弯折区位于所述非弯折区与所述显示区之间；所述柔性显示面板具有相对的第一表面以及第二表面，所述第二表面为显示表面；

设置在所述第一表面的第一保护层，所述第一保护层包括：覆盖所述显示区的第一部分保护层以及覆盖所述非弯折区的第二部分保护层；所述第一部分保护层与所述第二部分保护层之间具有露出所述弯折区的间隙区域；

复合胶带，所述复合胶带包括层叠的第一功能层以及第二功能层，所述第一功能层位于所述第一表面与所述第二功能层之间；所述第一功能层贴附固定所述第一部分保护层的表面，且延伸至所述间隙区域；所述第二功能层至少位于所述显示区；

当所述弯折区朝向所述复合胶带弯曲时，所述非弯折区固定在所述第二功能层表面，所述第一功能层延伸至所述间隙区域的部分用于控制所述弯折区的弯曲幅度。

2.根据权利要求1所述的显示装置，其特征在于，所述第一功能层包括：

第一子层，所述第一子层贴附固定所述第一部分保护层的表面，且延伸至所述间隙区域；

第二子层，所述第二子层贴附固定在所述第一子层表面，且位于所述显示区；

第三子层，所述第三子层贴附固定在所述第二子层表面，且位于所述显示区；

其中，所述第二子层与所述第三子层中的一者为用于电磁屏蔽的屏蔽层，另一者为用于使得热量均匀分布的匀热层。

3.根据权利要求2所述的显示装置，其特征在于，所述第一子层为泡棉层；

所述屏蔽层为铜层；

所述匀热层为石墨层。

4.根据权利要求1所述的显示装置，其特征在于，所述第一功能层延伸至所述间隙区域的部分通过胶层贴附固定在所述间隙区域表面。

5.根据权利要求1所述的显示装置，其特征在于，所述第一功能层延伸至所述间隙区域的部分覆盖20％-80％的所述间隙区域。

6.根据权利要求1所述的显示装置，其特征在于，所述第二功能层包括：支撑层，所述支撑层朝向所述第一功能层的表面通过第一胶层与所述第一功能层粘结固定，所述支撑层背离所述第一功能层的表面具有第二胶层，用于粘结固定所述第二部分保护层。

7.根据权利要求6所述的显示装置，其特征在于，所述支撑层为塑料板、陶瓷板以及玻璃板中的任一种。

8.根据权利要求1所述的显示装置，其特征在于，还包括：

在所述第二表面的第二保护层，所述第二保护层贴附固定在所述显示区。

9.根据权利要求8所述的显示装置，其特征在于，所述第二保护层包括：

偏光片和/或触控电极。

10.根据权利要求1所述的显示装置，其特征在于，所述显示区具有显示阵列；

所述非显示区具有与所述显示阵列连接的显示驱动电路以及与所述驱动电路连接的FPC，所述FPC用于与电路主板连接。

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一种显示装置

技术领域

[0001] 本发明涉及电子设备技术领域，更具体的说，涉及一种显示装置。

背景技术

[0002] 随着科学技术的不断发展，越来越多的具有显示功能的电子设备被广泛的应用于人们的日常生活以及工作当中，为人们的日常生活以及工作带来了巨大的便利，成为当今人们不可或缺的重要工具。

[0003] 电子设备实现显示功能的主要部件是显示面板。缩小显示面板的边框宽度，实现窄边框，甚至是实现无边框是显示面板的主要潮流。缩小显示面板的边框宽度的一种方式是采用柔性显示面板，将至少部分非显示区弯折固定在柔性显示面板的背面。

[0004] 现有柔性显示面板中，在将非显示区弯折固定在背面时，需要特定的支撑部件，支撑部件的制作工艺方法复杂，制作成本较高。

发明内容

[0005] 为了解决上述问题，本发明技术方案提供的显示装置中，复用复合胶带的第一功能层作为支撑部件，复合胶带的制作工艺方法简单，制作成本低。

[0006] 为了实现上述目的，本发明提供了如下技术方案：

[0007] 一种显示装置，所述显示装置包括：

[0008] 柔性显示面板，所述柔性显示面板包括显示区以及非显示区，所述非显示区分为弯折区和非弯折区，所述弯折区位于所述非弯折区与所述显示区之间；所述柔性显示面板具有相对的第一表面以及第二表面，所述第二表面为显示表面；

[0009] 设置在所述第一表面的第一保护层，所述第一保护层包括：覆盖所述显示区的第一部分保护层以及覆盖所述非弯折区的第二部分保护层；所述第一部分保护层与所述第二部分保护层之间具有露出所述弯折区的间隙区域；

[0010] 复合胶带，所述复合胶带包括层叠的第一功能层以及第二功能层，所述第一功能层位于所述第一表面与所述第二功能层之间；所述第一功能层贴附固定所述第一部分保护层的表面，且延伸至所述间隙区域；所述第二功能层至少位于所述显示区；

[0011] 当所述弯折区朝向所述复合胶带弯曲时，所述非弯折区固定在所述第二功能层表面，所述第一功能层延伸至所述间隙区域的部分用于控制所述弯折区的弯曲幅度。

[0012] 优选的，在上述显示装置中，所述第一功能层包括：

[0013] 第一子层，所述第一子层贴附固定所述第一部分保护层的表面，且延伸至所述间隙区域；

[0014] 第二子层，所述第二子层贴附固定在所述第一子层表面，且位于所述显示区；

[0015] 第三子层，所述第三子层贴附固定在所述第二子层表面，且位于所述显示区；

[0016] 其中，所述第二子层与所述第三子层中的一者为用于电磁屏蔽的屏蔽层，另一者为用于使得热量均匀分布的匀热层。

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[0017] 优选的，在上述显示装置中，所述第一子层为泡棉层；

[0018] 所述屏蔽层为铜层；

[0019] 所述匀热层为石墨层。

[0020] 优选的，在上述显示装置中，所述第一功能层延伸至所述间隙区域的部分通过胶层贴附固定在所述间隙区域表面。

[0021] 优选的，在上述显示装置中，所述第一功能层延伸至所述间隙区域的部分覆盖20％-80％的所述间隙区域。

[0022] 优选的，在上述显示装置中，所述第二功能层包括：支撑层，所述支撑层朝向所述第一功能层的表面通过第一胶层与所述第一功能层粘结固定，所述支撑层背离所述第一功能层的表面具有第二胶层，用于粘结固定所述第二部分保护层。

[0023] 优选的，在上述显示装置中，所述支撑层为塑料板、陶瓷板以及玻璃板中的任一种。

[0024] 优选的，在上述显示装置中，还包括：

[0025] 在所述第二表面的第二保护层，所述第二保护层贴附固定在所述显示区。

[0026] 优选的，在上述显示装置中，所述第二保护层包括：

[0027] 偏光片和/或触控电极。

[0028] 优选的，在上述显示装置中，所述显示区具有显示阵列；

[0029] 所述非显示区具有与所述显示阵列连接的显示驱动电路以及与所述驱动电路连接的FPC，所述FPC用于与电路主板连接。

[0030] 通过上述描述可知，本发明技术方案提供的显示装置中，通过弯折区对应的一部分非显示区的弯折特性，将弯折区朝向第一表面弯折，通过复合胶带将对应另一部分非显示区的非弯折区固定，复用第一功能层延伸至间隙区域的部分作为支撑部件，用于缓冲弯曲应力，通过复合胶带的第一功能层控制所述弯折区的弯曲幅度，无需特定的支撑部件，复合胶带的制作工艺方法简单，制作成本低。

附图说明

[0031] 为了更清楚地说明本发明实施例或现有技术中的技术方案，下面将对实施例或现有技术描述中所需要使用的附图作简单地介绍，显而易见地，下面描述中的附图仅仅是本发明的实施例，对于本领域普通技术人员来讲，在不付出创造性劳动的前提下，还可以根据提供的附图获得其他的附图。

[0032] 图1为一种柔性显示面板的窄边框设计原理示意图；

[0033] 图2为图1所示柔性显示面板在无支撑部件条件下弯曲对位的原理示意图；

[0034] 图3为图1所示柔性显示面板在无支撑部件条件下弯曲形成对位误差的原理示意图；

[0035] 图4为本发明实施例提供的一种显示装置未发生弯折时的结构示意图；

[0036] 图5为图4所示显示装置发生弯折后的结构示意图；

[0037] 图6为本发明实施例提供的一种显示装置的层次结构示意图。

具体实施方式

Petitioner Samsung Ex-1004, 0170

[0038] 下面将结合本发明实施例中的附图，对本发明实施例中的技术方案进行清楚、完整地描述，显然，所描述的实施例仅仅是本发明一部分实施例，而不是全部的实施例。基于本发明中的实施例，本领域普通技术人员在没有做出创造性劳动前提下所获得的所有其他实施例，都属于本发明保护的范围。

[0039] 如背景技术所述，可以通过将至少部分非显示区弯折固定在柔性显示面板的背面，缩小边框宽度，实现窄边框，甚至是实现无边框设计。而柔性显示面板的厚度一般较薄，以适应电子设备的轻薄化设计，故采用上述弯折方式实现缩小显示面板边框宽度目的，会导致柔性显示面板的弯折幅度较大。

[0040] 参考图1，图1为一种柔性显示面板的窄边框设计原理示意图，为了避免柔性显示面板弯折时局部受力集中，如图1所示，需要采用特定结构的支撑部件16，以支撑柔性显示面板12的弯折区121，缓冲弯折应力，以避免弯折区121处线路出现断路。

[0041] 柔性显示面板12的非显示区包括弯折区以及非弯折区，将弯折区121朝向柔性显示面板12的背面弯折，可以将非弯折区翻折到柔性显示面板12的背面。柔性显示面板12的背面位于其显示面相对的表面，其背面设置有下保护层13，下保护层13分为第一部分131和第二部分132，第一部分131对应显示区设置，第二部分132对应非弯折区设置，两部分之间具有间隙区域，用于露出弯折区121。下保护层13的第一部分131的表面设置有功能层14。支撑部件16通过胶层15与功能层14固定。支撑部件16背离胶层15的一侧具有胶层17，用于粘结固定下保护层13的第二部分132，将翻折后的非显示区的非弯折区进行位置固定。柔性显示面板12显示面具有上保护层11，上保护层11位于显示面的显示区，显示面的非显示区覆盖有胶层18，用于将显示装置与弯曲定型的背板粘结固定。非弯折区的背面具有柔性线路板FPC，用于将柔性显示面板与电路主板电连接。

[0042] 在将非显示区进行弯折固定时，需要通过设备19对显示装置施加压力，使得弯折区发生弯折，进而将非弯折区翻折到柔性显示面板12的背面一侧，以便于将非弯折区进行位置固定。在弯折过程中，非弯折区受到一分力F，将非弯折区翻折到柔性显示面板12的背面一侧。

[0043] 为了避免弯折区局部应力集中，需要设置支撑部件16与弯折区接触表面为具有特定曲率的光滑曲面，支撑部件16的结构复杂，这样会导致支撑部件16的制作工艺方法复杂，制作成本较高，进而增加显示装置的制作成本以及工艺难度。

[0044] 参考图2和图3，图2为图1所示柔性显示面板在无支撑部件条件下弯曲对位的原理示意图，图3为图1所示柔性显示面板在无支撑部件条件下弯曲形成对位误差的原理示意图。

[0045] 如图2所示，如果不采用支撑部件，那么在整个弯曲过程中，翻折后的上下两部分均需要保持与图2中虚线相交的位置上限正对，以精确对位，保证通过胶层贴合固定后，翻折后的上限两部分位置精确对位。

[0046] 但是柔性显示面板在无支撑部件条件下弯曲容易形成对位误差，发明人经过研究，发现了柔性显示面板在无支撑部件条件下弯曲形成对位误差的原理。具体请参考图3，发明人发现由于没有了支撑部件的横向支撑作用，由于弯折控力方式存在分离F，会导致较大的对位误差△x，进而导致应力集中在弯折区与显示区相邻的位置(图3中虚线圆圈所示区域)，使得该位置的线路损坏。

Petitioner Samsung Ex-1004, 0171

[0047] 通过上述描述可知，常规的窄边框设计方案中，如果采用支撑部件，由于支撑部件结构特殊，制作工艺复杂制作成本高，会导致显示装置的制作工艺复杂，制作成本高。而如果不采用支撑部件，会增大对位工艺难度，在弯曲过程中会发生应力集中问题，进而导致存在应力集中问题的位置处的线路发生损坏。

[0048] 为了解决上述问题，本发明实施例提供的显示装置中，在柔性显示面板的背面设置复合胶带，复合胶带用于对翻折后的非弯折区进行粘结固定，并通过复合胶带的第一功能层延伸至间隙区域的部分作为支撑部件，用于缓冲弯曲应力，通过复合胶带的第一功能层控制所述弯折区的弯曲幅度，无需特定的支撑部件，复合胶带的制作工艺方法简单，制作成本低。

[0049] 为使本发明的上述目的、特征和优点能够更加明显易懂，下面结合附图和具体实施方式对本发明作进一步详细的说明。

[0050] 参考图4和图5，图4为本发明实施例提供的一种显示装置未发生弯折时的结构示意图，图5为图4所示显示装置发生弯折后的结构示意图，本发明实施例所述显示装置包括：柔性显示面板22，所述柔性显示面板22包括显示区222以及非显示区，所述非显示区分为弯折区221和非弯折区223，所述弯折区221位于所述非弯折区223与所述显示区222之间；所述柔性显示面板22具有相对的第一表面以及第二表面，所述第二表面为显示表面。

[0051] 所述显示装置还包括设置在所述第一表面的第一保护层23，所述第一保护层23包括：覆盖所述显示区222的第一部分保护层231以及覆盖所述非弯折区223的第二部分保护层232；所述第一部分保护层231与所述第二部分保护层232之间具有露出所述弯折区221的间隙区域。所述第一保护层23未覆盖所述弯折区221，避免在弯折区发生弯折时，第一保护层23与柔性显示面板22的第一表面发生翘曲或是剥离问题。

[0052] 所述显示装置还包括复合胶带，所述复合胶带包括层叠的第一功能层24以及第二功能层20，所述第一功能层24位于所述第一表面与所述第二功能层20之间。

[0053] 所述第一功能层24贴附固定所述第一部分保护层231的表面，且延伸至所述间隙区域。所述第一功能层24延伸至所述间隙区域的部分通过弹性介质层30与正对的弯折区221贴合固定。所述弹性介质层30可以为具有弹性的胶层，以便于弯折区域222弯折形变。

[0054] 所述第二功能层20至少位于所述显示区222，即所述第二功能层20可以完全位于所述显示区222，也可以部分位于所述显示区。当所述第二功能层20部分位于所述显示区222时，另一部分可以延伸至弯折区，且该部分第二功能层20小于所述第一功能层24的范围。

[0055] 本发明实施例所述显示装置中，当所述弯折区221朝向所述复合胶带弯曲时，所述非弯折区223固定在所述第二功能层20表面，所述第一功能层24延伸至所述间隙区域的部分用于控制所述弯折区221的弯曲幅度。

[0056] 由于所述第一功能层24延伸至所述间隙区域部分的支撑作用，可以对弯折区221产生一个支撑力，可以对弯折区221的弯曲幅度进行调控，可以消除弯折区221的应力集中问题，避免线路损坏。由于该第一功能层24的作用，通过其施加的支撑力，便于位置对位，避免由于分力F的作用使得显示装置翻折到背面部分向左过度拉伸，从而减小对位误差△x，对位方法操作简单，且对位精度高。

[0057] 如图4和图5所示，所述第一功能层24包括：第一子层241，所述第一子层241贴附固

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定所述第一部分保护层231的表面，且延伸至所述间隙区域；第二子层242，所述第二子层242贴附固定在所述第一子层241表面，且位于所述显示区222；第三子层243，所述第三子层243贴附固定在所述第二子层242表面，且位于所述显示区222；其中，所述第二子层242与所述第三子层243中的一者为用于电磁屏蔽的屏蔽层，另一者为用于使得热量均匀分布的匀热层。

[0058] 所述第一功能层24通过所述第一子层241控制所述弯折区221的弯折幅度，通过所述第二子层242与所述第三子层243中的一者实现电磁屏蔽，另一者实现热量的均匀分布。

[0059] 设置第二子层242和第三子层243均完全位于显示区222。这样可以避免屏蔽层和匀热层延伸至弯折区221产生断裂或是翘曲问题，保障电磁屏蔽效果以及匀热效果。

[0060] 由于柔性显示面板22的驱动电路以及信号线均是设置在非显示区，通过弯折区221弯折，将非弯折区223翻折到显示装置的背面固定后，外部电磁信号以及非显示区的驱动电路以及信号线中的电磁信号会对显示区222的像素单元产生干扰，而本申请技术方案中，所述复合胶带具有电磁屏蔽作用，可以很好的避免该问题。

[0061] 另外，目前柔性显示面板22一般为OLED显示面板，其像素单元为OLED器件。OLED显示面板具有轻薄、耐震、视角广、不易发热以及发光效率高等优点，且易于制作柔性屏。驱动电路以及信号线工作时，均会产生热量，热量局部散热不均匀等原因导致的显示区222背面的热量分布不均匀问题，会导致OLED显示面板中不同温度区域的OLED性能不一致，影响图像显示效果。而本申请技术方案所述显示装置中，所述复合胶带具有热量均匀分布的作用，克服了该问题，保证了图像显示效果。

[0062] 可选的，本发明实施例所述技术方案中，所述第一子层241为泡棉。一方面，泡棉具有一定的机械强度适中，可以弯曲，且弯曲性能弱与柔性显示面板22，这样，当弯折区221弯曲时，可以用于为弯折区221施加一定的支撑力，避免其局部应力集成。另一方面，泡棉具有较好的隔热作用，能够避免驱动电路以及信号线工作时的温度对显示区222的OLED器件的热影响。泡棉材料可以直接通过胶层30固定在间隙区域，固定效果稳定，在弯曲时不会发生剥离问题，且泡棉材料具有较好的韧性，在弯折时，不会发生断裂问题。

[0063] 可选的，所述屏蔽层可以为金属层或是金属合金层或是其他具有导电性能的非金属材料层。优选的设置所述屏蔽层为铜层。一方面，铜层具有优良的导电性能，可以较好的实现电磁屏蔽作用，另一方面，铜层具有较好的导热性能，可以实现热量的快速传递，将局部高温区域的热量传递至其他地方，便于热量的均匀分布以及散热。

[0064] 可选的，所述匀热层为石墨层。石墨层可以使得热量均匀分布，避免局部热量集中的问题。

[0065] 本发明实施例中，所述第一功能层24延伸至所述间隙区域的部分通过胶层30贴附固定在所述间隙区域表面。具体的，所述第一子层241延伸至间隙区域的部分通过胶层30与柔性显示面板22固定。

[0066] 所述第一功能层24延伸至所述间隙区域的部分覆盖20％-80％的所述间隙区域。具体的，可以覆盖40％或是50％所述间隙区域。如果覆盖所述间隙区域的面积较小，在弯折区221弯折时，将会导致支撑力以及支撑面积较小，不能很好的实现控制弯曲幅度与缓冲应力的作用，如果覆盖所述间隙区域面积较大，在弯折区221弯折时，将会导致支撑力以及支撑面积较大，将会增大弯折难度，不便于弯折。本发明实施例所述覆盖数字范围，可以实现

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最优的弯曲效果。

[0067] 一般的，第一功能层24中，匀热层与屏蔽层均是较薄的薄膜结构。需要使得复合胶带具有一定的高度以匹配弯折幅度，将显示装置翻折到背面的部分固定。本发明实施例中，所述第二功能层20包括：支撑层26，所述支撑层26朝向所述第一功能层24的表面通过第一胶层25与所述第一功能层24粘结固定，所述支撑层26背离所述第一功能层24的表面具有第二胶层27，用于粘结固定所述第二部分保护层232，从而将显示装置翻折到背面的部分固定。所述复合胶带通过所述支撑层26调节厚度，以适配于弯折幅度，对弯折后的部分进行固定。可选的，所述支撑层26为塑料板、陶瓷板以及玻璃板中的任一种。

[0068] 本发明实施例所述显示装置还包括设置在所述第二表面的第二保护层21，所述第二保护层21贴附固定在所述显示区222。所述第二表面对应非显示区的区域还覆盖有胶层28，用于粘结固定弯曲定型的背板。可选的，所述第二保护层21包括：偏光片和/或触控电极。

[0069] 所述显示区222具有显示阵列。如上述柔性显示面板22为OLED面板，显示阵列为OLED阵列。所述非显示区具有与所述显示阵列连接的显示驱动电路以及与所述驱动电路连接的柔性线路板FPC，所述柔性线路板FPC用于与电路主板连接。

[0070] 参考图6，图6为本发明实施例提供的一种显示装置的层次结构示意图，图6所示显示装置中，柔性显示面板22由上至下依次包括柔性基板、缓冲层、用于制作TFT阵列驱动电路的低温多晶硅、OLED阵列、多层薄膜封装层、胶层以及水氧阻挡层。多层薄膜封装层包括多层交替分布的有机材料层和无机材料层。

[0071] 柔性显示面板22朝向柔性基板的一侧通过胶层23粘结固定有第一保护层23，第一保护层23通过网格胶粘结固定复合胶带，复合胶带结构与上述方式相同，图6仅示出了第一功能层中的作为屏蔽层的铜层、作为匀热层的石墨层以及作为第一子层泡棉层，未示出第二功能层。

[0072] 柔性显示面板22背离柔性基板的另一侧通过胶层62粘结固定第二保护层21。第二保护层21包括触控层和偏光片。第二保护层通过胶层63固定有盖板背离64。

[0073] 本发明实施例所述显示装置中，通过设备29施加压力使得柔性显示面板发生弯曲。在分力F的作用下，使得翻折到背面的部分向左移动，由于第一功能层24的作用，可以为弯折区221施加支撑力，并缓冲应力，从而减小对位误差△x，提高对位精度，避免线路损坏。

[0074] 对所公开的实施例的上述说明，使本领域专业技术人员能够实现或使用本发明。对这些实施例的多种修改对本领域的专业技术人员来说将是显而易见的，本文中所定义的一般原理可以在不脱离本发明的精神或范围的情况下，在其它实施例中实现。因此，本发明将不会被限制于本文所示的这些实施例，而是要符合与本文所公开的原理和新颖特点相一致的最宽的范围。

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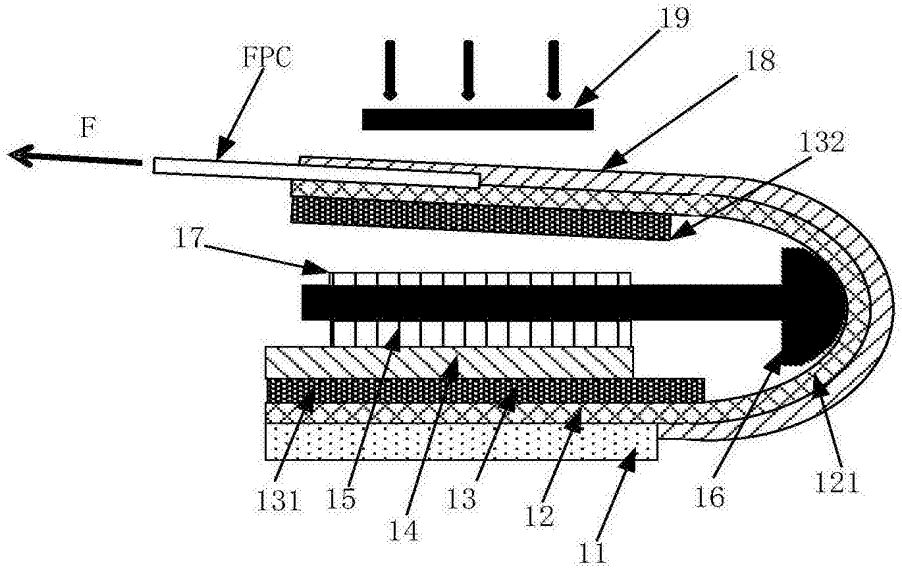


图1

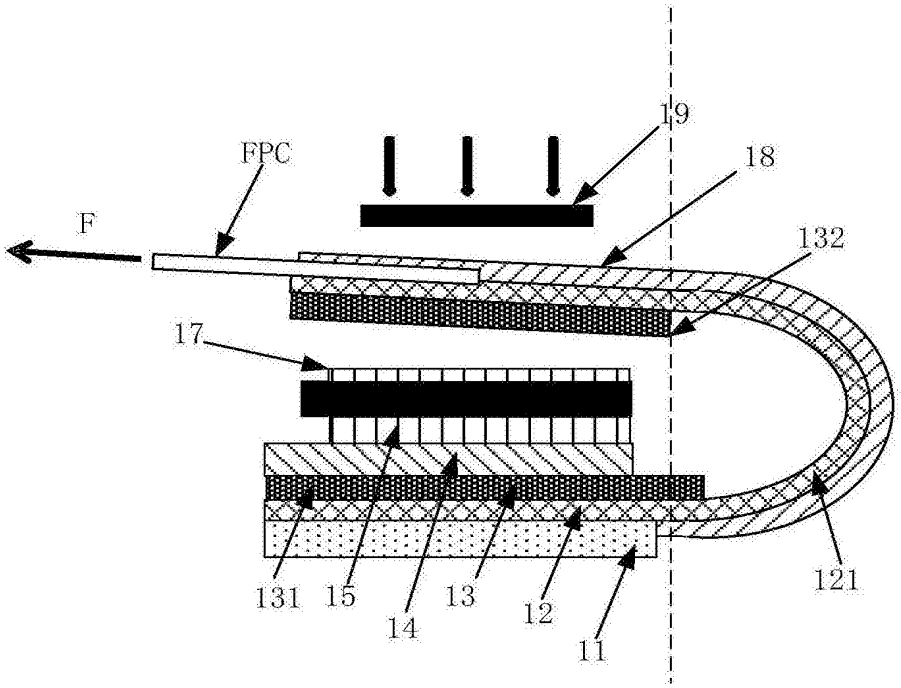


图2

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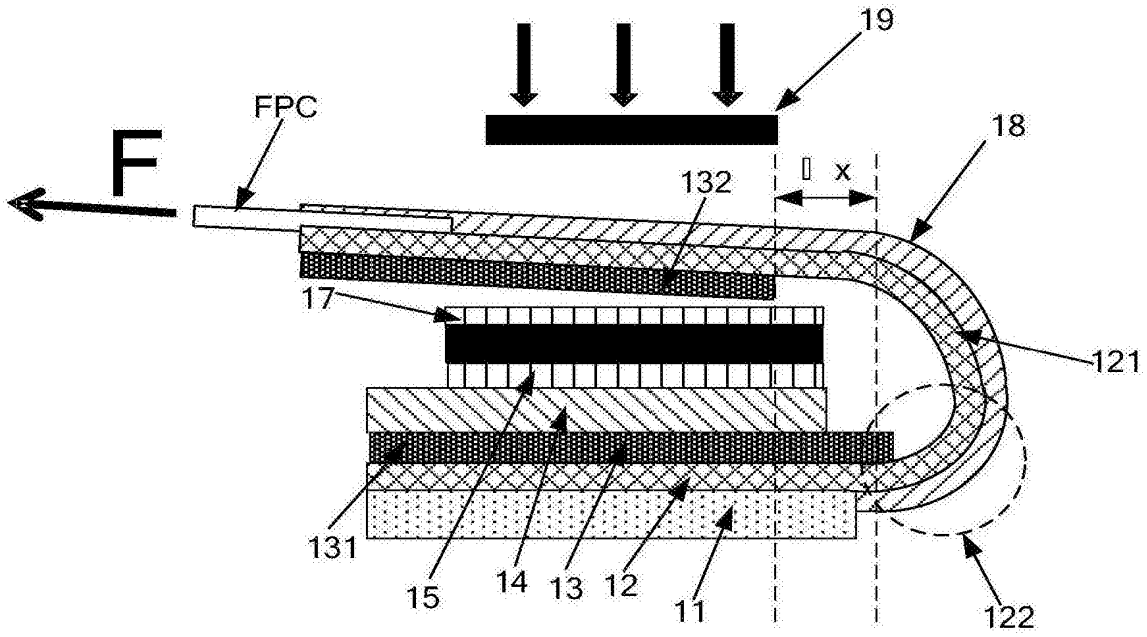


图3

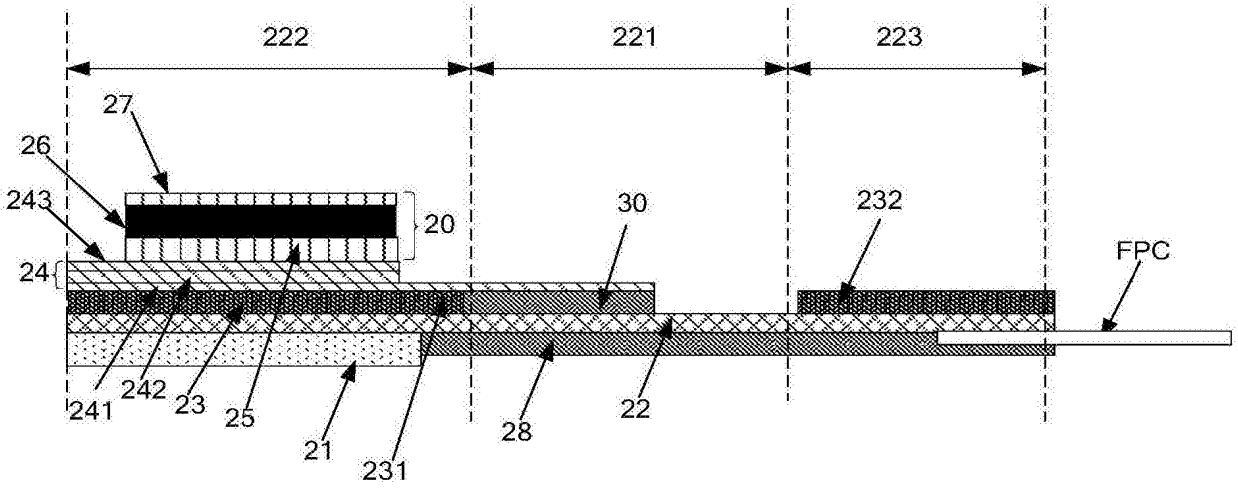


图4

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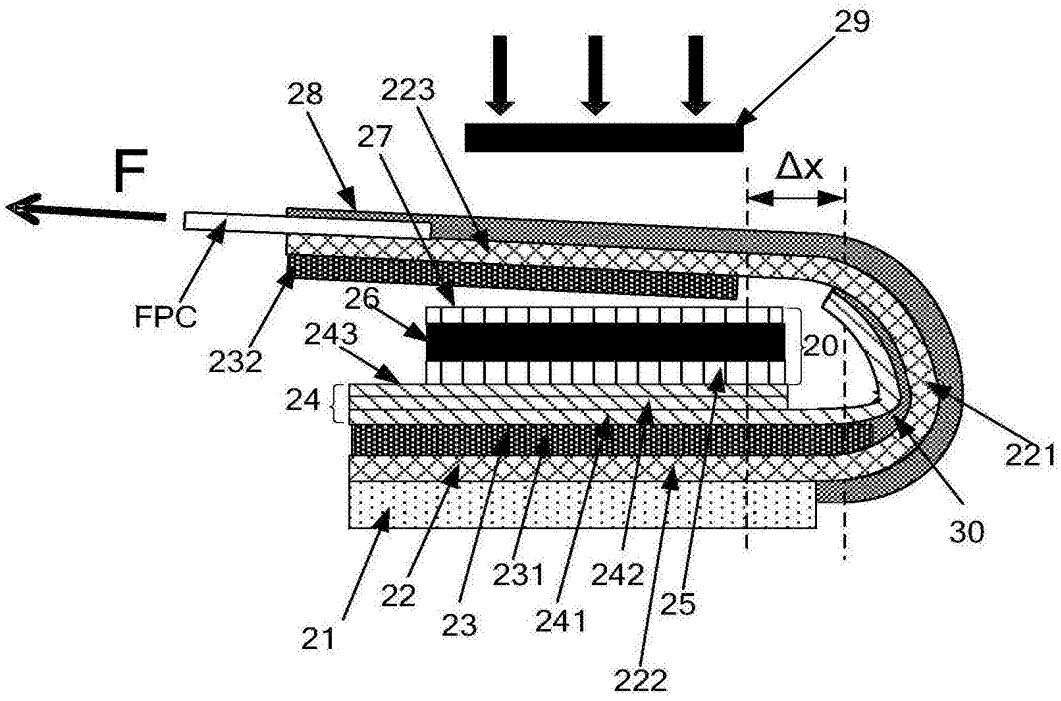


图5

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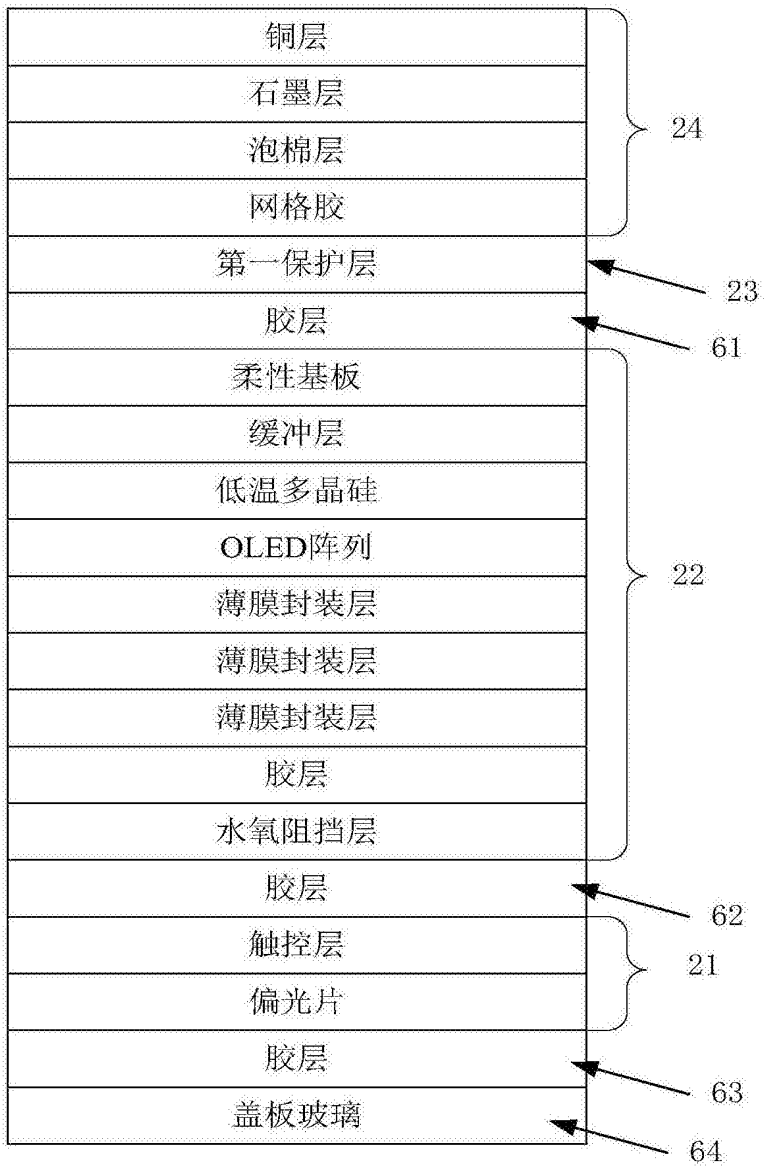


图6

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Abstract of CN108962029 (A)
The present invention relates to a kind of flexible display screen, preparation method and display devices.The flexible display screen includes screen body and flexible glue layer.Wherein screen body includes viewing area and includes flexible bent area and non-bent area from the outwardly extending non-display area in viewing area, non-display area.Flexible glue layer is attached to bent area, while the side of flexible glue layer forms rough curved surface, and the junction of the thickness of flexible glue layer from bent area and non-bent area is successively decreased along far from junction direction.By adhering to flexible glue layer in bent area, enhance the strength and toughness of bent area.And the curved surface of flexible glue layer disperses the bending stress of bent area by multi-angle, has dispersed stress concentration.The thickness of flexible glue layer successively decreases from junction to far from junction simultaneously, while so that junction screen body intensity is reinforced, bent area bending of being more convenient for.

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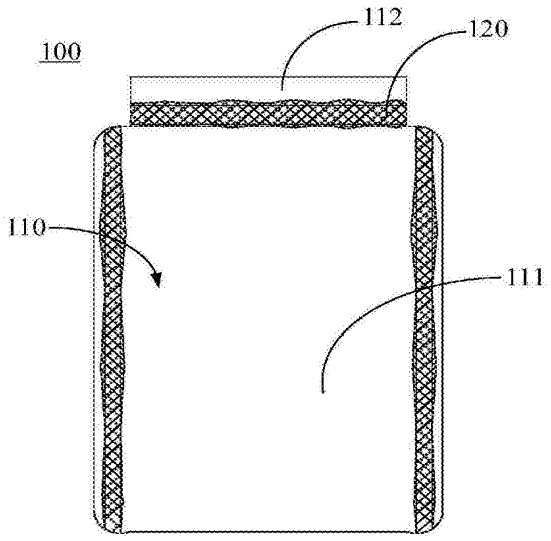
权利要求书1页 说明书6页 附图4页

(54)发明名称

柔性显示屏、其制备方法以及显示装置

(57)摘要

本发明涉及一种柔性显示屏、其制备方法以及显示装置。该柔性显示屏包括屏体以及软胶层。其中屏体包括显示区以及自显示区向外延伸的非显示区，非显示区上包括可弯曲的弯折区以及非弯折区。软胶层附着于弯折区，同时软胶层的侧面形成凹凸不平的曲面，并且软胶层的厚度自弯折区与非弯折区的连接处沿远离连接处方向递减。通过在弯折区附着软胶层，增强弯折区的强度与韧性。并且软胶层的曲面使得弯折区的弯曲应力被多角度分散，分散了应力集中。同时软胶层的厚度自连接处向远离连接处递减，使得连接处屏体强度加强的同时，更便于弯折区弯折。



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1.一种柔性显示屏，其特征在于，包括：

屏体，包括显示区以及自所述显示区向外延伸的非显示区；所述非显示区包括弯折区以及非弯折区；

软胶层，附着于所述弯折区，所述软胶层的侧面形成凹凸不平的曲面，且所述软胶层的厚度自所述弯折区与所述非弯折区的连接处沿远离所述连接处方向递减。

2.根据权利要求1所述的柔性显示屏，其特征在于，所述软胶层附着于所述弯折区的内侧表面。

3.根据权利要求2所述的柔性显示屏，其特征在于，所述弯折区的外侧表面也附着有软胶层。

4.根据权利要求1所述的柔性显示屏，其特征在于，所述软胶层覆盖所述弯折区。

5.根据权利要求1所述的柔性显示屏，其特征在于，所述软胶层的中部设置为镂空结构。

6.根据权利要求1所述的柔性显示屏，其特征在于，所述软胶层为可固化软胶，所述可固化软胶包括硅胶、硅酮胶或PU软胶。

7.根据权利要求1-6中任一项所述的柔性显示屏，其特征在于，所述非显示区包括沿所述屏体的长度方向向外延伸的第一非显示区；所述第一非显示区包括可弯折的第一弯折区；所述第一弯折区附着有所述软胶层。

8.根据权利要求7所述的柔性显示屏，所述非显示区还包括沿所述屏体宽度方向向屏体两侧延伸的第二非显示区以及第三非显示区，所述第二非显示区包括可弯折的第二弯折区；所述第三非显示区包括可弯折的第三弯折区；所述第二弯折区以及第三弯折区均附着有所述软胶层。

9.一种显示装置，其特征在于，包括如权利要求1-8中任一项所述的柔性显示屏、框架以及保护盖板，所述框架套设在所述柔性显示屏四周外；所述保护盖板附着于所述柔性显示屏上。

10.一种柔性显示屏的制备方法，其特征在于，包括以下步骤：

提供柔性屏体，所述柔性屏体包括显示区以及自所述显示区向外延伸的非显示区；所述非显示区包括弯折区以及非弯折区；

在所述弯折区上，自弯折区与非弯折区连接处沿远离所述连接处方向涂覆厚度递减的可固化软胶，且使得所述可固化软胶的侧面形成凹凸不平的曲面；

固化所述可固化软胶，形成软胶层；

将所述弯折区向所述柔性屏体的下侧弯折，得到所述柔性显示屏。

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柔性显示屏、其制备方法以及显示装置

技术领域

[0001] 本发明涉及柔性显示领域，特别是涉及柔性显示屏、其制备方法以及显示装置。

背景技术

[0002] 随着柔性显示技术的发展，柔性显示屏已成为未来显示终端的发展趋势。为了使柔性显示屏达到全面屏显示效果，通常采用将非显示区弯折的办法实现，即：将柔性显示屏的非显示区弯折到柔性显示屏的背面从而缩小屏体边框宽度，进而提高屏占比。

[0003] 但是，柔性显示屏由于其薄、软的特性，在对弯折区进行弯折时，弯折区特别是弯折线位置处容易出现应力集中现象，进而导致弯折区屏体或电路走线损伤失效等问题。

发明内容

[0004] 基于此，有必要针对如何防止导致弯折区屏体或电路走线损伤失效问题，提供一种柔性显示屏、其制备方法以及显示装置。

[0005] 一种柔性显示屏，其特征在于，包括：

[0006] 屏体，包括显示区以及自所述显示区向外延伸的非显示区；所述非显示区包括弯折区以及非弯折区；

[0007] 软胶层，附着于所述弯折区，所述软胶层的侧面形成凹凸不平的曲面，且所述软胶层的厚度自所述弯折区与所述非弯折区的连接处沿远离所述连接处递减。

[0008] 上述柔性显示屏包括屏体以及软胶层。其中屏体包括显示区以及自显示区向外延伸的非显示区，非显示区上包括可弯曲的弯折区以及与弯折区连接的非弯折区。软胶层附着于弯折区，同时软胶层的侧面形成凹凸不平的曲面，并且软胶层的厚度自弯折区与非弯折区的连接处沿远离连接处递减。由于屏体薄、软的特性，在对弯折区进行弯折时，弯折区与非弯折区连接位置处容易出现应力集中现象，导致弯折区屏体或电路走线损伤失效。通过在弯折区附着软胶层，加厚了弯折区厚度，增强弯折区的强度与韧性。将软胶层的侧面设置成凹凸不平的曲面能避免弯折区的受力点位于同一直线而产生的折痕，进而使得弯折区的弯曲应力被多角度分散，分散了应力集中。同时软胶层的厚度自连接处向远离连接处递减，使得软胶层在连接处的厚度较厚，而弯折区中部的软胶层较薄，进而使得连接处屏体强度加强的同时，更便于弯折区弯折。

[0009] 在其中一个实施例中，所述软胶层附着于所述弯折区的内侧表面。

[0010] 在其中一个实施例中，所述弯折区的外侧表面也附着有软胶层。

[0011] 在其中一个实施例中，所述软胶层覆盖所述弯折区。

[0012] 在其中一个实施例中，所述软胶层的中部设置为镂空结构。

[0013] 在其中一个实施例中，所述软胶层为可固化软胶，所述可固化软胶包括硅胶、硅酮胶或PU软胶。

[0014] 在其中一个实施例中，述非显示区包括沿所述屏体的长度方向向外延伸的第一非显示区；所述第一非显示区包括可弯折的第一弯折区；所述第一弯折区附着有所述软胶层。

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[0015] 在其中一个实施例中，所述非显示区还包括沿所述屏体宽度方向向屏体两侧延伸的第二非显示区以及第三非显示区，所述第二非显示区包括可弯折的第二弯折区；所述第三非显示区包括可弯折的第三弯折区；所述第二弯折区以及第三弯折区均附着有所述软胶层。

[0016] 一种显示装置，包括前述的柔性显示屏、框架以及保护盖板，所述框架套设在所述柔性显示屏四周外；所述保护盖板附着于所述柔性显示屏上。

[0017] 上述显示装置装了前述的柔性显示屏，该柔性显示屏通过在弯折区附着软胶层，并且软胶层的侧面形成凹凸不平的曲面，软胶层的厚度自弯折区与非弯折区的连接处向远离连接处方向递减。使得屏体弯折区的强度与韧性加强，同时还分散了应力集中。避免了弯折区屏体与电路走线损伤失效，进而提高了显示装置的使用寿命。

[0018] 一种柔性显示屏的制备方法，包括以下步骤：

[0019] 提供柔性屏体，所述柔性屏体包括显示区以及自所述显示区向外延伸的非显示区；所述非显示区包括弯折区以及非弯折区；

[0020] 在所述弯折区上，自弯折区与非弯折区连接处沿远离所述连接处方向涂覆厚度递减的可固化软胶，且使得所述可固化软胶的侧面形成凹凸不平的曲面；

[0021] 固化所述可固化软胶，形成软胶层；

[0022] 将所述弯折区向所述柔性屏体的下侧弯折，得到所述柔性显示屏。

[0023] 上述柔性显示屏的制备方法，通过在所述弯折区上涂覆可固化软胶，固化处理可固化软胶后形成侧面为凹凸不平曲面以及厚度自连接处向远离连接处递减的软胶层。软胶层使得屏体弯折区的强度与韧性加强，同时还分散了应力集中。避免了弯折区屏体与电路走线损伤失效。

附图说明

[0024] 图1为一实施例的柔性显示屏结构示意图；

[0025] 图2为图1中所示的柔性显示屏的屏体结构示意图；

[0026] 图3为一实施例的柔性显示屏结构剖视图；

[0027] 图4为另一实施例的柔性显示屏结构示意图；

[0028] 图5为一实施例的屏体结构示意图；

[0029] 图6为一实施例的柔性显示屏制备方法流程图。

具体实施方式

[0030] 为使本发明的上述目的、特征和优点能够更加明显易懂，下面结合附图对本发明的具体实施方式做详细的说明。在下面的描述中阐述了很多具体细节以便于充分理解本发明。但是本发明能够以很多不同于在此描述的其它方式来实施，本领域技术人员可以在不违背本发明内涵的情况下做类似改进，因此本发明不受下面公开的具体实施的限制。

[0031] 需要说明的是，当元件被称为“固定于”另一个元件，它可以直接在另一个元件上或者也可以存在居中的元件。当一个元件被认为是“连接”另一个元件，它可以是直接连接到另一个元件或者可能同时存在居中元件。

[0032] 除非另有定义，本文所使用的所有的技术和科学术语与属于本发明的技术领域的

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技术人员通常理解的含义相同。本文中在本发明的说明书中所使用的术语只是为了描述具体的实施例的目的，不是旨在于限制本发明。本文所使用的术语“及/或”包括一个或多个相关的所列项目的任意的和所有的组合。

[0033] 参见图1以及图2，一实施例的柔性显示屏100包括屏体110以及软胶层120，屏体110包括显示区111以及自显示区111延伸出来的非显示区112。具体地，显示区111为屏体110的显示图像区域，非显示区112为屏体110的不显示图像区域。进一步地，显示区111上分布有发光元件、像素阵列等用于显示图像的部件。非显示区112排布有用于实现信号传输、驱动发光元器件发光等功能的集成电路。需要说明的是，非显示区112可以从显示区111的一侧边向外延伸而成，但并不限于此，非显示区112也可以从显示区111的多条侧边向外延伸。

[0034] 进一步地，请继续参见图2以及图3，显示区111包括用于显示图像的显示面以及与显示面背对设置的背面。为了实现柔性显示面板100的全面屏显示，可以把不显示图像的非显示区112朝屏体下侧弯折180°，将非显示区112弯折到显示区111的背面，从而隐藏掉非显示区112，提高屏体110的正面上显示区111的面积占比，从而提高柔性显示面板100的屏占比。为了实现非显示区112的弯折，非显示区112具有可弯折的弯折区112a，而非显示区112上弯折区112a以外的区域即为非弯折区112b。进一步地，弯折区112a上具有与非弯折区112b连接的连接处112c。具体地，连接处112c有两个，两个连接处112c之间所限定的区域即为弯折区112b。

[0035] 具体地，软胶层120附着于弯折区112a，以增强弯折区112a的强度与韧性。进一步地，软胶层120的侧面形成凹凸不平的曲面。其中，软胶层120的侧面指的是软胶层120的靠近连接处112c的表面。而凹凸不平的曲面可以是连续的拱形结构，也可以是由多个凸起与凹陷依次交替形成，还可以是不规则的波浪状起伏结构。更进一步地，继续参见图3，软胶层120的厚度自弯折区112a与非弯折区112c的连接处112c沿远离连接处112c递减。即软胶层120在连接处112c的厚度最大，逐渐向弯折区112a的中部递减，至弯折区112a中部的软胶层120的厚度最小。

[0036] 上述柔性显示屏100包括屏体110以及软胶层120。其中屏体110包括显示区111以及自显示区111向外延伸的非显示区112，非显示区112上包括可弯曲的弯折区112a以及与弯折区112a连接的非弯折区112b。软胶层120附着于弯折区112a，同时软胶层120的侧面形成凹凸不平的曲面，并且软胶层120的厚度自连接处112c向远离连接处112c方向递减。由于屏体薄、软的特性，在对弯折区进行弯折时，弯折区112a与非弯折区112b的连接处12c容易出现应力集中现象，导致弯折区112a的屏体或电路走线损伤失效。通过在弯折区112a附着软胶层120，加厚了弯折区112a厚度，增强弯折区112a的强度与韧性。将软胶层120的侧面设置成凹凸不平的曲面能避免弯折区112a的受力点位于同一直线而产生折痕，进而使得弯折区112a的弯曲应力被多角度分散，分散了应力集中。同时软胶层120的厚度自连接处112c向远离连接处112c方向递减，使得软胶层120在连接处112c的厚度较厚，而弯折区112a的中部的软胶层120较薄，进而使得连接处112c屏体强度加强的同时，更便于弯折区112a弯折。

[0037] 具体地，请继续参见图3，弯折区112a具有弯折后靠近显示区111背面的内侧表面以及与内侧表面背对的外侧表面。在一实施例中，软胶层120附着于弯折区112a的内侧表面，从而对弯折区112a的内侧表面起到保护以及支撑作用。进一步地，弯折区112a的外则表

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面也可以附着上软胶层120，从而防止弯折后的弯折区112a受到外力作用造成变形损坏。通过在弯折区112a的内外表面均附着上软胶层，能对弯折区112a进行全方位加强保护。

[0038] 具体地，在其中一个实施例中，软胶层120的材料为可固化软胶，可固化软胶包括但不限于PU胶、硅胶、或硅酮胶等。进一步地，通过在弯折区112a的反复涂覆可固化软胶，直至可固化软胶的边缘形成凹凸不平的曲面结构。并且在弯折区112a与非弯折区112b的连接处112c，可固化软胶涂覆得厚些，然后向弯折区112a的中部可固化软胶的厚度逐渐递减。再经过UV固化或热固化等固化处理涂覆好的可固化软胶，使之形成软胶层120。

[0039] 具体地，继续参见图3，在一实施例中，屏体110包括柔性基板以及设置于柔性基板的上的显示层以及驱动部件，柔性基板的材料可以为聚酰亚胺、聚碳酸脂、聚对苯二甲酸乙二醇酯、硅胶等具有良好柔韧性的材料。柔性基板上可分为显示区域以及自显示区域延伸的非显示区域。显示层设置在柔性基板的显示区域上，显示层可以包括多个用于显示图像的显示部件，从而使柔性基板的显示区域形成屏体110的显示区111，显示部件包括诸如薄膜晶体管、栅线、数据线、电容、阳极、阴极、有机发光层、彩色滤光膜等不同的显示部件。驱动部件设置在柔性基板的非显示区域上，用于实现信号传输、驱动图像显示等功能，从而形成屏体110的非显示区112。驱动部件可以包括驱动元件131以及柔性电路板132等。在对屏体110进行弯折时，只对柔性基板的非显示区域进行弯折，而设置在柔性基板的显示区域上的各功能层则不需要进行弯折。进一步地，在本实施例中，屏体110采用COP(Chip On Pi薄膜上芯片)封装技术。

[0040] 进一步地，屏体110显示区111上还可以设置偏光片160，以增加屏体110的透光，以及减少外光反射。偏光片160可以通过第一感光胶层181贴附于屏体110的显示区111上。偏光片181上还可以设置触摸敏感层170，触摸敏感层170集成有触摸传感器以感知用户触摸操作。触摸敏感层170上还设置有用于保护屏体110的柔性盖板190。触摸敏感层170与柔性盖板190之间通过第二感光胶层182连接。进一步地，柔性盖板190的靠近触摸敏感层170的一侧的四周边缘还涂覆有用于遮光的油墨层191，以提高柔性显示屏100的显示效果。屏体110的显示区111的背面可设置第一支撑膜141，屏体110的非显示区112上除弯折区113以外的区域的背面可设置第二支撑膜142。第一支撑膜141以及第二支撑膜142的刚性比屏体110强，从而对屏体110进行刚性支撑。为了限定弯折区的弯折半径，第一支撑膜141以及第二支撑膜142之间还可以设置垫高块143，垫高块143通过复合胶层144与第一支撑膜141粘贴连接。

[0041] 具体地，在其中一个实施例中，软胶层120覆盖弯折区112a，如图1中所示。软胶层120覆盖整个弯折区112a的表面，使得弯折区112a的表面各位点均得到软胶层112a的保护加强。

[0042] 需要说明的是，在另一实施例中，软胶层120也可以不完全覆盖弯折区112a。具体地，参见图2以及图4，在另一实施例中，软胶层120的中部设置为镂空结构121。即软胶层120只覆盖到弯折区112a与非弯折区112b的连接处附近，而弯折区112a的中部为空白或具有镂空图案的结构。进一步地，镂空结构121可以是沿弯折区112a长度方向延伸的凹槽，在形成软胶层120时，将可固化软胶只涂覆于弯折区112a于非弯折区112b的连接处，而弯折区112a的中部进行留白即可形成类似的镂空结构，如图4中所示。镂空结构121也可以是其他的网状结构等。具有中部镂空结构121的软胶层120在保护弯折区112a与非弯折区112b的连接处

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112c的同时，减少了弯折区112a中部的弯折阻碍，使得弯折区112a更易于弯折，且节省软胶层120的材料。

[0043] 请参见图5，如前所述，非显示区112可以从显示区111的多条侧边向外延伸。具体地，非显示区包括自显示区111沿屏体110的长度方向向外延伸的第一非显示区1121。第一非显示区1121包括可朝屏体110下侧弯折的第一弯折区1131。非显示区还包括自显示区111沿屏体110的宽度方向向屏体110左右两侧延伸的第二非显示区1122以及第三非显示区1123。其中，第二非显示区1122包括可朝屏体110的下侧弯折的第二弯折区1132。第三非显示区1123包括可朝屏体110的下侧弯折的第三弯折区1133。

[0044] 进一步地，第一弯折区1131、第二弯折区1132以及第三弯折区1133均附着有软胶层120，从而软胶层120使得屏体110的各弯折区的强度与韧性加强，同时还分散了各弯折区的应力集中，进而降低了各弯折区的屏体以及电路走线损伤失效的风险。

[0045] 在本申请的一实施例中，还提供一种显示装置，该显示装置包括柔性显示屏100。进一步地，显示装置还可以包括用以支撑柔性显示面板的框架以及用以保护柔性显示屏的保护盖板，框架套设在柔性显示面板的四周，进一步地，框架可以为柔性的，但框架的刚度比柔性显示面板的刚度高。保护盖板附着于柔性显示面板的显示面上。进一步地，显示装置可以为手机、平板电脑等。

[0046] 上述显示装置装了前述的柔性显示屏100柔性显示屏100通过在弯折区112a附着软胶层120，并且软胶层120的侧面形成凹凸不平的曲面，软胶层120的厚度自弯折区112a与非弯折区112b的连接处112c向远离连接处112c方向递减。使得屏体110弯折区112a的强度与韧性加强，同时还分散了应力集中。避免了弯折区112a屏体与电路走线损伤失效，进而提高了显示装置的使用寿命。

[0047] 参见图6，在本申请的一实施例中，还提供一种柔性显示屏的制备方法：

[0048] S110：提供柔性屏体，柔性屏体包括显示区以及自显示区向外延伸的非显示区，非显示区包括弯折区以及非弯折区。

[0049] S120：在所述弯折区上，自弯折区与非弯折区连接处沿远离所述连接处方向涂覆厚度递减的可固化软胶，且使得所述可固化软胶的侧面形成凹凸不平的曲面；

[0050] 具体地，在弯折区的反复涂覆多层可固化软胶，直至可固化软胶的边缘形成凹凸不平的曲面结构。并且在弯折区与非弯折区112b的连接处，可固化软胶涂覆得厚些，然后向弯折区112a的中部可固化软胶的厚度逐渐递减。进一步地，可固化软胶包括但不限于PU胶、硅胶、或硅酮胶等。

[0051] S130：固化可固化软胶，形成软胶层。

[0052] 具体地，固化处理可以采用UV固化处理或热固化处理。

[0053] S140：将弯折区向柔性屏体的下侧弯折，得到柔性显示屏。

[0054] 具体地，将弯折区向柔性屏体的下侧弯折180°，从而将非显示区弯折到显示区111的背面，进而隐藏掉非显示区，提高柔性显示面板的屏占比。

[0055] 上述柔性显示屏的制备方法，通过在弯折区上反复涂覆可固化软胶，固化处理可固化软胶后形成侧面为凹凸不平曲线以及厚度自连接处向远离连接处递减的软胶层。软胶层使得使得屏体弯折区的强度与韧性加强，同时还分散了应力集中。避免了弯折区屏体与电路走线损伤失效。

Petitioner Samsung Ex-1004, 0186

[0056] 以上所述实施例的各技术特征可以进行任意的组合，为使描述简洁，未对上述实施例中的各个技术特征所有可能的组合都进行描述，然而，只要这些技术特征的组合不存在矛盾，都应当认为是本说明书记载的范围。

[0057] 以上所述实施例仅表达了本发明的几种实施方式，其描述较为具体和详细，但并不能因此而理解为对发明专利范围的限制。应当指出的是，对于本领域的普通技术人员来说，在不脱离本发明构思的前提下，还可以做出若干变形和改进，这些都属于本发明的保护范围。因此，本发明专利的保护范围应以所附权利要求为准。

Petitioner Samsung Ex-1004, 0187

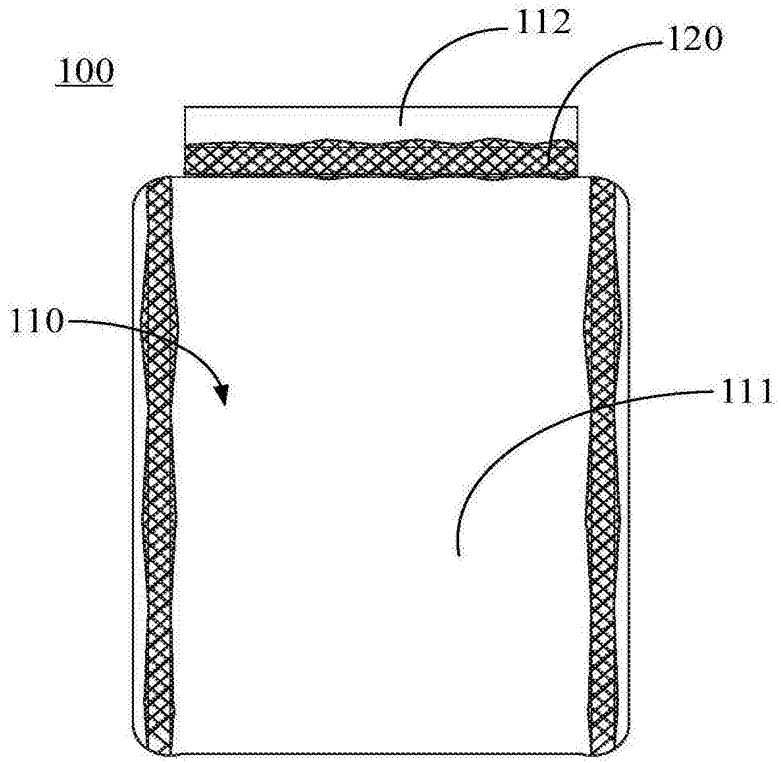


图1

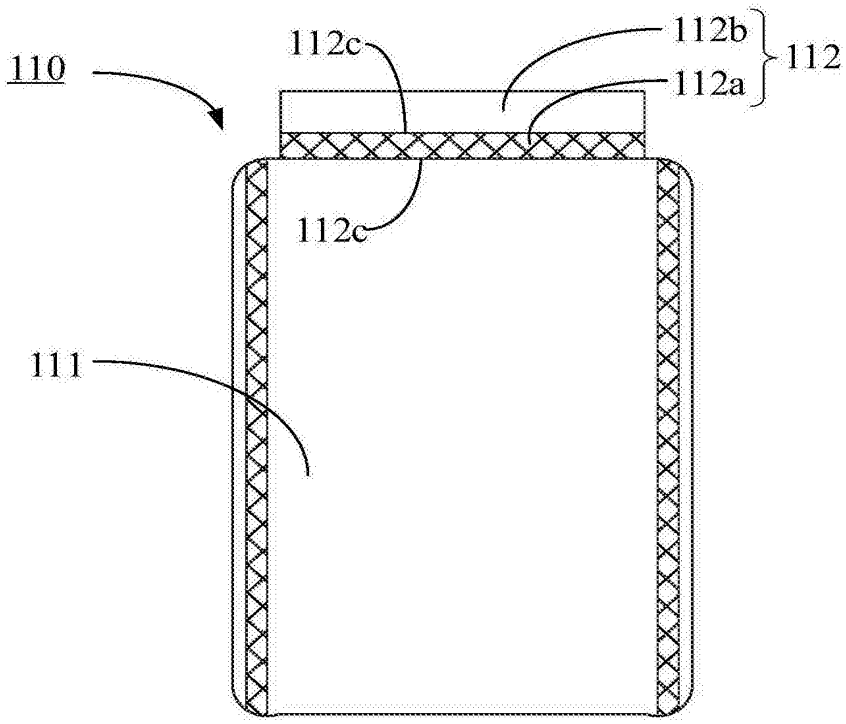


图2

Petitioner Samsung Ex-1004, 0188

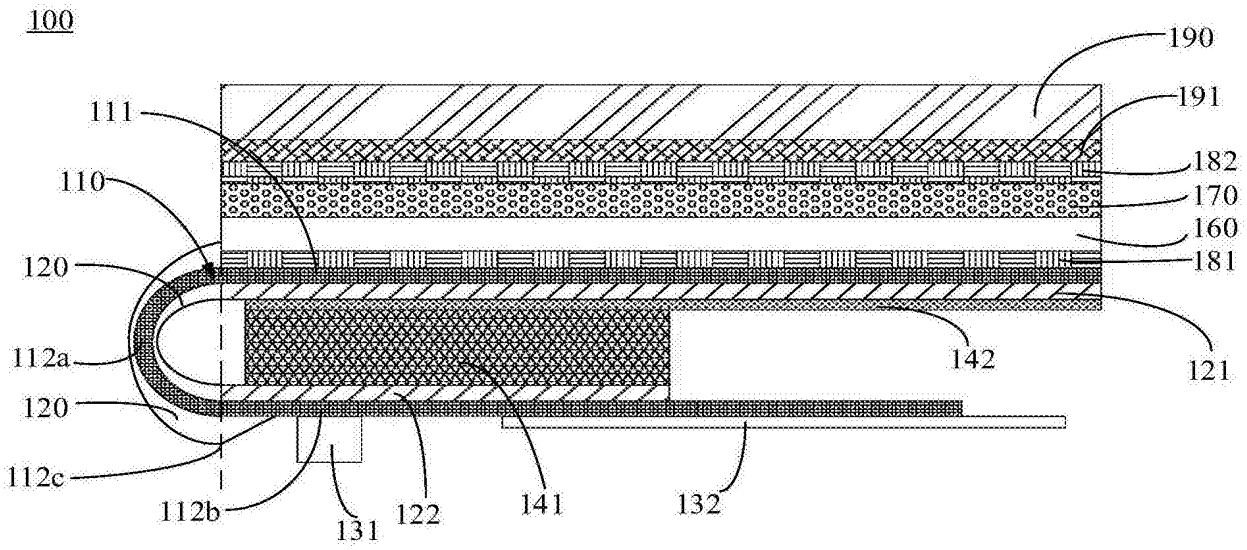


图3

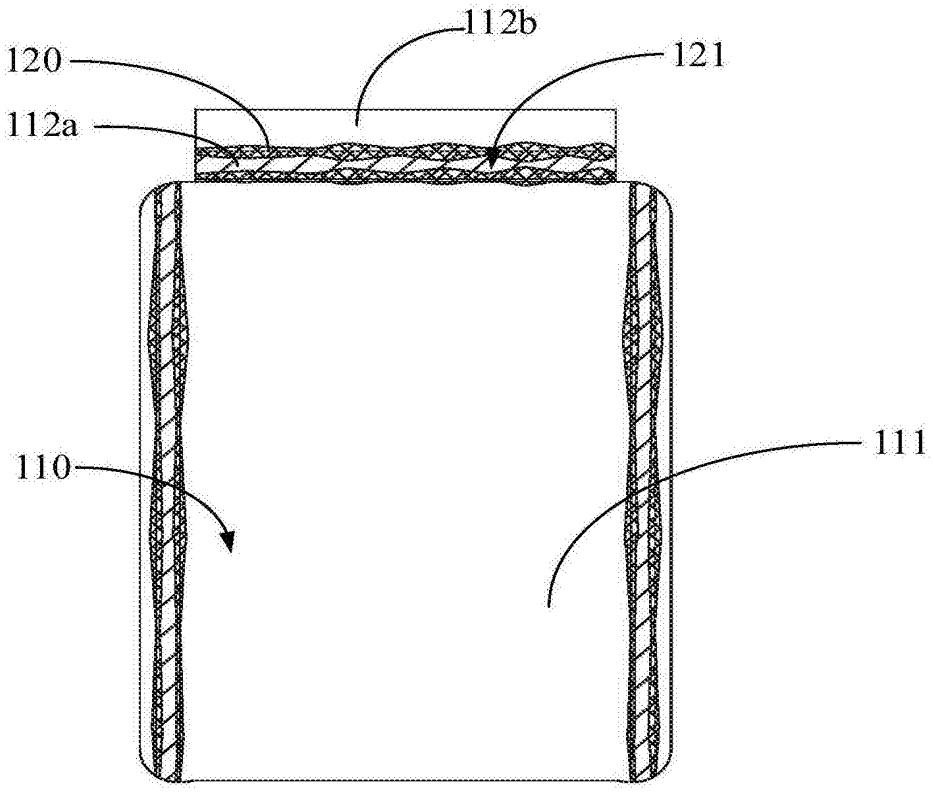


图4

Petitioner Samsung Ex-1004, 0189

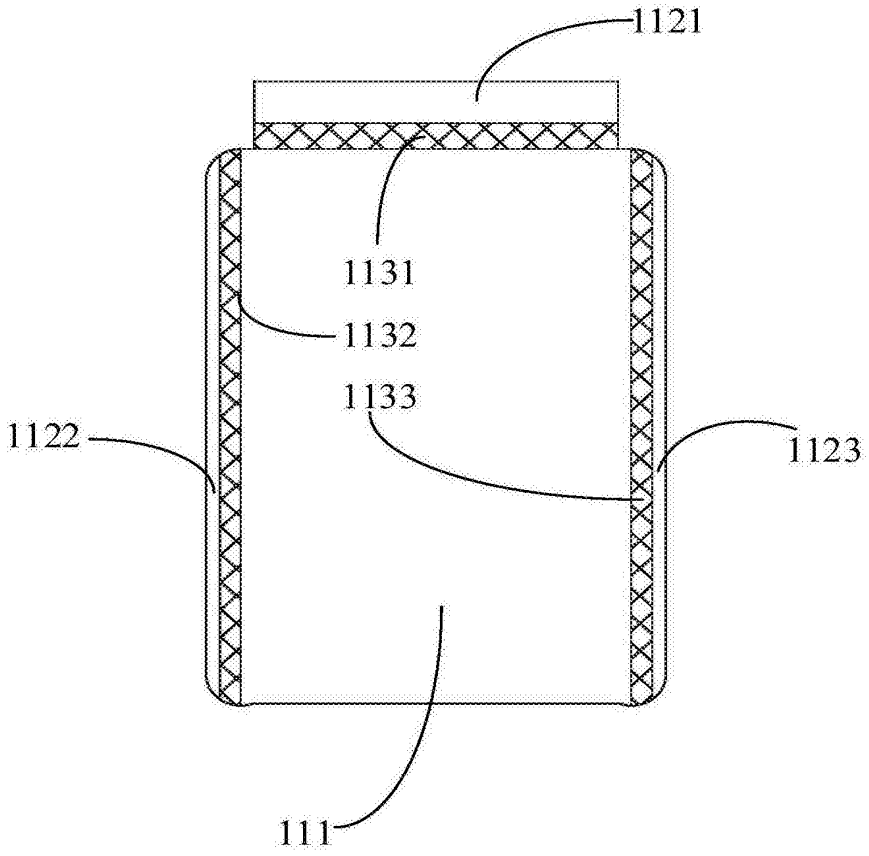


图5

Petitioner Samsung Ex-1004, 0190

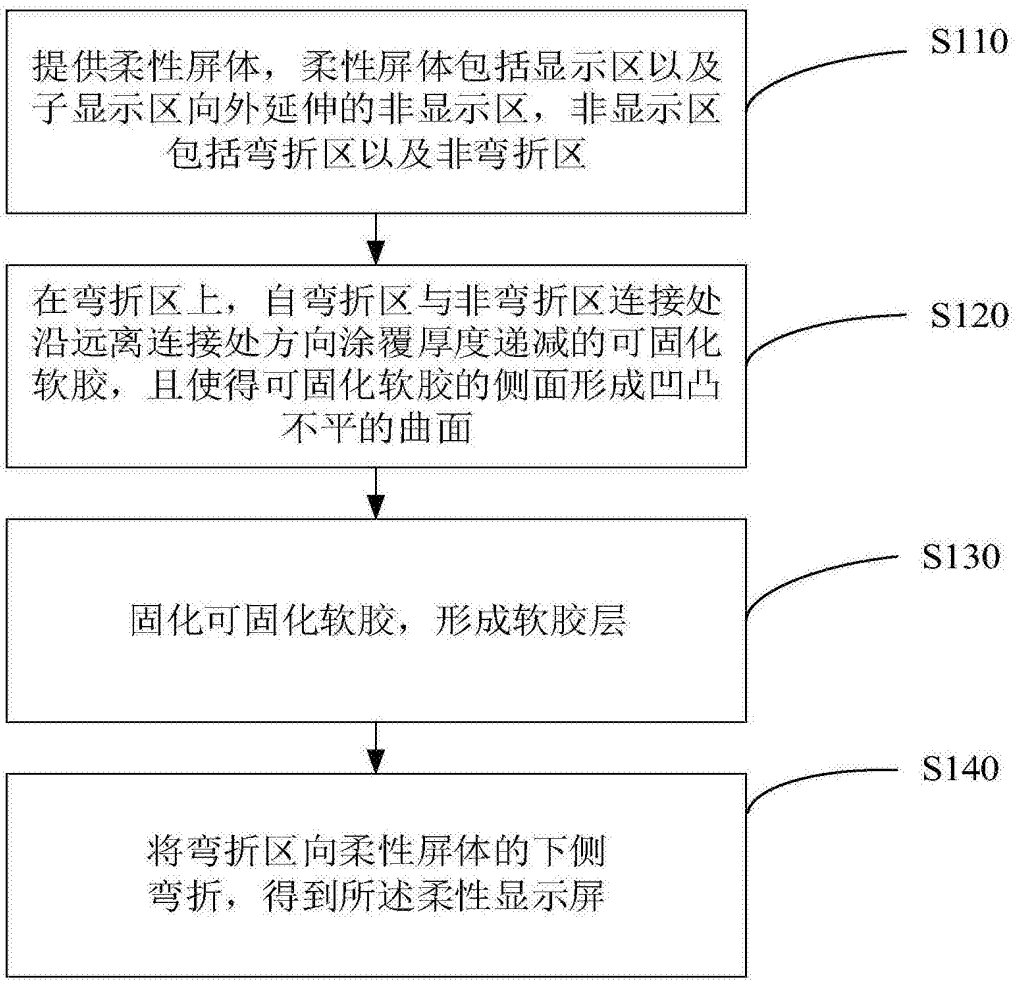


图6

Petitioner Samsung Ex-1004, 0191

Abstract of CN109119453 (A)
The invention discloses a kind of display panel and preparation method thereof and display devices.Display panel includes: the first substrate being oppositely arranged and the second substrate;First substrate includes the first flexible substrate, display layer and the encapsulated layer set gradually, and display layer includes multiple luminescence units, and display layer further includes pixel defining layer, and pixel defining layer has multiple first openings, and luminescence unit is located in the first opening;The second substrate includes: the second flexible substrate and touch-control coloured silk film composite layer, and touch-control coloured silk film composite layer is located at the second flexible substrate close to encapsulated layer side;Touch-control coloured silk film composite layer includes: color blocking, and on perpendicular to display panel direction, color blocking is correspondingly arranged with luminescence unit;Black matrix, black matrix have multiple second openings, and second, which is open, exposes color blocking;On perpendicular to display panel direction, the orthographic projection of black matrix plane where touch control electrode covers touch control electrode, and touch control electrode is made of Metal Mesh material.The present invention is conducive to display panel slimming, is promoted flexible.

Description

Display panel and preparation method thereof and display device

Technical field
The present invention relates to field of display technology, fill more particularly, to a kind of display panel and preparation method thereof and display
It sets.

Background technique

In existing display device technology, display panel is broadly divided into liquid crystal display panel and organic light emitting display panel two The technology of kind mainstream.Wherein, liquid crystal display panel can be controlled by applying voltage, formation on pixel electrode and public electrode The electric field of liquid crystal molecule deflection, and then control the display function through realization display panel of light;Organic light emitting display panel Using electroluminescent organic material, when there is electric current to pass through electroluminescent organic material, luminescent material will shine, and then realize The display function of display panel.

Organic light emitting display panel has self-luminous, ultra-thin, high contrast, super wide viewing angle, low power consumption, display brightness It is high, bright in luster, and as the emphasis paid close attention at present the advantages that Flexible Displays can be made.At present light and thin type display panel and Display device has become the direction of the following display technology development.

Therefore it provides a kind of display panel of slimming and preparation method thereof and display device, are that this field is urgently to be resolved The technical issues of.

Summary of the invention

In view of this, solving above-mentioned skill the present invention provides a kind of display panel and preparation method thereof and display device Art problem.

In a first aspect, to solve the above-mentioned problems, the present

invention provides a kind of display panel, comprising: first be oppositely arranged
Substrate and the second substrate;
First substrate includes the first flexible substrate, display layer and the encapsulated layer set gradually, wherein display layer includes multiple
Luminescence unit, display layer further include pixel defining layer, and pixel defining layer has multiple first openings, and luminescence unit is located at first and opens
In mouthful;
The second substrate includes: the second flexible substrate and touch-control coloured silk film composite layer, and it is flexible that touch-control coloured silk film composite layer is located at second
Substrate is close to encapsulated layer side;Wherein, touch-control coloured silk film composite layer includes:
Color blocking, on perpendicular to display panel direction, color blocking is correspondingly arranged with luminescence unit;
Black matrix, black matrix have multiple second openings, and second, which is open, exposes color blocking;
Touch control electrode, on perpendicular to display panel direction, black matrix is put down where touch control electrode
The orthographic projection in face covers touch control electrode, and touch control electrode is made of Metal Mesh material.
Second aspect, to solve the above-mentioned problems, the present invention provide a kind of display device, including proposed by the present invention any
A kind of display panel.
The third aspect, to solve the above-mentioned problems, the present invention provide a kind of production method of display panel, comprising:
The first flexible substrate is made in the first support plate;
Display layer is made in the first flexible substrate, display layer includes multiple luminescence units, and display layer further includes that pixel is fixed

Adopted layer, pixel defining layer have multiple first openings, and luminescence unit is located in the first opening;
Encapsulated layer is made on display layer, obtains the first substrate with the first support plate;
The second flexible substrate is made in the second support plate;
Touch-control coloured silk film composite layer is made in the second flexible substrate, obtains the second substrate with the second support plate;Wherein,
Touch-control coloured silk film composite layer includes: black matrix, color blocking and touch control electrode, and black matrix has multiple second openings, and the second opening includes
Color blocking, touch control electrode are made of Metal Mesh material, and the orthographic projection of black matrix plane where touch control electrode covers touch-control
Electrode;
First substrate with the first support plate and the second substrate with the second support plate are subjected to contraposition fitting;
The first support plate of laser lift-off and the second support plate.
Compared with prior art, display panel provided by the invention and preparation method thereof and display device, at least realize
It is following the utility model has the advantages that
It invents in the display panel provided, plays the function of preventing the reflection of environment light instead of rotatory polarization piece using color blocking,
Color blocking thickness is typically not greater than 20 μm, and color blocking thickness is far smaller than the thickness of rotatory polarization piece, is conducive to subtracting for display panel thickness
Thin, the rotatory polarization piece for not using brittleness big is also beneficial to promote the pliability of display panel.Touch-control coloured silk film is provided in the present invention
Composite layer, touch control electrode are integrated with color blocking and black matrix, the touch control electrode film layer made of Metal Mesh material

Thickness is thin, can further be conducive to the slimming of display panel, is promoted flexible.In addition, black matrix is in touch-control in the present invention

The orthographic projection of plane where electrode covers touch control electrode, and the design of touch control electrode will not influence display surface in touch-control coloured silk film composite layer

Plate aperture opening ratio.

Certainly, implementing any of the products of the present invention specific needs while must not reach all the above technical effect.

By referring to the drawings to the detailed description of exemplary embodiment of the present invention, other feature of the invention and its Advantage will become apparent.

Detailed description of the invention

It is combined in the description and the attached drawing for constituting part of specification shows the embodiment of the present invention, and even

With its explanation together principle for explaining the present invention.

Fig. 1 is the film layer structure figure of display panel provided in an embodiment of the present invention;

Fig. 2 is the schematic top plan view of display panel provided in an embodiment of the present invention;

Fig. 3 is a kind of optional embodiment film layer structure figure of display panel provided in an embodiment of the present invention;

Fig. 4 is another optional embodiment film layer structure figure of display panel provided in an embodiment of the present invention;

Fig. 5 is the light path schematic diagram that luminescence unit emits beam in display panel;

Fig. 6 is the section rough schematic view of display panel;

Fig. 7 is a kind of rough schematic view of display panel provided by the invention;

Fig. 8 is another optional embodiment film layer structure figure of display

panel provided in an embodiment of the present invention;
Fig. 9 is another optional embodiment film layer structure figure of display panel provided in an embodiment of the present invention;
Figure 10 is another optional embodiment film layer structure figure of display panel provided in an embodiment of the present invention;
Figure 11 is display device schematic diagram provided in an embodiment of the present invention;
Figure 12 is display panel production method flow chart provided in an embodiment of the present invention.

Specific embodiment
Carry out the various exemplary embodiments of detailed description of the present invention now with reference to attached drawing.It should also be noted that unless in addition having
Body explanation, the unlimited system of component and the positioned opposite of step, numerical expression and the numerical value otherwise illustrated in these embodiments is originally
The range of invention.
Be to the description only actually of at least one exemplary embodiment below it is illustrative, never as to the present invention
And its application or any restrictions used.
Technology, method and apparatus known to person of ordinary skill in the relevant may be not discussed in detail, but suitable
In the case of, the technology, method and apparatus should be considered as part of specification.
It is shown here and discuss all examples in, any occurrence should be construed as merely illustratively, without
It is as limitation.Therefore, other examples of exemplary embodiment can have different values.
It should also be noted that similar label and letter indicate similar terms in following attached drawing, therefore, once a certain Xiang Yi
It is defined in a attached drawing, then in subsequent attached drawing

does not need that it is further discussed.
Fig. 1 is the film layer structure figure of display panel provided in an embodiment of the present invention.Fig. 2 is provided in an embodiment of the present invention aobvious
Show the schematic top plan view of panel.
As shown in Figure 1, display panel includes: the first substrate 11 being oppositely arranged and the second substrate 12;First substrate 11 wraps
Include the first flexible substrate 111, display layer 112 and the encapsulated layer 113 set gradually, wherein display layer 112 includes multiple luminous lists
Member 1121, display layer 112 further include pixel defining layer 1122, and pixel defining layer 1122 has multiple first opening K1, shines single
Member 1121 is located in the first opening K1.The second substrate 12 includes: the second flexible substrate 121 and touch-control coloured silk film composite layer 122, touch-control
Color film composite layer 122 is located at the second flexible substrate 121 close to 113 side of encapsulated layer;Wherein, touch-control coloured silk film composite layer 122 includes:
Color blocking 1221, on perpendicular to display panel direction, color blocking 1221 is correspondingly arranged with luminescence unit 1121;Black matrix 1222 is black
Matrix 1222 has multiple second opening K2, the second opening K2 exposure color blocking 1221;Touch control electrode 1223, perpendicular to display surface
On plate direction, black matrix 1222 covers touch control electrode 1223, touch control electrode in the orthographic projection of 1223 place plane of touch control electrode
1223 are made of Metal Mesh material.Metal Mesh, that is, metal grill, impedance is low, conducts electricity very well, using its system
The conductive layer of work can be thinner than the conductive layer of conventional indium tin oxide production.Touch-control coloured silk film composite layer 122 only shows in Fig. 1
Meaning property indicates, wherein touch control electrode 1223 can be

located at black matrix 1222 far from 11 side of first substrate, or can also be such as figure
Shown in 1, touch control electrode 1223 can be located at black matrix 1222 close to 11 side of first substrate.
As shown in Fig. 2, display panel includes viewing area AA and non-display area BA, wherein luminescence unit 1121 is located at viewing area
AA, 1121 (not shown) of luminescence unit are correspondingly arranged with color blocking 1221, in the viewing of face display panel, luminescence unit
1121 are located at the lower section of color blocking 1221.Black matrix 1222 has multiple second opening K2, the second opening K2 exposure color blocking 1221, hair
The light that light unit 1121 issues penetrates second opening K2 outgoing of the color blocking 1221 from black matrix 1222.
Display panel provided by the invention can make first substrate and the second substrate in production respectively, then again by the
One substrate and the second substrate contraposition fitting.For example when making first substrate, the first flexible substrate is made first, then first
Display layer is made in flexible substrate, encapsulated layer is then made on display layer, wherein the effect of encapsulated layer is prevented in display layer
Infringement of the luminescence unit by water oxygen, guarantee the service life of luminescence unit.For example it when making the second substrate, makes first
Then second flexible substrate makes touch-control coloured silk film composite layer, wherein black matrix can be made first, so in the second flexible substrate
Color blocking is made after black matrix technique afterwards, then makes touch control electrode layer.Finally by the first substrate to complete and second
Substrate is bonded.
Rotatory polarization piece can be all provided in conventional display

panel to reduce the reflection of environment light, but prior art system
The rotatory polarization piece of work is multiple film layer structure, and thickness is thick usually in 100 μm, extra-thin rotatory polarization piece thickness also at 70 μm or so
Degree is thicker, is unfavorable for the slimming of display panel, and rotatory polarization piece brittleness is big, influences display panel pliability.And it is of the invention
In the display panel of offer, the function of preventing the reflection of environment light is played instead of rotatory polarization piece using color blocking, color blocking thickness is usual
No more than 20 μm, color blocking thickness is far smaller than the thickness of rotatory polarization piece, is conducive to being thinned for display panel thickness, does not use brittleness
Big rotatory polarization piece is also beneficial to promote the pliability of display panel.Touch-control coloured silk film composite layer, touch-control electricity are provided in the present invention
Pole is integrated with color blocking and black matrix, and the touch control electrode thicknesses of layers made of Metal Mesh material is thin, Neng Goujin
One step is conducive to the slimming of display panel.In addition, the orthographic projection of black matrix plane where touch control electrode covers in the present invention
Touch control electrode, the design of touch control electrode will not influence display panel aperture opening ratio in touch-control coloured silk film composite layer.
Optionally, touch control electrode can be located at black matrix close to first substrate side, namely from display panel in the present invention
Display surface viewing when touch control electrode be located at the lower section of black matrix, line position can be walked to avoid touch control electrode in display panel and is generated
Reflection of ambient light influences visual effect when display panel display.
Fig. 3 is a kind of optional embodiment film layer structure figure of display

panel provided in an embodiment of the present invention.Such as Fig. 3 institute
Show, the first flexible substrate 111 includes array layer 1111, and array layer 1111 includes multiple thin film transistor (TFT) T, and thin film transistor (TFT) T makees
For the switching device of pixel in display panel.Thin film transistor (TFT) T includes active layer T1, source electrode T2, drain electrode T3 and grid T4, Fig. 3
In exemplary representation is only carried out with the thin film transistor (TFT) T of top gate structure, it should be noted that thin film transistor (TFT) T can also in the present invention
To be bottom grating structure.Luminescence unit 1121 is organic luminescence display unit in display layer 112, and luminescence unit includes anode a, shines
Layer b and cathode c, is only illustrated by taking the luminescence unit structure of top emitting in Fig. 3 as an example, in this structure Anodic a as reflection
Electrode generallys use metal material production, can be by Ag, Mg, Al, Pt, Pd, Au, Ni, Nd, Ir, Cr or their mixture
It is formed;Luminescent layer b may include red light emitting layer, green light emitting layer, blue light-emitting layer or white light-emitting layer;Cathode c is transparent
Electrode may include tin indium oxide (ITO), indium zinc oxide (IZO), zinc oxide (ZnO) or indium oxide (In2O3) etc. materials;Anode
The luminescent layer b light emitted effectively can be reflected into light emission side by a, improve light extraction efficiency.Anode a in luminescence unit 1121 with
The source electrode T2 or drain electrode T3 of thin film transistor (TFT) T is electrically connected, and the drain electrode T3 of anode a Yu thin film transistor (TFT) T are schematically shown in Fig. 3
Electrical connection.
Shown in continuing to refer to figure 1, pixel defining layer 1122 is made of light absorbent.The making material packet of pixel defining layer

Include chromium, chromium oxide, chromium nitride, black organic material, modified organic material or photochromic material.The production of pixel defining layer

Material may include one or more, such as or chromium oxide/chromium nitride/chromium composition composite material, above-mentioned material is equal

The effect that light realizes shading antireflection can be absorbed, the light for preventing luminescence unit from issuing is emitted to adjacent luminescence unit,

Cause colour mixture.

Optionally, display panel provided by the invention, the color blocking in touch-control coloured silk film composite layer may include transparent color blocking, show

Show that the luminescence unit in layer includes emitting red light unit, blue-light-emitting unit and green emitting unit, wherein each shines single First top is correspondingly arranged a transparent color blocking.

Optionally, display panel provided by the invention, the color blocking in touch-control coloured silk film composite layer may include red resistance, blue

Resistance and green resistance.In one embodiment, white light can be issued with the one-to-one luminescence unit of color blocking in display layer, so

White light is emitted feux rouges, blue light and green light after penetrating red resistance, blue resistance and green resistance accordingly afterwards;In another embodiment

In, the luminescence unit in display layer includes emitting red light unit, blue-light-emitting unit and green emitting unit, and red resistance is located at red

On color luminescence unit, blue resistance is located on blue-light-emitting unit, and green resistance is located on green emitting unit, i.e., identical face

The luminescence unit and color blocking of color are arranged in a one-to-one correspondence.

Fig. 4 is another optional embodiment film layer structure figure of display panel provided in an embodiment of the present invention.Such as Fig. 4 institute
Show, luminescence unit 1121 includes at least emitting red light unit 1121R, blue-light-emitting unit 1121B and green emitting unit
1121G, color blocking 1221 include at least red resistance 1221R, blue resistance 1221B and green resistance 1221G;Red resistance 1221R is located at red
On color luminescence unit 1121R, blue resistance 1221B is located on blue-light-emitting unit 1121B, and green resistance 1221G is located at green
On luminescence unit 1121G, i.e. the luminescence unit of same color and color blocking list is arranged in a one-to-one correspondence.
After inventor is it has furthermore been found that replace polaroid using color blocking, it is thinned display panel thickness, but is being regarded greatly
There may be colour mixture risks under angle.With continued reference to shown in Fig. 4, under big visual angle (angle of vertical direction is θ in visual angle and figure),
There may be the light of emitting red light unit 1121R sending from the green emitting unit adjacent with emitting red light unit 1121R
The top of 1121G is emitted, i.e. red light penetration green resistance 1221G outgoing, and leads to colour mixture.Based on this, inventor is further
It is proposed solution, it can be by being adjusted to the organic layer thickness between color blocking and luminescence unit or by display surface
The width of black matrix is adjusted in plate, to reduce colour mixture risk under big visual angle.
In one embodiment, it in order to improve big visual angle colour mixture problem, can be thinned between color blocking and luminescence unit
Thicknesses of layers.At least provided with one layer of inorganic layer and one layer of organic layer between luminescence unit and color blocking,

perpendicular to display surface

On plate direction, inorganic layer with a thickness of dIt is inorganic, organic layer with a thickness of dIt is organic,

Wherein, LPDLFor on the light-emitting surface of luminescence unit, adjacent two

The width of pixel defining layer between luminescence unit, LBMThe width of black matrix between two adjacent color blockings.

Fig. 5 is the light path schematic diagram that luminescence unit emits beam in display panel.As shown in figure 5, with color blocking 1221 and hair

It include for an an organic layer C1 and inorganic layer C2 between light unit 1121, light is propagated between different media and can be sent out

Raw refraction, changes optical path.Luminescence unit 1121 initially enters inorganic layer C2 after emitting beam, the refraction angle into inorganic layer C2 is

θ 1, then entering the refraction angle of organic layer C1 from inorganic layer C2 is θ 2, then enters color blocking 1221, color blocking 1221 from organic layer C1

It is equally made of organic material, so light enters color blocking 1221 and refraction do not occur substantially (or refractive index very little is neglected herein

Slightly), it is θ 3 that then light, which is emitted from color blocking 1221 into the refraction angle of the second flexible substrate 121,.When refraction angle θ 3 is less than second

When the critical angle of flexible substrate 121, light can penetrate the outgoing of the second flexible substrate 121, and when refraction angle θ 3 is greater than or equal to the

When the critical angle of two flexible substrates 121, light can be totally reflected in the second flexible substrate 121.Inventor thinks can be from

The angle thinking for being totally reflected light inside display panel, to improve big visual angle colour mixture problem.

In the present invention the second flexible substrate can using the organic materials production such as polyimides, inventor through test of many

times and
Great mass of data is browsed, the critical angle for obtaining the second flexible substrate is about 36 °, and the refractive index n1 of the second flexible substrate is 1.7, is shown
Show that the refractive index n2 of organic layer C1 in panel is about 1.5, the refractive index n3 of inorganic layer C2 is about 1.8 in display panel.After
Continue refering to what is shown in Fig. 5, according to the law of refraction, it is known that in organic layer C1, inorganic layer C2 and the second refraction accordingly of flexible substrate 121
There are following relationships between angle:
As refraction angle θ 3=36 °, light is all-trans in the second flexible substrate 121
It penetrates, at this time θ 1=34 °, θ 2=42 °.
On perpendicular to display panel direction e, inorganic layer C2 with a thickness of dIt is inorganic, organic layer C1 with a thickness of dIt is organic, color blocking
The distance between 1221 and luminescence unit 1121 are d, then d=dIt is organic+dIt is inorganic□
As shown in figure 5, L represents the offset distance of light, i.e., in sectional view, from the light of the outgoing of luminescence unit 1121
To the distance that when color blocking direction outgoing adjacent thereto, optical path is horizontally offset from, wherein can be calculated according to Pythagorean theorem
L1 and L2, L=L1+L2,
Then L=dIt is organic*tanθ2+dIt is inorganic*tanθ1□
In sectional view, when light is emitted from the right end of 1121 light-emitting surface of luminescence unit, through organic layer and inorganic layer
After refraction, being incident on the situation in color blocking 1221 from the figure and right side of black matrix 1222 is a critical condition, at this time inclined
Shifting distance L is smallest offset distance.If the light with smallest offset

distance can be all-trans in the second flexible substrate
Penetrate, then the offset distance of light be greater than smallest offset apart from when, light also can necessarily be all-trans in the second flexible substrate
It penetrates, then solves the problems, such as the big visual angle colour mixture in display panel.
Fig. 6 is the section rough schematic view of display panel.As shown in fig. 6, luminous generally for guaranteeing in display panel
The width of black matrix as far as possible small will be arranged, between two adjacent luminescence units in the light extraction efficiency and aperture opening ratio of device as far as possible
Pixel defining layer sectional view substantially Fig. 6 in trapezoidal shape.The light-emitting surface of luminescence unit be luminescence unit structure most
The surface (with face M signal in figure) in outside, on light-emitting surface M, the width of the pixel defining layer between two adjacent luminescence units
Degree is LPDL.In sectional view, the width of the black matrix between two adjacent color blockings is LBM, wherein LPDLAnd LBMMeet as follows
Relationship:This formula is substituted into the calculation formula of above-mentioned offset distance L, is obtained:
Again because of L=dIt is organic*tanθ2+dIt is inorganic* tan θ 1, wherein tan θ 2 and tan θ 1 is definite value, works as dIt is inorganicSize is constant
When, dIt is organicBecome smaller, then offset distance L can become smaller, then with continued reference to shown in Fig. 5, when offset distance L is smallest offset distance
When, if offset distance L becomes smaller on the basis of smallest offset distance, light will be blocked by black matrix, and cannot be gone out from color blocking
It penetrates, so that there is no colour mixture problems.So being designed in the present inventionGuarantee dIt is organic
Become smaller in a certain range, solve colour mixture risk under big visual angle, while being also beneficial to being thinned for display panel

thickness.
Further, according to above-mentioned formula
It can obtain: LBM=1.8dIt is organic-LPDL+1.34dIt is inorganic, as shown in fig. 6, black square is arranged under normal conditions in display panel
The width L of battle arrayBMThe width L of < pixel defining layerPDL.Fig. 7 is a kind of rough schematic view of display panel provided by the invention.Such as Fig. 7
It is shown, in the case that thickness is constant between color blocking 1221 and luminescence unit 1121, if the width of black matrix 1222 increased,
I.e. in figure to the right extend a part, then light can be blocked by black matrix 1222, thus adjacent color blocking 1221 will not be penetrated and
Outgoing, and then colour mixture problem under big visual angle can be improved.The width of the black matrix between two adjacent color blockings is designed in the present invention
Degree is LBMMeet following condition, 1.8dIt is organic-LPDL+1.34dIt is inorganic≤LBM≤LPDL, guarantee to improve the same of colour mixture problem under big visual angle
When, the influence to the aperture opening ratio of display panel is smaller.
Fig. 8 is another optional embodiment film layer structure figure of display panel provided in an embodiment of the present invention.Such as Fig. 8 institute
Show, be provided with optical cement 13 between encapsulated layer 113 and touch-control coloured silk film composite layer 122, first substrate 11 is realized by optical cement 12
With the fixation of the second substrate 12.It optionally, further include planarization layer 123 in the second substrate 12, when making the second substrate 12,
Planarization layer 123 is made on touch-control coloured silk film composite layer 122 after completing the production of touch-control coloured silk film composite layer 122, is provided one and is put down
Smooth surface can fit closely when guaranteeing that first substrate 11

and the second substrate 12 are bonded and guarantee display panel structure stability.

Wherein, optical cement 13 and planarization layer 123 generally use organic material production, in order to improve the big visual angle of display panel

Light mixing problem, by the production of the thicknesses of layers of optical cement 13 and planarization layer 123 as far as possible than relatively thin when production, such as in a kind of reality

It applies in example, the thickness of optical cement 13 is about 2 μm or so, and planarization layer 123 is about 3 μm or so.

In some alternative embodiments, the encapsulated layer of display panel includes at least one inorganic encapsulated layer and at least one

A organic encapsulation layer.Wherein, inorganic encapsulated layer density can effectively obstruct well water oxygen, and organic encapsulation layer has soft well

Toughness, inorganic encapsulated layer and organic encapsulation layer combine, and when display panel is bent, organic encapsulation layer can alleviate inorganic envelope

The folding s tress that layer is born is filled, prevents inorganic encapsulated layer from cracking, influences packaging effect.

In one embodiment, encapsulated layer includes two inorganic encapsulated layers and at least one organic encapsulation layer.Fig. 9 is this hair

Another optional embodiment film layer structure figure for the display panel that bright embodiment provides.As shown in figure 9, encapsulated layer 113 includes

Two inorganic encapsulated layers 1131 and at least one organic encapsulation layer 1132.Organic encapsulation layer 1132 is located at two inorganic encapsulated layers

Between 1131.Optionally, in order to improve the big visual angle light mixing problem of display panel, in the premise for guaranteeing display panel packaging effect

Under, 1 μm or so can be set by the thickness of inorganic encapsulated

layer.It can be incited somebody to action in the case where meeting the formula in above-described embodiment
The thickness of organic encapsulation layer is thinned.
Figure 10 is another optional embodiment film layer structure figure of display panel provided in an embodiment of the present invention.Such as Figure 10
It is shown, on perpendicular to display panel direction, blue resistance 1221B with a thickness of d1, red resistance 1221R with a thickness of d2, green
Hinder 1221G with a thickness of d3, wherein d1 < d2, and d1 < d3.Light, which penetrates any film layer, can all generate certain light loss, but light
Transmitance has differences when line penetrates the color blocking of different colours, and the thickness of setting blue resistance is less than the thickness of green resistance in the present invention
Degree, by the way that the thickness of blue resistance is thinned, to increase the transmitance that light penetrates blue resistance, guarantees aobvious again smaller than the thickness of red resistance
Show that the transmitance of blue ray in panel, red light and green light is roughly the same.
By taking color blocking is with a thickness of 2.2 μm as an example, it is about 80%-90% that light, which penetrates red resistance and the transmitance of green resistance,
The transmitance that light penetrates blue resistance is about 70%.In one embodiment, the thickness of red resistance and green resistance are with a thickness of 2.2
μm, and blue resistance with a thickness of 1 μm, light penetrate blue resistance transmitance be about 77%, embodiment provided by the invention, increase
Big light penetrates the transmitance of blue resistance, guarantees the transmitance of blue ray, red light and green light in display panel
It is roughly the same, so that whole transmitance is relatively uniform in display panel.
Optionally, 1.0 μm≤d1≤2.0 μm, 1.5 μm≤d2≤2.5 μm, 1.5 μm≤d3≤2.5 μm.It is

set in the present invention
The thickness for setting blue resistance is less than the thickness of green resistance, again smaller than the thickness of red resistance, the thickness of the thickness of green resistance and red resistance
It can be the same or different, environment light can be absorbed in the setting of color blocking simultaneously in the present invention, reduces reflectivity, is thinned in setting
When the thickness increasing light of blue resistance penetrates the penetrance of blue resistance, while the thickness for avoiding blue from hindering is excessively thin, and to reflect
Rate increases, and influences display effect.Consider the shadow to penetrance and reflectivity when the thickness of color blocking simultaneously in display panel is set
It rings.
Based on the same inventive concept, the present invention also provides a kind of display device, Figure 11 is provided in an embodiment of the present invention aobvious
Showing device schematic diagram, as shown in figure 11, display device include the display panel 100 that above-mentioned any embodiment provides.The present invention mentions
The display device of confession includes but is not limited to following classification: television set, laptop, desktop displays, tablet computer, number
Camera, mobile phone, Intelligent bracelet, intelligent glasses, Vehicular display device, Medical Devices, industrial control equipment, touch interactive terminal etc..
Based on the same inventive concept, the present invention also provides a kind of production method of display panel, Figure 12 is that the present invention is implemented
The display panel production method flow chart that example provides.As shown in figure 12, production method includes:
Step S101: the first flexible substrate is made in the first support plate;
Step S102: making display layer in the first flexible substrate, and display

layer includes multiple luminescence units, and display layer also wraps
Pixel defining layer is included, pixel defining layer has multiple first openings, and luminescence unit is located in the first opening;
Step S103: making encapsulated layer on display layer, obtains the first substrate with the first support plate;
Step S104: the second flexible substrate is made in the second support plate;
Step S105: making touch-control coloured silk film composite layer in the second flexible substrate, obtains second with the second support plate
Substrate;Wherein, touch-control coloured silk film composite layer includes: black matrix, color blocking and touch control electrode, and black matrix has multiple second openings, the
Two openings include color blocking, and touch control electrode is made of Metal Mesh material, the positive throwing of black matrix plane where touch control electrode
Shadow covers touch control electrode;
Step S106: the first substrate with the first support plate and the second substrate with the second support plate are aligned
Fitting;
Step S107: the first support plate of laser lift-off and the second support plate.
It can be referred in the present invention using the display panel of production method provided by the invention production arbitrarily about display surface
The embodiment explanation of plate.When making display panel, the first substrate and the second substrate for having support plate are made respectively first, when
First substrate and the second substrate contraposition are bonded and then using the corresponding support plates of laser lift-off, and manufacture craft is mature.The present invention
The display panel production method of offer, the function of preventing the reflection of environment light is played using color blocking instead of rotatory polarization piece, and color blocking is thick

Typically not greater than 20 μm of degree, color blocking thickness is far smaller than the thickness of rotatory polarization piece, is conducive to being thinned for display panel thickness, and
The rotatory polarization piece for not using brittleness big is also beneficial to promote the pliability of display panel.Production has touch-control coloured silk film compound in the present invention
Layer, touch control electrode are integrated with color blocking and black matrix, the touch control electrode thicknesses of layers made of Metal Mesh material
It is thin, it can further be conducive to the slimming of display panel.In addition, plane is being just where touch control electrode for black matrix in the present invention
Projection covers touch control electrode, and the design of touch control electrode will not influence display panel aperture opening ratio in touch-control coloured silk film composite layer.
Through the foregoing embodiment it is found that display panel provided by the invention and preparation method thereof and display device, at least in fact
Showed it is following the utility model has the advantages that
It invents in the display panel provided, plays the function of preventing the reflection of environment light instead of rotatory polarization piece using color blocking,
Color blocking thickness is typically not greater than 20 μm, and color blocking thickness is far smaller than the thickness of rotatory polarization piece, is conducive to subtracting for display panel thickness
Thin, the rotatory polarization piece for not using brittleness big is also beneficial to promote the pliability of display panel.Touch-control coloured silk film is provided in the present invention
Composite layer, touch control electrode are integrated with color blocking and black matrix, the touch control electrode film layer made of Metal Mesh material
Thickness is thin, can further be conducive to the slimming of display panel.In addition, black matrix plane where touch control electrode in the

present invention
Orthographic projection cover touch control electrode, the design of touch control electrode will not influence display panel aperture opening ratio in touch-control coloured silk film composite layer.
Although some specific embodiments of the invention are described in detail by example, the skill of this field
Art personnel it should be understood that example above merely to being illustrated, the range being not intended to be limiting of the invention.The skill of this field
Art personnel are it should be understood that can without departing from the scope and spirit of the present invention modify to above embodiments.This hair
Bright range is defined by the following claims.

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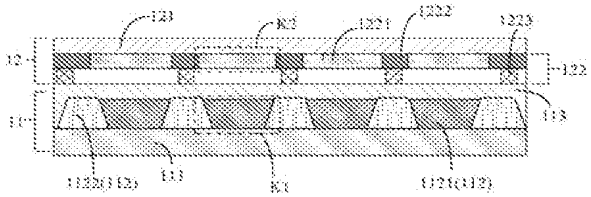
权利要求书2页 说明书8页 附图7页

(54)发明名称

显示面板及其制作方法和显示装置

(57)摘要

本发明公开了一种显示面板及其制作方法和显示装置。显示面板包括:相对设置的第一基板和第二基板;第一基板包括依次设置的第一柔性衬底、显示层和封装层,显示层包括多个发光单元,显示层还包括像素定义层,像素定义层具有多个第一开口,发光单元位于第一开口内;第二基板包括:第二柔性衬底和触控彩膜复合层,触控彩膜复合层位于第二柔性衬底靠近封装层一侧;触控彩膜复合层包括:色阻,在垂直于显示面板方向上,色阻与发光单元对应设置;黑矩阵,黑矩阵具有多个第二开口,第二开口暴露色阻;在垂直于显示面板方向上,黑矩阵在触控电极所在平面的正投影覆盖触控电极,触控电极采用Metal Mesh材料制作。本发明有利于显示面板薄型化,提升可挠性。



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1.一种显示面板，其特征在于，包括：相对设置的第一基板和第二基板；

所述第一基板包括依次设置的第一柔性衬底、显示层和封装层，其中，所述显示层包括多个发光单元，所述显示层还包括像素定义层，所述像素定义层具有多个第一开口，所述发光单元位于所述第一开口内；

所述第二基板包括：第二柔性衬底和触控彩膜复合层，所述触控彩膜复合层位于所述第二柔性衬底靠近所述封装层一侧；其中，所述触控彩膜复合层包括：

色阻，在垂直于所述显示面板方向上，所述色阻与所述发光单元对应设置；

黑矩阵，所述黑矩阵具有多个第二开口，所述第二开口暴露所述色阻；

触控电极，在垂直于所述显示面板方向上，所述黑矩阵在所述触控电极所在平面的正投影覆盖所述触控电极，所述触控电极采用Metal Mesh材料制作。

2.根据权利要求1所述的显示面板，其特征在于，

在所述发光单元和所述色阻之间至少设置有一层无机层和一层有机层，在垂直于所述显示面板方向上，所述无机层的厚度为$d_{无机}$，所述有机层的厚度为$d_{有机}$，

$0<d_{有机}\leq\frac{L_{PDL}+L_{BM}-1.34d_{无机}}{1.8}$，其中，

L_{PDL}为在发光单元的出光面上，相邻的两个所述发光单元之间的所述像素定义层的宽度，L_{BM}为相邻的两个所述色阻之间的所述黑矩阵的宽度。

3.根据权利要求1所述的显示面板，其特征在于，

相邻的两个所述色阻之间的所述黑矩阵的宽度为L_{BM}；

$1.8d_{有机}-L_{PDL}+1.34d_{无机}\leqslant L_{BM}\leqslant L_{PDL}$，其中，

L_{PDL}为在发光单元的出光面上，相邻的两个所述发光单元之间的所述像素定义层的宽度；在所述发光单元和所述色阻之间至少设置有一层无机层和一层有机层，$d_{无机}$为所述无机层在垂直于所述显示面板方向上的厚度，$d_{有机}$为所述有机层在垂直于所述显示面板方向上的厚度。

4.根据权利要求1所述的显示面板，其特征在于，

所述封装层和所述触控彩膜复合层之间设置有光学胶，通过所述光学胶实现所述第一基板和所述第二基板的固定。

5.根据权利要求1所述的显示面板，其特征在于，

所述像素定义层采用吸光材料制作。

6.根据权利要求1所述的显示面板，其特征在于，

所述封装层包括至少一个无机封装层和至少一个有机封装层。

7.根据权利要求1所述的显示面板，其特征在于，

所述发光单元至少包括红色发光单元、蓝色发光单元和绿色发光单元，所述色阻至少包括红色阻、蓝色阻和绿色阻；

所述红色阻位于所述红色发光单元之上，所述蓝色阻位于所述蓝色发光单元之上，所述绿色阻位于所述绿色发光单元之上。

8.根据权利要求7所述的显示面板，其特征在于，

在垂直于所述显示面板方向上，所述蓝色阻的厚度为d1、所述红色阻的厚度为d2、所述绿色阻的厚度为d3，其中，$d1<d2$，且$d1<d3$。

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9.根据权利要求8所述的显示面板，其特征在于，

1.0μm≤d1≤2.0μm，1.5μm≤d2≤2.5μm，1.5μm≤d3≤2.5μm。

10.一种显示装置，其特征在于，包括权利要求1至9任一项所述的显示面板。

11.一种显示面板的制作方法，其特征在于，所述制作方法包括：

在第一支撑板上制作第一柔性衬底；

在所述第一柔性衬底上制作显示层，所述显示层包括多个发光单元，所述显示层还包括像素定义层，所述像素定义层具有多个第一开口，所述发光单元位于所述第一开口内；

在所述显示层之上制作封装层，得到带有所述第一支撑板的第一基板；

在第二支撑板上制作第二柔性衬底；

在所述第二柔性衬底上制作触控彩膜复合层，得到带有所述第二支撑板的第二基板；其中，所述触控彩膜复合层包括：黑矩阵、色阻和触控电极，所述黑矩阵具有多个第二开口，所述第二开口包括所述色阻，所述触控电极采用Metal Mesh材料制作，所述黑矩阵在所述触控电极所在平面的正投影覆盖所述触控电极；

将带有所述第一支撑板的第一基板和带有所述第二支撑板的第二基板进行对位贴合；

激光剥离所述第一支撑板和所述第二支撑板。

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显示面板及其制作方法和显示装置

技术领域

[0001] 本发明涉及显示技术领域，更具体地，涉及一种显示面板及其制作方法和显示装置。

背景技术

[0002] 现有的显示装置技术中，显示面板主要分为液晶显示面板和有机发光显示面板两种主流的技术。其中，液晶显示面板通过在像素电极和公共电极上施加电压，形成能够控制液晶分子偏转的电场，进而控制光线的透过实现显示面板的显示功能；有机发光显示面板采用有机电致发光材料，当有电流通过有机电致发光材料时，发光材料就会发光，进而实现了显示面板的显示功能。

[0003] 有机发光显示面板具有自发光、超薄、高对比度、超广视角、低功率消耗、显示亮度高、色彩鲜艳，并且能够制作柔性显示等优点成为时下关注的重点。目前轻薄型显示面板和显示装置已成为未来显示技术发展的方向。

[0004] 因此，提供一种薄型化的显示面板及其制作方法和显示装置，是本领域亟待解决的技术问题。

发明内容

[0005] 有鉴于此，本发明提供了一种显示面板及其制作方法和显示装置，解决了上述技术问题。

[0006] 第一方面，为了解决上述问题，本发明提供一种显示面板，包括：相对设置的第一基板和第二基板；

[0007] 第一基板包括依次设置的第一柔性衬底、显示层和封装层，其中，显示层包括多个发光单元，显示层还包括像素定义层，像素定义层具有多个第一开口，发光单元位于第一开口内；

[0008] 第二基板包括：第二柔性衬底和触控彩膜复合层，触控彩膜复合层位于第二柔性衬底靠近封装层一侧；其中，触控彩膜复合层包括：

[0009] 色阻，在垂直于显示面板方向上，色阻与发光单元对应设置；

[0010] 黑矩阵，黑矩阵具有多个第二开口，第二开口暴露色阻；

[0011] 触控电极，在垂直于显示面板方向上，黑矩阵在触控电极所在平

[0012] 面的正投影覆盖触控电极，触控电极采用Metal Mesh材料制作。

[0013] 第二方面，为了解决上述问题，本发明提供一种显示装置，包括本发明提出的任意一种显示面板。

[0014] 第三方面，为了解决上述问题，本发明提供一种显示面板的制作方法，包括：

[0015] 在第一支撑板上制作第一柔性衬底；

[0016] 在第一柔性衬底上制作显示层，显示层包括多个发光单元，显示层还包括像素定义层，像素定义层具有多个第一开口，发光单元位于第一开口内；

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[0017] 在显示层之上制作封装层，得到带有第一支撑板的第一基板；

[0018] 在第二支撑板上制作第二柔性衬底；

[0019] 在第二柔性衬底上制作触控彩膜复合层，得到带有第二支撑板的第二基板；其中，触控彩膜复合层包括：黑矩阵、色阻和触控电极，黑矩阵具有多个第二开口，第二开口包括色阻，触控电极采用Metal Mesh材料制作，黑矩阵在触控电极所在平面的正投影覆盖触控电极；

[0020] 将带有第一支撑板的第一基板和带有第二支撑板的第二基板进行对位贴合；

[0021] 激光剥离第一支撑板和第二支撑板。

[0022] 与现有技术相比，本发明提供的显示面板及其制作方法和显示装置，至少实现了如下的有益效果：

[0023] 发明提供的显示面板中，采用色阻代替圆偏光片起到防止环境光的反射的功能，色阻厚度通常不超过20μm，色阻厚度远远小于圆偏光片的厚度，有利于显示面板厚度的减薄，不采用脆性大的圆偏光片也有利于提升显示面板的可挠性。本发明中设置有触控彩膜复合层，触控电极与色阻和黑矩阵集成在一起，采用Metal Mesh材料制作的触控电极膜层厚度薄，能够进一步有利于显示面板的薄型化，提升可挠性。另外，本发明中黑矩阵在触控电极所在平面的正投影覆盖触控电极，触控彩膜复合层中触控电极的设计不会影响显示面板开口率。

[0024] 当然，实施本发明的任一产品必不特定需要同时达到以上所述的所有技术效果。

[0025] 通过以下参照附图对本发明的示例性实施例的详细描述，本发明的其它特征及其优点将会变得清楚。

附图说明

[0026] 被结合在说明书中并构成说明书的一部分的附图示出了本发明的实施例，并且连同其说明一起用于解释本发明的原理。

[0027] 图1为本发明实施例提供的显示面板的膜层结构图；

[0028] 图2为本发明实施例提供的显示面板的俯视示意图；

[0029] 图3为本发明实施例提供的显示面板的一种可选实施方式膜层结构图；

[0030] 图4为本发明实施例提供的显示面板的另一种可选实施方式膜层结构图；

[0031] 图5为显示面板中发光单元发出光线的光路示意图；

[0032] 图6为显示面板的截面简化示意图；

[0033] 图7为本发明提供的显示面板一种简化示意图；

[0034] 图8为本发明实施例提供的显示面板的另一种可选实施方式膜层结构图；

[0035] 图9为本发明实施例提供的显示面板的另一种可选实施方式膜层结构图；

[0036] 图10为本发明实施例提供的显示面板的另一种可选实施方式膜层结构图；

[0037] 图11为本发明实施例提供的显示装置示意图；

[0038] 图12为本发明实施例提供的显示面板制作方法流程图。

具体实施方式

[0039] 现在将参照附图来详细描述本发明的各种示例性实施例。应注意到：除非另外具

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体说明，否则在这些实施例中阐述的部件和步骤的相对布置、数字表达式和数值不限制本发明的范围。

[0040] 以下对至少一个示例性实施例的描述实际上仅仅是说明性的，决不作为对本发明及其应用或使用的任何限制。

[0041] 对于相关领域普通技术人员已知的技术、方法和设备可能不作详细讨论，但在适当情况下，所述技术、方法和设备应当被视为说明书的一部分。

[0042] 在这里示出和讨论的所有例子中，任何具体值应被解释为仅仅是示例性的，而不是作为限制。因此，示例性实施例的其它例子可以具有不同的值。

[0043] 应注意到：相似的标号和字母在下面的附图中表示类似项，因此，一旦某一项在一个附图中被定义，则在随后的附图中不需要对其进行进一步讨论。

[0044] 图1为本发明实施例提供的显示面板的膜层结构图。图2为本发明实施例提供的显示面板的俯视示意图。

[0045] 如图1所示，显示面板包括：相对设置的第一基板11和第二基板12；第一基板11包括依次设置的第一柔性衬底111、显示层112和封装层113，其中，显示层112包括多个发光单元1121，显示层112还包括像素定义层1122，像素定义层1122具有多个第一开口K1，发光单元1121位于第一开口K1内。第二基板12包括：第二柔性衬底121和触控彩膜复合层122，触控彩膜复合层122位于第二柔性衬底121靠近封装层113一侧；其中，触控彩膜复合层122包括：色阻1221，在垂直于显示面板方向上，色阻1221与发光单元1121对应设置；黑矩阵1222，黑矩阵1222具有多个第二开口K2，第二开口K2暴露色阻1221；触控电极1223，在垂直于显示面板方向上，黑矩阵1222在触控电极1223所在平面的正投影覆盖触控电极1223，触控电极1223采用Metal Mesh材料制作。Metal Mesh即金属网格，其阻抗低，导电性能好，采用其制作的导电层能够比常规的铟锡氧化物制作的导电层更薄。图1中触控彩膜复合层122仅是示意性表示，其中，触控电极1223可以位于黑矩阵1222远离第一基板11一侧，或者也可以如图1中示出的，触控电极1223可以位于黑矩阵1222靠近第一基板11一侧。

[0046] 如图2所示，显示面板包括显示区AA和非显示区BA，其中发光单元1121位于显示区AA，发光单元1121(图中未示出)与色阻1221对应设置，在正对显示面板观看时，发光单元1121位于色阻1221的下方。黑矩阵1222具有多个第二开口K2，第二开口K2暴露色阻1221，发光单元1121发出的光线穿透色阻1221从黑矩阵1222的第二开口K2出射。

[0047] 本发明提供的显示面板在制作时可以分别制作第一基板和第二基板，然后再将第一基板和第二基板对位贴合。比如在制作第一基板时，首先制作第一柔性衬底，然后在第一柔性衬底上制作显示层，然后在显示层上制作封装层，其中，封装层的作用是防止显示层中的发光单元受到水氧的侵害，保证发光单元的使用寿命。比如在制作第二基板时，首先制作第二柔性衬底，然后在第二柔性衬底上制作触控彩膜复合层，其中可以首先制作黑矩阵，然后在黑矩阵工艺之后制作色阻，然后制作触控电极层。最后将制作完成的第一基板和第二基板进行贴合。

[0048] 在常规的显示面板中都会设置有圆偏光片以减少环境光的反射，但是现有技术制作的圆偏光片为多膜层结构，厚度通常在100μm、超薄型的圆偏光片厚度也在70μm左右，厚度较厚，不利于显示面板的薄型化，并且圆偏光片脆性大，影响显示面板可挠性。而本发明提供的显示面板中，采用色阻代替圆偏光片起到防止环境光的反射的功能，色阻厚度通常

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不超过20μm，色阻厚度远远小于圆偏光片的厚度，有利于显示面板厚度的减薄，不采用脆性大的圆偏光片也有利于提升显示面板的可挠性。本发明中设置有触控彩膜复合层，触控电极与色阻和黑矩阵集成在一起，采用Metal Mesh材料制作的触控电极膜层厚度薄，能够进一步有利于显示面板的薄型化。另外，本发明中黑矩阵在触控电极所在平面的正投影覆盖触控电极，触控彩膜复合层中触控电极的设计不会影响显示面板开口率。

[0049] 可选的，本发明中触控电极可以位于黑矩阵靠近第一基板一侧，也即从显示面板的显示面观看时触控电极位于黑矩阵的下方，可以避免显示面板中触控电极走线位置产生环境光反射，影响显示面板显示时视觉效果。

[0050] 图3为本发明实施例提供的显示面板的一种可选实施方式膜层结构图。如图3所示，第一柔性衬底111包括阵列层1111，阵列层1111包括多个薄膜晶体管T，薄膜晶体管T作为显示面板中像素的开关器件。薄膜晶体管T包括有源层T1、源极T2、漏极T3和栅极T4，图3中仅以顶栅结构的薄膜晶体管T进行示例性表示，需要说明的是本发明中薄膜晶体管T也可以是底栅结构。显示层112中发光单元1121为有机发光显示单元，发光单元包括阳极a、发光层b和阴极c，仅以图3中顶发射的发光单元结构为例进行说明，在此结构中阳极a作为反射电极，通常采用金属材料制作，可以由Ag、Mg、Al、Pt、Pd、Au、Ni、Nd、Ir、Cr或者它们的混合物形成；发光层b可以包含红色发光层、绿色发光层、蓝色发光层或白色发光层；阴极c为透明电极，可以包括氧化铟锡(ITO)、氧化铟锌(IZO)、氧化锌(ZnO)或氧化铟(In_2O_3)等材料；阳极a可以有效的将发光层b发射的光反射到出光侧，提高出光效率。发光单元1121中的阳极a与薄膜晶体管T的源极T2或者漏极T3电连接，图3中示意性表示阳极a与薄膜晶体管T的漏极T3电连接。

[0051] 继续参考图1所示，像素定义层1122采用吸光材料制作。像素定义层的制作材料包括铬、氧化铬、氮化铬、黑色有机材料、改性有机材料或者光致变色材料。像素定义层的制作材料可以包括一种或多种，例如也可以为氧化铬/氮化铬/铬组成的复合材料，上述材料均能够吸收光线实现遮光防反射的效果，防止发光单元发出的光线向相邻的发光单元出射，造成混色。

[0052] 可选的，本发明提供的显示面板，触控彩膜复合层中的色阻可以包括透明色阻，显示层中的发光单元包括红色发光单元、蓝色发光单元和绿色发光单元，其中，每一个发光单元上方对应设置一个透明色阻。

[0053] 可选的，本发明提供的显示面板，触控彩膜复合层中的色阻可以包括红色阻、蓝色阻和绿色阻。在一种实施例中，显示层中与色阻一一对应的发光单元可以发出白色光线，然后白色光线穿透红色阻、蓝色阻和绿色阻后相应的出射红光、蓝光和绿光；在另一种实施例中，显示层中的发光单元包括红色发光单元、蓝色发光单元和绿色发光单元，红色阻位于红色发光单元之上，蓝色阻位于蓝色发光单元之上，绿色阻位于绿色发光单元之上，即相同颜色的发光单元和色阻一一对应设置。

[0054] 图4为本发明实施例提供的显示面板的另一种可选实施方式膜层结构图。如图4所示，发光单元1121至少包括红色发光单元1121R、蓝色发光单元1121B和绿色发光单元1121G，色阻1221至少包括红色阻1221R、蓝色阻1221B和绿色阻1221G；红色阻1221R位于红色发光单元1121R之上，蓝色阻1221B位于蓝色发光单元1121B之上，绿色阻1221G位于绿色发光单元1121G之上，即相同颜色的发光单元和色阻单一一对应设置。

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[0055] 发明人进一步发现，采用色阻代替偏光片之后，减薄了显示面板厚度，但是在大视角下可能存在混色风险。继续参考图4中所示，大视角下(视角与图中竖直方向的夹角为θ)，可能会存在红色发光单元1121R发出的光线从与红色发光单元1121R相邻的绿色发光单元1121G的上方出射，即红色光线穿透绿色阻1221G出射，而导致混色。基于此，发明人进一步提出解决方案，可以通过对色阻与发光单元之间的有机层厚度进行调整或者通过对显示面板中黑矩阵的宽度进行调整，以降低大视角下混色风险。

[0056] 在一种实施方式中，为了改善大视角混色问题，可以减薄色阻与发光单元之间的膜层厚度。在发光单元和色阻之间至少设置有一层无机层和一层有机层，在垂直于显示面板方向上，无机层的厚度为$d_{无机}$，有机层的厚度为$d_{有机}$，

[0057] $0<d_{有机}\leq\frac{L_{PDL}+L_{BM}-1.34d_{无机}}{1.8}$，其中，$L_{PDL}$为在发光单元的出光面上，相邻的两个发光单元之间的像素定义层的宽度，L_{BM}为相邻的两个色阻之间的黑矩阵的宽度。

[0058] 图5为显示面板中发光单元发出光线的光路示意图。如图5所示，以色阻1221与发光单元1121之间包括一个有机层C1和一个无机层C2为例，光线在不同的介质之间传播会发生折射，改变光路。发光单元1121发出光线后首先进入无机层C2，进入无机层C2的折射角为θ1，然后从无机层C2进入有机层C1的折射角为θ2，然后从有机层C1进入色阻1221，色阻1221同样采用有机材料制作，所以光线进入色阻1221基本不发生折射(或者折射率很小，此处忽略)，然后光线从色阻1221出射进入第二柔性衬底121的折射角为θ3。当折射角θ3小于第二柔性衬底121的临界角时，光线会穿透第二柔性衬底121出射，而当折射角θ3大于或等于第二柔性衬底121的临界角时，光线会在第二柔性衬底121内发生全反射。发明人认为可以从使光线在显示面板内部发生全反射的角度思考，来改善大视角混色问题。

[0059] 本发明中第二柔性衬底可以采用聚酰亚胺等有机材料制作，发明人经多次试验和翻阅大量资料，得到第二柔性衬底的临界角大约为36°，第二柔性衬底的折射率n1为1.7，显示面板中有机层C1的折射率n2大约为1.5，显示面板中无机层C2的折射率n3大约为1.8。继续参考图5所示，根据折射定律，可知在有机层C1、无机层C2和第二柔性衬底121相应的折射角之间存在如下关系：

[0060] $\frac{\sin\theta1}{\sin\theta2}=\frac{n2}{n3},\frac{\sin\theta2}{\sin\theta3}=\frac{n1}{n2}$，当折射角θ3＝36°，光线在第二柔性衬底121内发生全反射，此时θ1＝34°，θ2＝42°。

[0061] 在垂直于显示面板方向e上，无机层C2的厚度为$d_{无机}$，有机层C1的厚度为$d_{有机}$，色阻1221与发光单元1121之间的距离为d，则$d=d_{有机}+d_{无机}$。

[0062] 如图5所示，L代表光线的偏移距离，即在截面示图中，从发光单元1121出射的光线向与其相邻的色阻方向出射时，光路在水平方向上偏离的距离，其中，根据勾股定理可计算L1和L2，L＝L1+L2，

[0063] 则$L=d_{有机}*\tan\theta2+d_{无机}*\tan\theta1$。

[0064] 在截面图中，当光线从发光单元1121出光面的最右端出射，经有机层和无机层的折射后，从图中和黑矩阵1222的右侧入射到色阻1221内的情况为一个临界情况，此时的偏移距离L为最小偏移距离。如果具有最小偏移距离的光线能够在第二柔性衬底内发生全反射，则光线的偏移距离大于最小偏移距离时，光线也必然能够在第二柔性衬底内发生全反

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射，则解决了在显示面板中大视角混色问题。

[0065] 图6为显示面板的截面简化示意图。如图6所示，在显示面板中通常为了保证发光器件的出光效率和开口率，要尽量设置黑矩阵的宽度尽量的小，相邻的两个发光单元之间的像素定义层的截面图大致为图6中的梯形形状。发光单元的出光面为发光单元结构的最外侧的表面(图中以面M示意)，在出光面M上，相邻的两个发光单元之间的像素定义层的宽度为L_{PDL}。在截面图中，相邻的两个色阻之间的黑矩阵的宽度为L_{BM}，其中L_{PDL}和L_{BM}满足如下关系：$L=L_{PDL}-\frac{L_{PDL}-L_{BM}}{2}$，将此公式代入上述偏移距离L的计算公式中，得到：$d_{有机}=\frac{L_{PDL}+L_{BM}-1.34d_{无机}}{1.8}$。

[0066] 又因为，$L=d_{有机}*\tan\theta 2+d_{无机}*\tan\theta 1$，其中，$\tan\theta 2$和$\tan\theta 1$均为定值，当$d_{无机}$大小不变时，$d_{有机}$变小，则偏移距离L会变小，则继续参考图5中所示的，当偏移距离L为最小偏移距离时，偏移距离L在最小偏移距离基础上变小的话，光线就会被黑矩阵遮挡，而不能从色阻出射了，从而不会存在混色问题。所以，本发明中设计$0<d_{有机}\leq\frac{L_{PDL}+L_{BM}-1.34d_{无机}}{1.8}$，保证$d_{有机}$在一定范围内变小，解决了大视角下混色风险，同时也有利于显示面板厚度的减薄。

[0067] 进一步的，根据上述公式$d_{有机}=\frac{L_{PDL}+L_{BM}-1.34d_{无机}}{1.8}$，

[0068] 可得：$L_{BM}=1.8d_{有机}-L_{PDL}+1.34d_{无机}$，在显示面板中如图6所示，通常情况下设置黑矩阵的宽度L_{BM}<像素定义层的宽度L_{PDL}。图7为本发明提供的显示面板一种简化示意图。如图7所示，在色阻1221与发光单元1121之间厚度不变的情况下，如果将黑矩阵1222的宽度增大，即图中向右侧延长一部分，则光线会被黑矩阵1222遮挡，从而不会穿透相邻的色阻1221而出射，进而能够改善大视角下混色问题。本发明中设计相邻的两个色阻之间的黑矩阵的宽度为L_{BM}满足如下条件，$1.8d_{有机}-L_{PDL}+1.34d_{无机}\leq L_{BM}\leq L_{PDL}$，保证改善大视角下混色问题的同时，对显示面板的开口率的影响较小。

[0069] 图8为本发明实施例提供的显示面板的另一种可选实施方式膜层结构图。如图8所示，封装层113和触控彩膜复合层122之间设置有光学胶13，通过光学胶12实现第一基板11和第二基板12的固定。可选的，在第二基板12中还包括平坦化层123，在制作第二基板12时，完成触控彩膜复合层122的制作后在触控彩膜复合层122上制作平坦化层123，提供一个平坦的表面，保证第一基板11和第二基板12贴合时，能够紧密贴合保证显示面板结构稳定性。

[0070] 其中，光学胶13和平坦化层123通常采用有机材料制作，为了改善显示面板大视角混光问题，制作时将光学胶13和平坦化层123的膜层厚度制作的尽量比较薄，例如在一种实施例中，光学胶13的厚度大约为2μm左右，平坦化层123大约为3μm左右。

[0071] 在一些可选的实施方式中，显示面板的封装层包括至少一个无机封装层和至少一个有机封装层。其中，无机封装层密实性好能够有效的阻隔水氧，有机封装层具有很好的柔韧性，无机封装层和有机封装层结合，当显示面板发生弯折时，有机封装层能够缓解无机封装层承受的弯折应力，防止无机封装层产生裂纹，影响封装效果。

[0072] 在一种实施例中，封装层包括两个无机封装层和至少一个有机封装层。图9为本发明实施例提供的显示面板的另一种可选实施方式膜层结构图。如图9所示，封装层113包括

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两个无机封装层1131和至少一个有机封装层1132。有机封装层1132位于两个无机封装层1131之间。可选的，为了改善显示面板大视角混光问题，在保证显示面板封装效果的前提下，可以将无机封装层的厚度设置为1μm左右。在满足上述实施例中的公式的情况下可以将有机封装层的厚度减薄。

[0073] 图10为本发明实施例提供的显示面板的另一种可选实施方式膜层结构图。如图10所示，在垂直于显示面板方向上，蓝色阻1221B的厚度为d1、红色阻1221R的厚度为d2、绿色阻1221G的厚度为d3，其中，d1<d2，且d1<d3。光穿透任意膜层都会产生一定的光损失，但光线穿透不同颜色的色阻时透过率存在差异，本发明中设置蓝色阻的厚度小于绿色阻的厚度，也小于红色阻的厚度，通过减薄蓝色阻的厚度，来增大光穿透蓝色阻的透过率，保证显示面板中蓝色光线、红色光线和绿色光线的透过率大致相同。

[0074] 以色阻的厚度为2.2μm为例，光线穿透红色阻和绿色阻的透过率约为80%-90%，光线穿透蓝色阻的透过率约为70%。在一种实施例中，红色阻的厚度和绿色阻的厚度为2.2μm，而蓝色阻的厚度为1μm，光线穿透蓝色阻的透过率约为77%，本发明提供的实施方式，增大了光线穿透蓝色阻的透过率，保证显示面板中蓝色光线、红色光线和绿色光线的透过率大致相同，使得显示面板中整体透过率比较均匀。

[0075] 可选的，1.0μm≤d1≤2.0μm，1.5μm≤d2≤2.5μm，1.5μm≤d3≤2.5μm。本发明中设置蓝色阻的厚度小于绿色阻的厚度，也小于红色阻的厚度，绿色阻的厚度和红色阻的厚度可以相同也可以不同，本发明中色阻的设置同时可以吸收环境光，减少反射率，在设置减薄蓝色阻的厚度增大光线穿透蓝色阻的穿透率时，同时避免蓝色阻的厚度过薄，而使得反射率增大，影响显示效果。在设置显示面板中色阻的厚度时同时考量对穿透率和反射率的影响。

[0076] 基于同一发明构思，本发明还提供一种显示装置，图11为本发明实施例提供的显示装置示意图，如图11所示，显示装置包括上述任意实施例提供的显示面板100。本发明提供的显示装置包括但不限于以下类别：电视机、笔记本电脑、桌上型显示器、平板电脑、数码相机、手机、智能手环、智能眼镜、车载显示器、医疗设备、工控设备、触摸交互终端等。

[0077] 基于同一发明构思，本发明还提供一种显示面板的制作方法，图12为本发明实施例提供的显示面板制作方法流程图。如图12所示，制作方法包括：

[0078] 步骤S101：在第一支撑板上制作第一柔性衬底；

[0079] 步骤S102：在第一柔性衬底上制作显示层，显示层包括多个发光单元，显示层还包括像素定义层，像素定义层具有多个第一开口，发光单元位于第一开口内；

[0080] 步骤S103：在显示层之上制作封装层，得到带有第一支撑板的第一基板；

[0081] 步骤S104：在第二支撑板上制作第二柔性衬底；

[0082] 步骤S105：在第二柔性衬底上制作触控彩膜复合层，得到带有第二支撑板的第二基板；其中，触控彩膜复合层包括：黑矩阵、色阻和触控电极，黑矩阵具有多个第二开口，第二开口包括色阻，触控电极采用Metal Mesh材料制作，黑矩阵在触控电极所在平面的正投影覆盖触控电极；

[0083] 步骤S106：将带有第一支撑板的第一基板和带有第二支撑板的第二基板进行对位贴合；

[0084] 步骤S107：激光剥离第一支撑板和第二支撑板。

Petitioner Samsung Ex-1004, 0223

[0085] 采用本发明提供的制作方法制作的显示面板可以参考本发明中任意关于显示面板的实施例说明。在制作显示面板时，首先分别制作带有支撑板的第一基板和第二基板，当第一基板和第二基板对位贴合之后，再采用激光剥离对应的支撑板，制作工艺成熟。本发明提供的显示面板制作方法，采用色阻代替圆偏光片起到防止环境光的反射的功能，色阻厚度通常不超过20μm，色阻厚度远远小于圆偏光片的厚度，有利于显示面板厚度的减薄，而且不采用脆性大的圆偏光片也有利于提升显示面板的可挠性。本发明中制作有触控彩膜复合层，触控电极与色阻和黑矩阵集成在一起，采用Metal Mesh材料制作的触控电极膜层厚度薄，能够进一步有利于显示面板的薄型化。另外，本发明中黑矩阵在触控电极所在平面的正投影覆盖触控电极，触控彩膜复合层中触控电极的设计不会影响显示面板开口率。

[0086] 通过上述实施例可知，本发明提供的显示面板及其制作方法和显示装置，至少实现了如下的有益效果：

[0087] 发明提供的显示面板中，采用色阻代替圆偏光片起到防止环境光的反射的功能，色阻厚度通常不超过20μm，色阻厚度远远小于圆偏光片的厚度，有利于显示面板厚度的减薄，不采用脆性大的圆偏光片也有利于提升显示面板的可挠性。本发明中设置有触控彩膜复合层，触控电极与色阻和黑矩阵集成在一起，采用Metal Mesh材料制作的触控电极膜层厚度薄，能够进一步有利于显示面板的薄型化。另外，本发明中黑矩阵在触控电极所在平面的正投影覆盖触控电极，触控彩膜复合层中触控电极的设计不会影响显示面板开口率。

[0088] 虽然已经通过例子对本发明的一些特定实施例进行了详细说明，但是本领域的技术人员应该理解，以上例子仅是为了进行说明，而不是为了限制本发明的范围。本领域的技术人员应该理解，可在不脱离本发明的范围和精神的情况下，对以上实施例进行修改。本发明的范围由所附权利要求来限定。

Petitioner Samsung Ex-1004, 0224

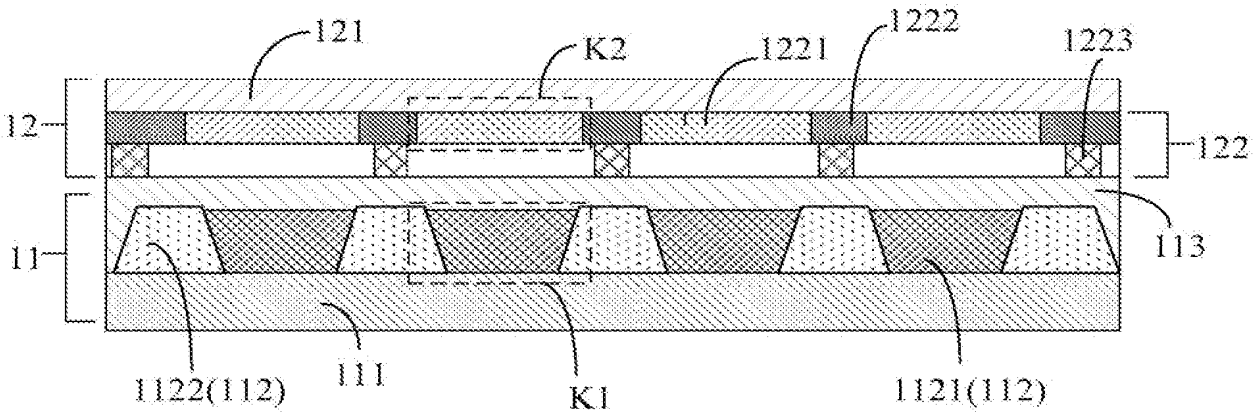


图1

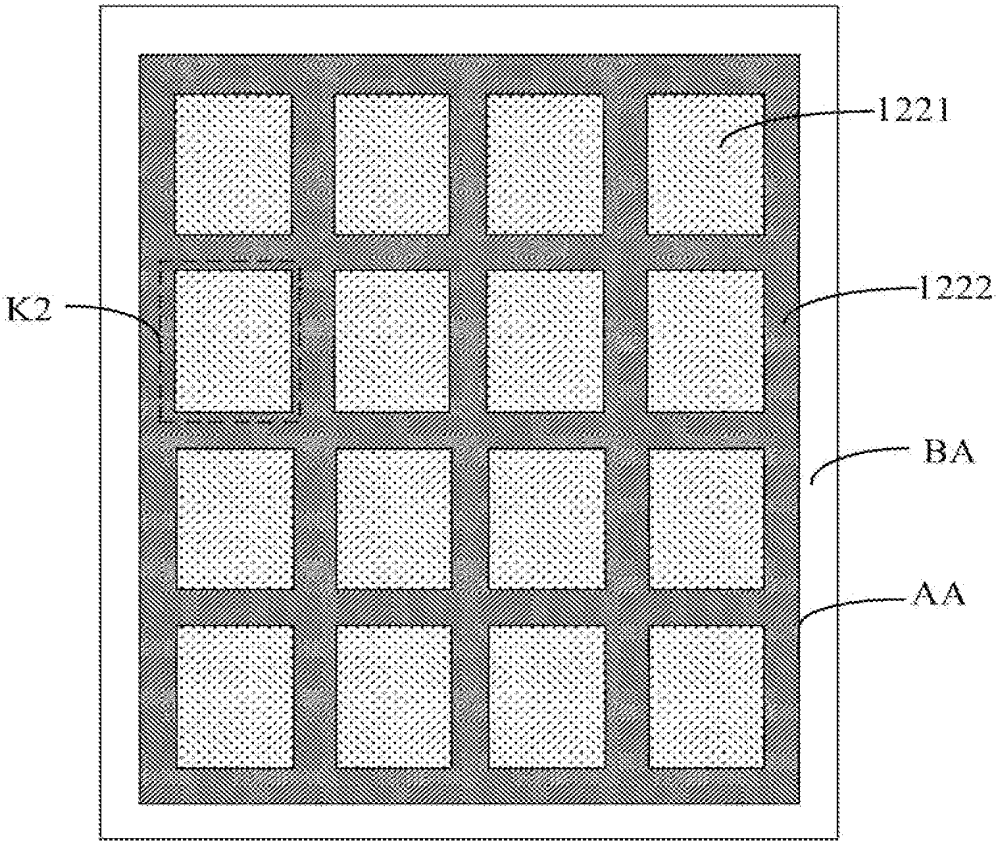


图2

Petitioner Samsung Ex-1004, 0225

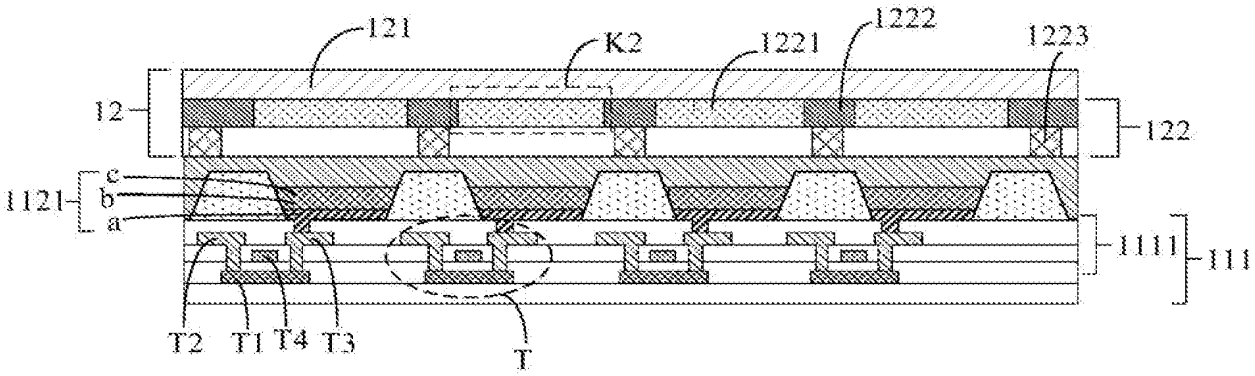


图3

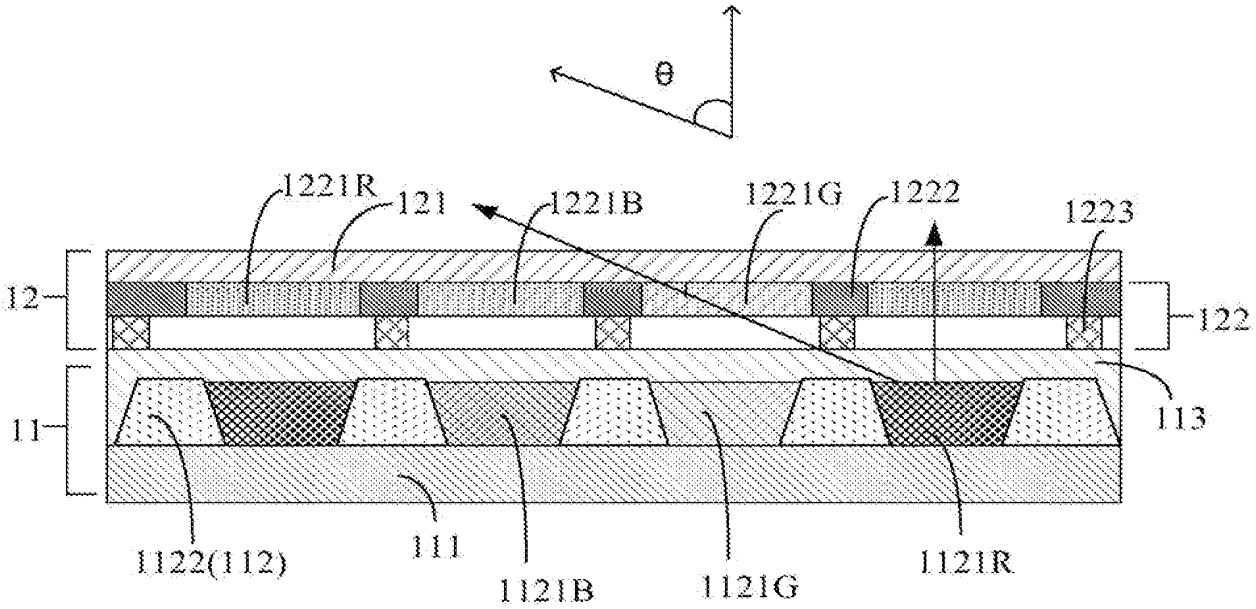


图4

Petitioner Samsung Ex-1004, 0226

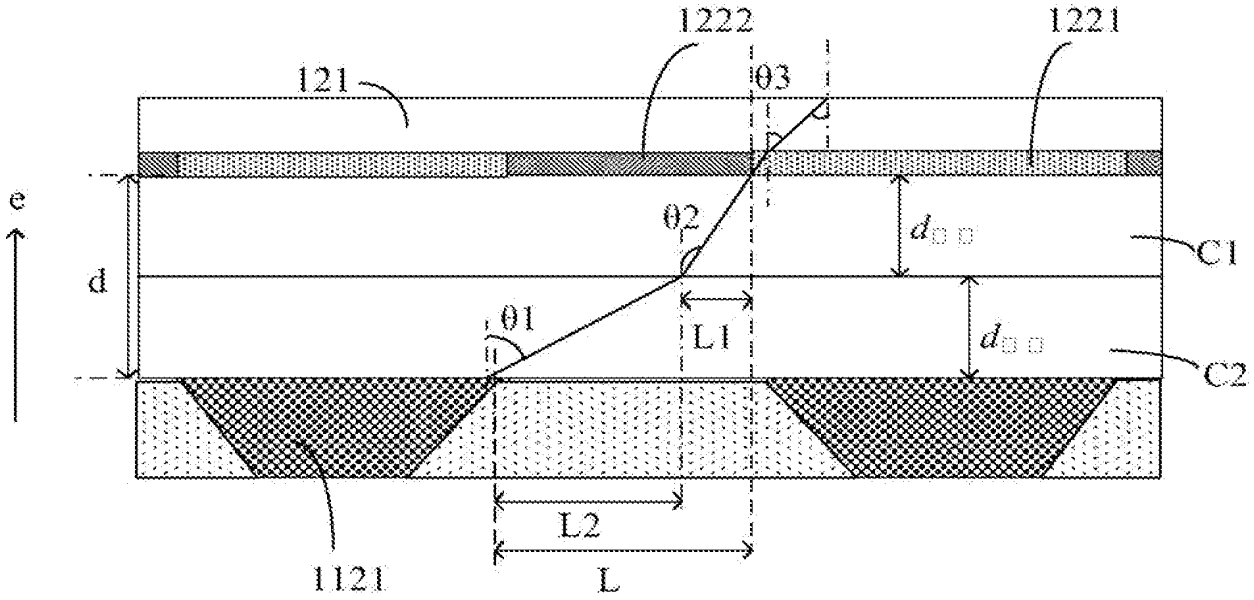


图5

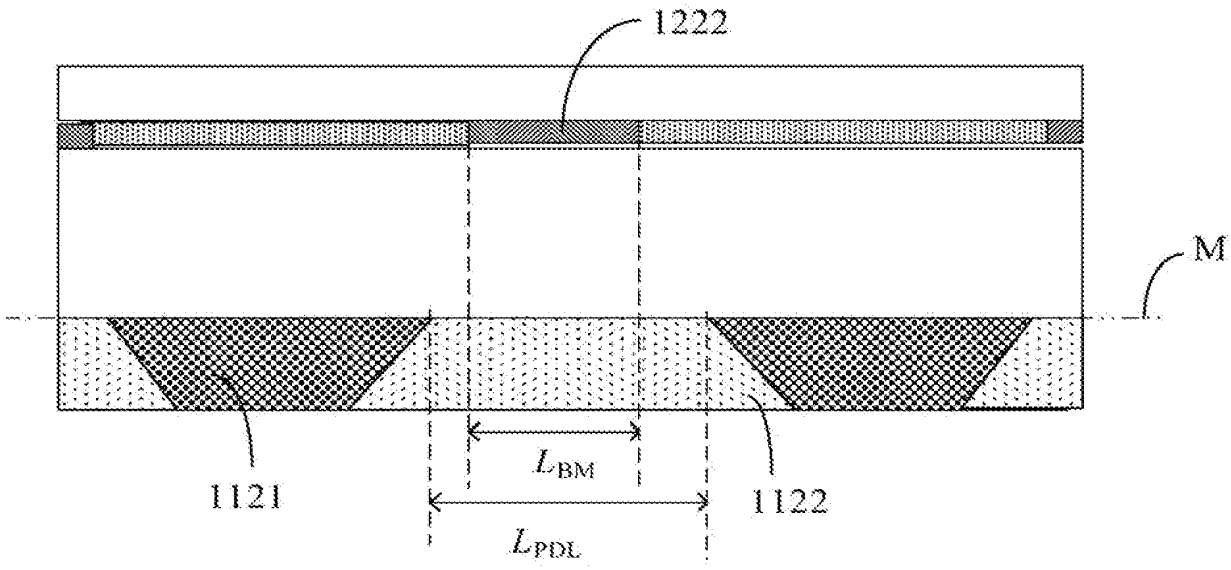


图6

Petitioner Samsung Ex-1004, 0227

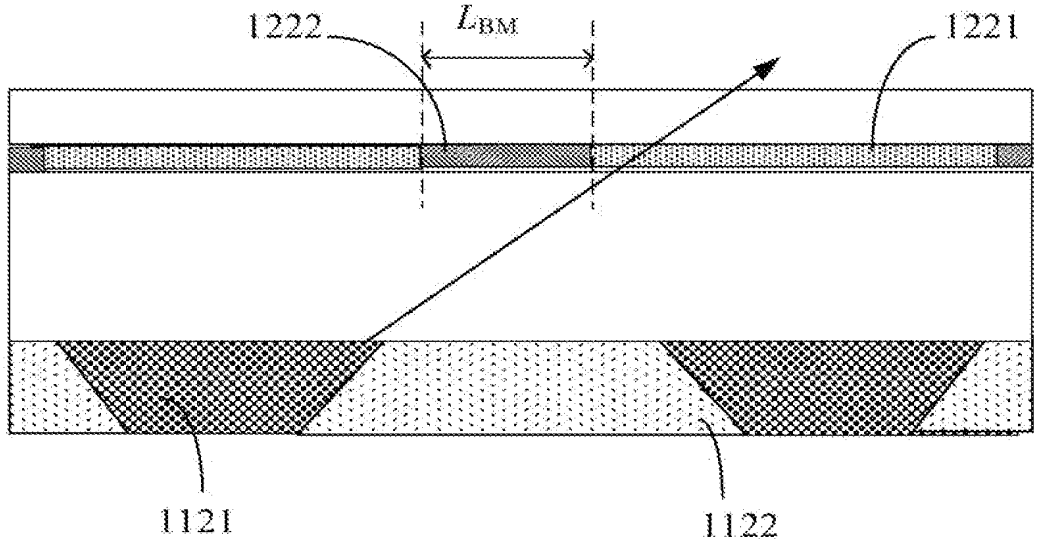


图7

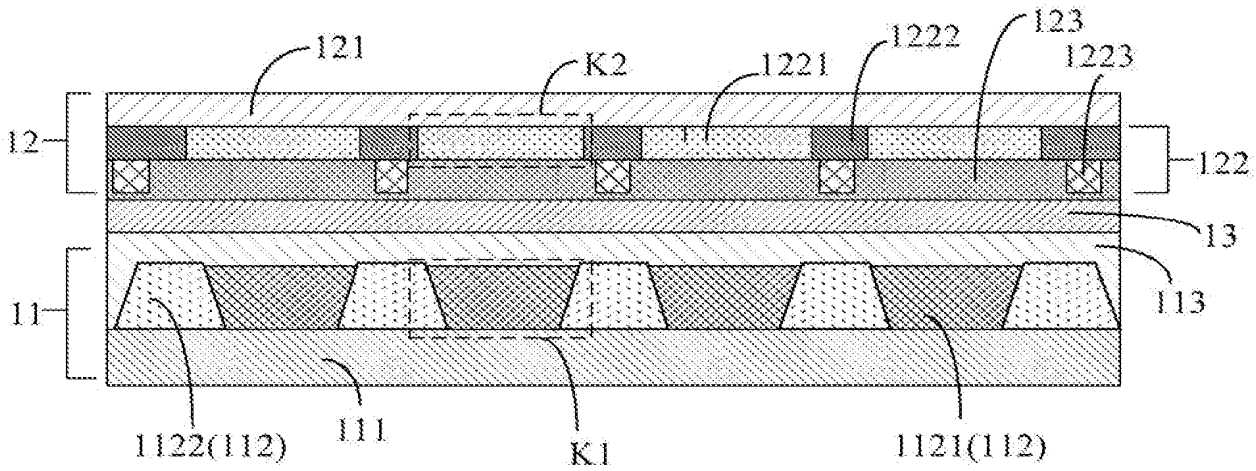


图8

Petitioner Samsung Ex-1004, 0228

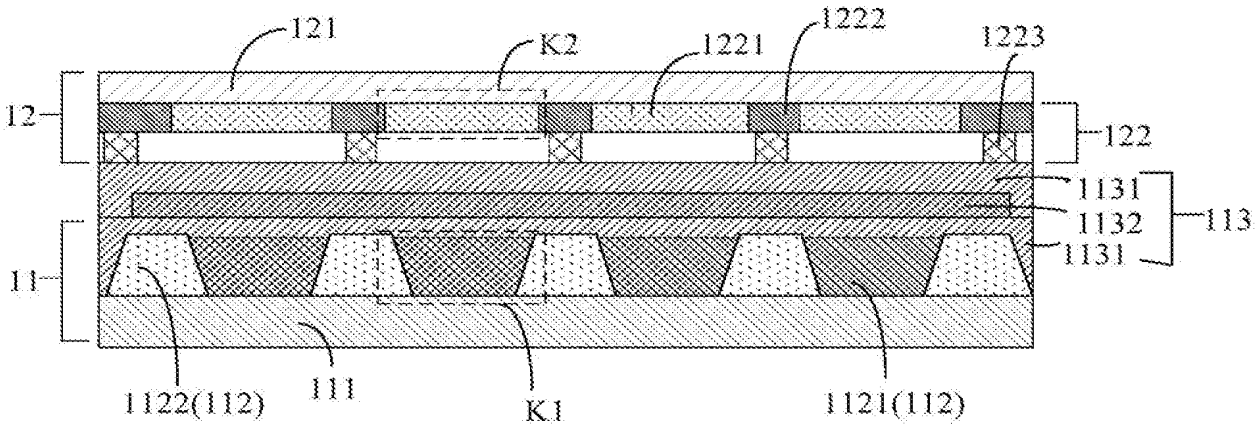


图9

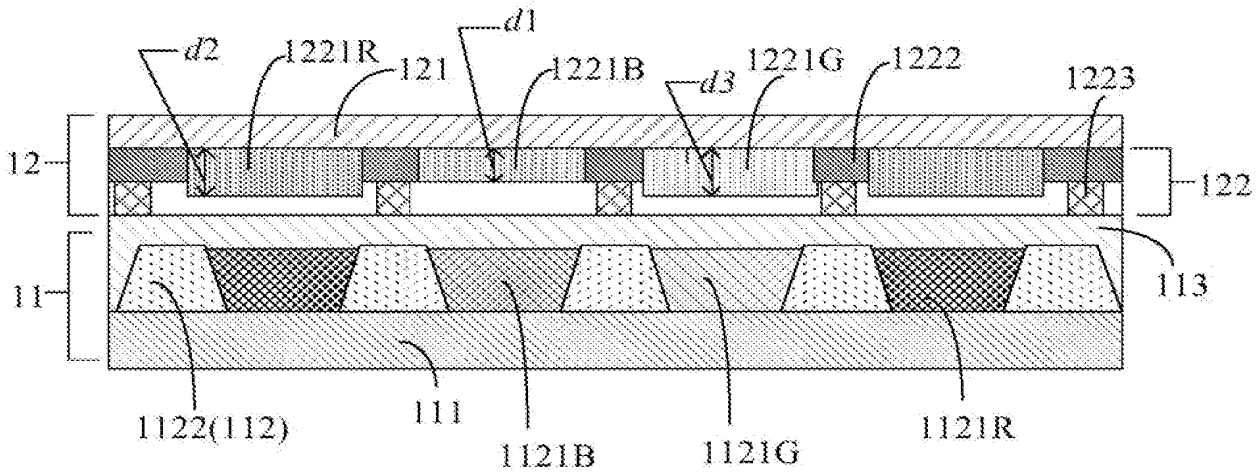


图10

Petitioner Samsung Ex-1004, 0229

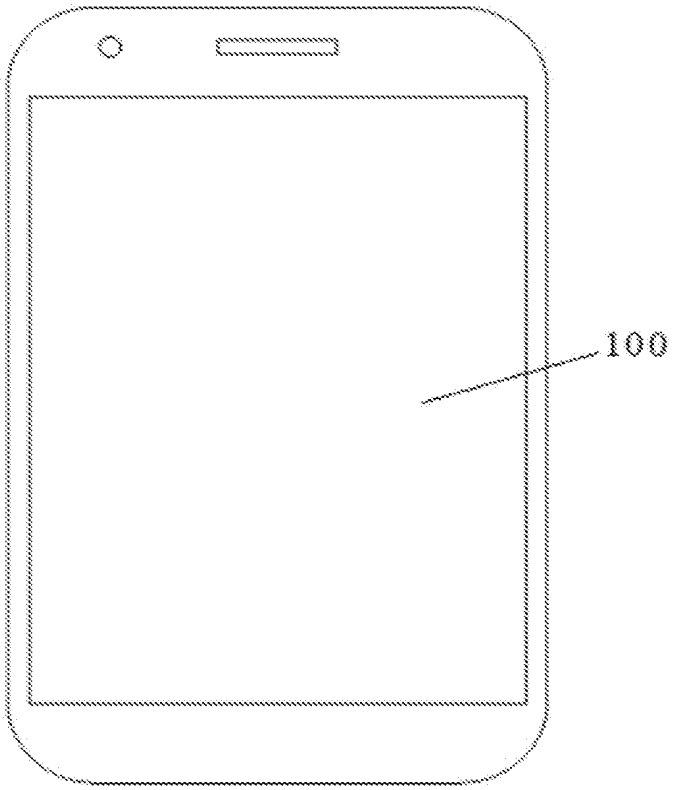


图11

Petitioner Samsung Ex-1004, 0230

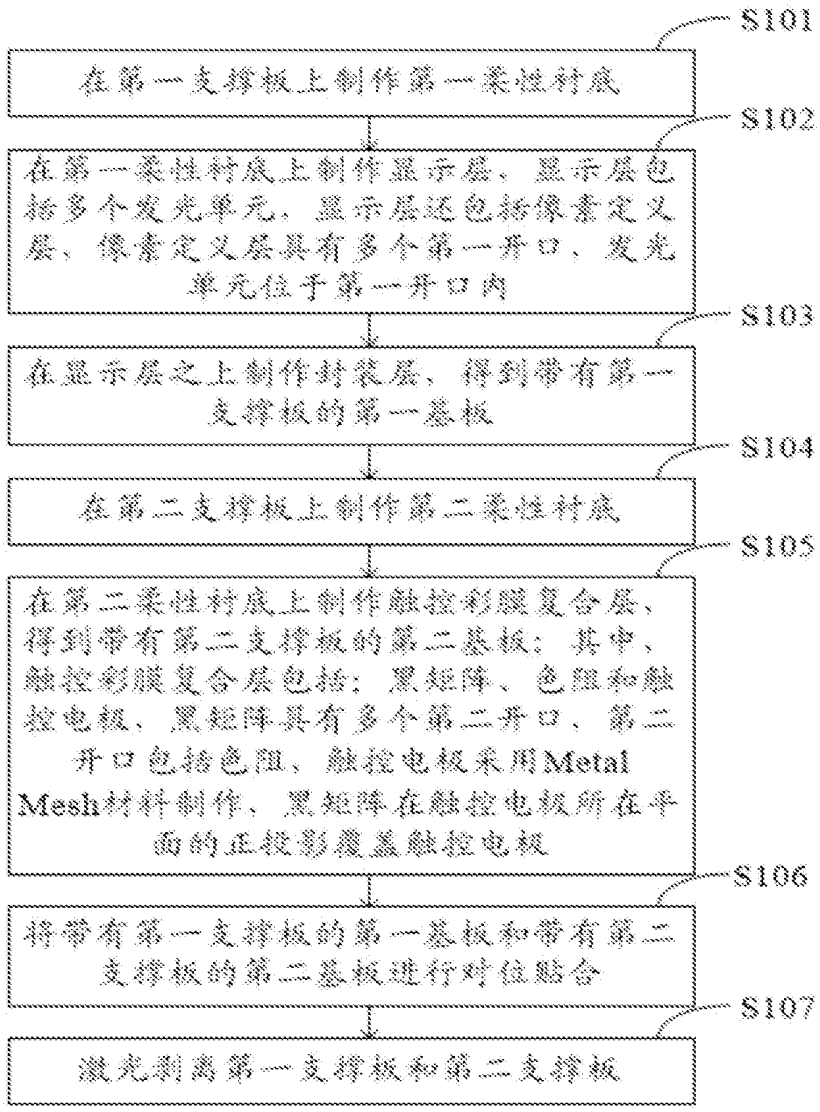


图12

Petitioner Samsung Ex-1004, 0231

Abstract of CN109859642 (A)
The embodiment of the invention discloses a kind of display panel and display devices, the display panel includes: flexible base board, it include the first surface and second surface mutually deviated from including the first non-bent area, the second non-bent area and the bent area between the first non-bent area and the second non-bent area, flexible base board;Display layer, display layer are located on the first surface of flexible base board, and are located at the first non-bent area;First protective layer, the first protective layer are located at the first surface of flexible base board, and at least cover the bent area of flexible base board;Second protective layer; deviate from the side of flexible base board positioned at the first protective layer; and at least cover the portion connection of bent area and the first non-bent area; and/or at least cover the portion connection of bent area and the second non-bent area; present invention improves the bending resistances of display panel; meanwhile it is bad by showing caused by folding s tress in stress concentrated position to avoid display panel, improves the stability of display panel.

Description

A kind of display panel and display device

Technical field
The present embodiments relate to display technology more particularly to a kind of display panel and display devices.

Background technique
With the development of display technology, display technology using more and more extensive, wherein organic electroluminescent (Organic Light-Emitting Diode, OLED) display has that self-luminous, reaction is fast, visual angle is wide, brightness is high, color is gorgeous, frivolous etc.

Advantage, thus OLED display using relatively broad.
Current full frameization mobile phone popularity is higher and higher, and the screen of height screen accounting is becoming increasingly popular, thus is expedited the emergence of out
Many narrow frame schemes improve in the scheme for shielding accounting for lower frame area, flexible base board are usually located at lower frame position
The part set is bent to the viewing area back side, to reduce the width of lower frame.In display panel bending process, how to guarantee to bend
The bending characteristic in area improves display panel yield, becomes people's urgent problem to be solved.

Summary of the invention
The present invention provides a kind of display panel and display device and avoids display panel to protect the bent area of display panel
It is bad by being shown caused by folding s tress in stress concentrated position.
In a first aspect, the embodiment of the invention provides a kind of display panels, comprising:
Flexible base board, including the first non-bent area, the second non-bent area and it is located at the described first non-bent area and described
Bent area between second non-bent area, the flexible base board include the first surface and second surface mutually deviated from;
Display layer, the display layer are located on the first surface of the flexible base board, and it is non-curved to be located at described first
Folding area;
First protective layer, first protective layer are located at the first surface of the flexible base board, and at least cover described soft
The bent area of property substrate;
Second protective layer, the side of the flexible base board is deviated from positioned at first protective layer, and is at least covered described curved
The portion connection of folding area and the first non-bent area, and/or

at least cover the bent area and the second non-bent area
Portion connection.
Optionally, the elasticity modulus of second protective layer is greater than the elasticity modulus of first protective layer.
Optionally, edge is parallel to the described first non-bent area or the second non-bent area place plane and far from described
The thickness in the direction of the maximum gauge of the second protective layer, second protective layer is gradually reduced.
Optionally, the maximum gauge of the junction of the bent area and the first non-bent area and second protective layer
The distance of projection of the position on the flexible base board is less than or equal to 100 μm, and/or, the bent area and described second non-
The junction of bent area and the maximum gauge position of second protective layer are less than at a distance from the projection on the flexible base board
Or it is equal to 100 μm.
Optionally, in the state that the flexible base board is flat, the bent area is directed toward by the described first non-bent area
On direction, the length of second protective layer is less than or equal to 500 μm.
Optionally, second protective layer is strip, and edge is parallel to the bent area and the first non-bent area
The direction of connecting line extend, and/or prolong along the direction of the connecting line that is parallel to the bent area and the second non-bent area
It stretches.
Optionally, second protective layer is multiple discrete protection structures, and the multiple discrete protection structure is flat
Row is sequentially distributed on the direction of the connecting line of the bent area and the first non-bent area, and/or described curved being parallel to
It is sequentially distributed on the direction of the connecting line of folding area and second bent area.

Optionally, the display panel further includes support plate, and the support plate includes first and second, the support
Plate is located at the second surface of the flexible base board, and the first position is in the described first non-bent area, the second position in
The second non-bent area.
Optionally, the display panel further includes bending supporter, and the bending supporter includes fixation interconnected
Interconnecting piece and bending support portion, the portion of being fixedly connected be located in the described first non-bent area and the second non-bent area it
Between;The bending support portion is adjacent to the bent area, and the side of the bending support portion towards the bent area is in cambered surface.
Optionally, the described first non-bent area includes viewing area, and first of the support plate deviates from the flexible base board
Side be equipped with heat dissipating layer, the heat dissipating layer is located at the viewing area;
The portion of being fixedly connected of the bending supporter includes the first surface and second surface mutually deviated from, described solid
The first surface and the heat dissipating layer for determining interconnecting piece are adhesively fixed, the second surface for being fixedly connected with portion with it is described
Described second of support plate is adhesively fixed.
Optionally, the heat dissipating layer includes foamed cotton layer, graphite linings and copper foil layer;
The first surface for being fixedly connected with portion is also set up respectively with the second surface for being fixedly connected with portion
Have the first glue-line and the second glue-line, first glue-line be adhesively fixed it is described be fixedly connected with portion and the heat dissipating layer, described second
Described second for being fixedly connected with portion and the support

plate is adhesively fixed in glue-line.
Optionally, first protective layer and second protective layer include UV solidification glue.
Optionally, the thickness range of first protective layer is 30~150 μm, and the thickness range of second protective layer is
30~150 μm.
Second aspect, the embodiment of the invention also provides a kind of display devices, including aobvious as described in first aspect is any
Show panel.
Display panel provided in an embodiment of the present invention and display device, by least in the bending of flexible substrate first surface
Area covers the first protective layer, the second protective layer then is arranged away from the side of flexible base board in the first protective layer, and second protects
Sheath at least covers the bent area of flexible base board and the portion connection of the first non-bent area, and/or at least covers flexible base board
Bent area and the second non-bent area portion connection, when further protecting bent area, and flexible base board can be made to bend
Stress concentrated position stress reduce, thus reinforce flexible base board bending stress concentrated position protection, avoid display surface
Plate is bad by showing caused by folding s tress in stress concentrated position, improves the stability of display panel, ensure that display
The yield of panel.

Detailed description of the invention
Fig. 1 is a kind of structural schematic diagram of display panel provided in an embodiment of the present invention;
Fig. 2 is the front view of display panel shown in FIG. 1;
Fig. 3 is the front view of another display panel provided in an embodiment of the present invention in its flat state;

Fig. 4 is the top view of display panel shown in Fig. 3;
Fig. 5 is the top view of another display panel provided in an embodiment of the present invention in its flat state;
Fig. 6 is the front view of another display panel provided in an embodiment of the present invention;
Fig. 7 is the front view of another display panel provided in an embodiment of the present invention;
Fig. 8 is a kind of structural schematic diagram of display device provided in an embodiment of the present invention.

Specific embodiment
The present invention is described in further detail with reference to the accompanying drawings and examples.It is understood that this place is retouched
The specific embodiment stated is used only for explaining the present invention rather than limiting the invention.It also should be noted that in order to just
Only the parts related to the present invention are shown in description, attached drawing rather than entire infrastructure.
Traditional display panel when being bent flexible base board can it is excessive due to stress and cause bent area bend radian
It is excessive, and wiring can be arranged in the part of lower frame position in flexible base board, bent area bending radian is excessive may also lead to it is curved
The cabling of folding area is broken.Display panel provided in an embodiment of the present invention and display device, by least in flexible base board
The bent area on one surface covers the first protective layer, then in the first protective layer away from the second protection of the side of flexible base board setting
Layer, and the second protective layer at least covers the bent area of flexible base board and the portion connection of the first non-bent area,

and/or at least
Cover the bent area of flexible base board and the portion connection of the second non-bent area.The present invention can reinforce answering for flexible base board bending
The protection of power concentrated position, it is bad by showing caused by folding s tress in stress concentrated position to avoid display panel, improves
The stability of display panel, ensure that the yield of display panel.
Fig. 1 is a kind of structural schematic diagram of display panel provided in an embodiment of the present invention, and Fig. 2 is display surface shown in FIG. 1
The front view of plate, with reference to Fig. 1 and Fig. 2, which includes: flexible base board 10, including the first non-bent area 11, second is non-curved
Folding area 12 and the bent area 13 between the first non-bent area 11 and the second non-bent area 12, flexible base board 10 include mutual
The first surface 101 and second surface 102 deviated from;Display layer 20, display layer 20 are located at the first surface 101 of flexible base board 10
On, and it is located at the first non-bent area 11;First protective layer 31, the first protective layer 31 are located at the first surface 101 of flexible base board 10,
And at least cover the bent area 13 of flexible base board 10;Second protective layer 32, positioned at the first protective layer 31 away from flexible base board 10
Side, and the portion connection of bent area 13 and the first non-bent area 11 is at least covered, and/or at least cover bent area 13 and the
The portion connection of two non-bent areas 12.
Wherein, in display panel, flexible base board 10 is made of flexible material, such as polyimide material etc., soft
Property substrate 10 on formed display layer 20 after, 10 one side edge of flexible base board can be bent to the back side, will be on flexible base board 10

Cabling is connect with driving circuit, to realize that the display to display layer 20 drives.Display layer 20 includes organic array of light emitting cells, Organic light-emitting units therein then shine under the driving of driving circuit, and the display panel that cooperatively forms for passing through luminescent color

Show picture.Bent area 13 can be divided into according to crooked place in flexible base board 10, in flexible base board 10 with 13 two sides of bent area

Connected non-bending part is then referred to as the first non-bent area 11 and the second non-bent area 12.Usual bent area 13 is curved in progress

When folding, bending angle is fillet, but when folding s tress is larger, when bending radian is larger, the cabling that is arranged on bent area 13 at this time

It may be broken, influence the normal work of display panel.Folding s tress of the bent area by stress concentrated position in order to prevent

Influence, the embodiment of the present invention in display panel be provided with the first protective layer 31 and the second protective layer 32, specifically, first protect

Sheath 31 and the second protective layer 32 can be used glue class material and be bonded to bent area 13 and protected.First protective layer 31 is due to whole

Body covers bent area 13, therefore can integrally alleviate the stress of bent area 13, carries out Global Macros, certain journey to bent area 13

The probability that bent area 13 is influenced by the folding s tress of stress concentrated position is reduced on degree, however, the stress in bending of bent area 13

And it is uneven, stress concentrated position can be generated, it, can not be pointedly to bent area in the case where covering the first protective layer 31

13 are protected;Second protective layer 32 is then directed to stress concentrated position, that is, bent area of the flexible base board 10 when bent area 13 is bent

It is protected with the junction of non-bent area, with shown in the sectional view of display panel shown in Fig. 2, bent area and non-bent area Junction indicates bent area and non-bent area connecting line and its neighbouring region, and there are one fixed widthes for junction.First protective layer

The stress of the 31 stress concentrated positions of its covering when can alleviate bending, so as to avoid the stress of covering position from concentrating.

Display panel provided in an embodiment of the present invention, by least covering first in the bent area of flexible substrate first surface

Then the second protective layer is arranged away from the side of flexible base board in the first protective layer in protective layer, and the second protective layer at least covers

The portion connection of the bent area of lid flexible base board and the first non-bent area, and/or at least cover flexible base board bent area and

The portion connection of second non-bent area, stress when can be protected to bent area, and flexible base board can be made to bend

Concentrated position stress reduces, to reinforce the protection of the stress concentrated position of flexible base board bending, avoids display panel and is answering

Power concentrated position is bad by showing caused by folding s tress, improves the stability of display panel, ensure that display panel

Yield.

Furthermore it should be noted that the first non-bent area 11 and the second non-bent area 12 are not limited to flat construction, due to

A part of flexible base board 10 is also belonged to, therefore the first non-bent area 11 and the second non-bent area 12 are also possible to flexible structure,

When the display panel is flexible display panels, the first non-bent area 11 and the second non-bent area 12 can according to the use of user into

Row bending, the herein division of bent area and non-bent area are only used for distinguishing the bending of flexible base board 10 to connect back side driving circuit

Part.
With reference to Fig. 2, wherein it further include support plate 40 in display panel, support plate 40 includes first 41 and second 42,
Support plate 40 is located at the second surface 102 of flexible base board 10, and first 41 is located at the first non-bent area 11, and second 42 is located at
Second non-bent area 12.In the display panel of preparation rigidity, need to be supported flexible base board 10, therefore in flexible base board 10
Second surface 102 be arranged support plate 40, flexible base board 10 is not supported first 41 of plate 40 at this time and second 42 is propped up
The region of support is then bent area 13.Since support plate 40 is rigid structure, the stress in bending of flexible base board 10 is concentrated in propping up
The edge of fagging 40, thus first 41 and second 42 marginal position, that is, bent area 13 respectively with the first non-bent area 11 and
Stress is more concentrated at the connecting line of two non-bent areas 12, and it is bad that easy affected by force causes display panel to show.
Optionally, the material including ultraviolet (UltraViolet, UV) solidification glue can be used in the first protective layer and the second protective layer
Material, relative to heat-curable glue and visible-light curing glue, UV solidification glue can avoid visible light, and stress is relatively small.But
Since the component of UV solidification glue is different, to the protective capability of bent area, there is also difference, count through experimental data, in identical reality
Under the conditions of testing, there are significantly different for bending yield of the different UV solidification glues to display panel, wherein the higher UV of Young's modulus
The bending yield of glue is best, and the bending yield of the lower UV glue of Young's modulus is minimum.Therefore, the first protective layer and the second protection
Identical UV solidification glue material can be used in layer, and the UV solidification glue of different component can also be used according to

respective effect.In addition, being
Take into account the protective capability and stress itself of the first protective layer and the second protective layer, the film of the first protective layer and the second protective layer
Thickness cannot it is too small can not be blocked up, optionally, the thickness range of the first protective layer is 30~150 μm, the thickness of the second protective layer
Range is 30~150 μm.Wherein, the first protective layer and the second protective layer thickness are set and are greater than or equal to 30 μm, the can be prevented
The problem of one protective layer and the second protective layer too small because of thickness folding s tress that cannot alleviate its covering position, and be arranged first and protect
Sheath and the second protective layer thickness are less than or equal to 150 μm, can be to avoid the rigidity relatively edge by force of thickness protective layer when excessive
Place regenerates the problem of new stress concentrated position.
Since the junction stress of non-bent area and bent area is relatively large, in order to alleviate stress herein, it is preferable that can
It is greater than the elasticity modulus of the first protective layer using the elasticity modulus of the second protective layer.Wherein, elasticity modulus is to measure material to generate
The index of flexible deformation complexity, value is bigger, and the stress for making material that certain flexible deformation occur is also bigger, i.e. material stiffness
It is bigger, that is, under certain stress, it is smaller that flexible deformation occurs.Therefore, biggish second protective layer of elasticity modulus is rigid
Property it is larger, the rigid of its covering position can be improved in bending, alleviate the stress of the position, to can guarantee the second protection
It is bad that the non-bent area and bent area of layer covering will not cause display panel to show under bending state by stress influence.

Fig. 3 is the front view of another display panel provided in an embodiment of the present invention in its flat state, with reference to Fig. 3,
In, display panel is in flat condition before the bend, at this time if the second protective layer of figure 32 is due to only covering non-bent area and curved
At least partly junction of folding area, therefore the second protective layer 32 is answered when can bend to bent area 13 when bent area 13 is bent
Power distribution has an impact, and in order to avoid 32 edge of the second protective layer becomes the position that stress is concentrated, settable edge is parallel to first
The direction of non-bent area 11 or the second non-12 place plane of bent area and the maximum gauge far from the second protective layer 32, second protects
The thickness of sheath 32 is gradually reduced.At this point, the thickness of the second protective layer 32 is gradually become smaller by middle position to marginal position, i.e.,
Noticeable steps is not present in the edge of two protective layers 32, and in bending, bent area stress is not concentrated in the side of the second protective layer 32
Edge, in addition to this, since 32 marginal position of the second protective layer does not have noticeable steps, in the process of bending and bending state
Under, 32 marginal position of the second protective layer can avoid marginal position from the first protective layer 31 with 31 tight bond of the first protective layer
Upper cracking.
The position of maximum gauge can be generated when the materials such as UV solidification glue form the second protective layer 32 with continued reference to Fig. 3,
In order to guarantee that the second protective layer 32 to the protecting effect of non-bent area and bent area junction, need to guarantee the second protective layer 32 as far as possible

The corresponding junction for being located at non-bent area and bent area in maximum gauge position.Therefore, optionally, bent area 13 and first non-curved
The junction of folding area 11 be less than with projection distance L1 of the maximum gauge position of the second protective layer 32 on flexible base board 10 or
Equal to 100 μm, and/or, the junction of bent area 13 and the second non-bent area 12 and the maximum gauge position of the second protective layer 32
The distance L2 of projection on flexible base board 10 is less than or equal to 100 μm.The maximum gauge position of the second protective layer 32 is adjacent at this time
It is bordering on the junction i.e. position of stress concentration of non-bent area and bent area, non-bent area can be dramatically increased and connected with bent area
Locate the rigid of position, to ensure that the second protective layer 32 lays special stress on protecting the effect of stress concentrated position, prevents junction
Stress is excessive, causes display panel to show bad.
In addition to this, in order to guarantee the protecting effect of the second protective layer, the width of the second protective layer has been needed to be appropriately arranged with
The junction of non-bent area and bent area is completely covered, therefore optionally, it is non-by first in the state that flexible base board 10 is flat
Bent area 11 is directed toward on the direction of bent area 13, and the length d of the second protective layer 32 is less than or equal to 500 μm.Due to the first protection
Layer is whole to cover bent area, can alleviate the stress of bent area to a certain extent, therefore not for the setting of the second protective layer
It must be wide;Width by the way that the second protective layer is arranged is less than or equal to 500 μm, the second protective layer when width can be prevented wide

Stress relief is scattered in the position of other portion other than connected portion, guarantee the second protective layer just for non-bent area and bent area junction into
Row stress protection.
For the shape and structure of the second protective layer, the embodiment of the invention also provides two kinds of optinal plans, Fig. 4 is Fig. 3 institute
The bottom view of the display panel shown, with reference to Fig. 4, wherein optionally, the second protective layer 32 may be configured as strip, and edge is parallel to
The direction of the connecting line of bent area 13 and the first non-bent area 11 extends, and/or edge is parallel to bent area 13 and the second non-bending
The direction of the connecting line in area 12 extends.Connection can be completely covered in second protective layer 32 of strip on connecting line extending direction
Line, the stress concentrated position where thereby may be ensured that connecting line are protected.
Fig. 5 is that the bottom view of another display panel provided in an embodiment of the present invention in its flat state can with reference to Fig. 5
Selection of land, the second protective layer may also be configured to multiple discrete protection structures 321, and multiple discrete protection structures 321 are being parallel to
It is sequentially distributed on the direction of the connecting line of bent area 13 and the first non-bent area 11, and/or is being parallel to bent area 13 and second
It is sequentially distributed on the direction of the connecting line of bent area 12.
Wherein, when the second protective layer 32 is that UV glue material is made, discrete protection structure 321 can be UV glue and pass through drop
The glue point formed is applied, or by smearing the shorter strip adhesive

tape of the length formed.Discrete protection structure 321 is relative to such as
On the one hand strip structure shown in Fig. 4 reduces the usage amount of UV glue, on the other hand can be to avoid strip structure rigidity energy
The problem of power is stronger, is easy to produce new stress concentrated position when alleviating the stress of stress concentrated position.It should be noted that
On connecting line extending direction, the spacing between discrete protection structure 321 cannot be excessive, and discrete protection structure 321 is arranged
When need to consider at uncovered connecting line may the larger problem of folding s tress, specifically those skilled in the art can root
It is designed according to actual conditions.
The embodiment of the invention also provides a kind of specific display panel, Fig. 6 be it is provided in an embodiment of the present invention another
The front view of display panel, with reference to Fig. 6, display panel further includes connector 50, and connector 50 is located in the first non-bent area 11
And second between non-bent area 12, the first non-bent area 11 includes viewing area 110, and first 41 of support plate deviates from flexible base board
10 side is equipped with heat dissipating layer 60, and heat dissipating layer 60 is located at viewing area 110, and connector 50 includes the first surface 501 mutually deviated from
With second surface 502, first surface 501 and the heat dissipating layer 60 of connector 50 are adhesively fixed, the second surface 502 of connector 50 with
Second 42 of support plate is adhesively fixed.
Specifically, heat dissipating layer may include foamed cotton layer, graphite linings and copper foil layer (not shown);First table of connector 50
Face 501 and second surface 502 are additionally provided with the first

glue-line 71 and the second glue-line 72,71 bonding connection body of the first glue-line, 50 He respectively
Heat dissipating layer 60, second 42 of 72 bonding connection body 50 of the second glue-line and support plate.
Wherein, foamed cotton layer is mostly foam grid glue, for being fitted in second of support plate, and can prevent from being bonded
The bubble of generation, graphite linings and copper foil layer are then used to radiate, and graphite linings are mainly used for soaking, and copper foil layer is while heat dissipation,
It can also play the role of shielding outer signals interference.Certainly, those skilled in the art can select heat dissipation according to actual design
Each functional layer being laminated in layer, the present embodiment are stacked foamed cotton layer, graphite linings and copper foil layer in heat dissipating layer and only preferably show
Example, herein with no restrictions.
Further, it can be supported to guarantee that the bent area 13 after bending bends radian, prevent display panel from existing
Bent area 13 is deformed by external force in use process, and display panel is caused to show situations such as bad, can be arranged in display panel
Bend supporter.Fig. 7 is the front view of another display panel provided in an embodiment of the present invention, and with reference to Fig. 7, display panel is also wrapped
Include bending supporter, bending supporter include it is interconnected be fixedly connected with portion 51 and bending support portion 52, be fixedly connected with portion 51
It is located between the first non-bent area 11 and the second non-bent area 12;Support portion 52 is bent adjacent to bent area 13, and bends support
The side of portion 52 towards bent area 13 is in cambered surface.Bending supporter can be in 13 bending process of bent area and display surface at this time

Bent area 13 is supported in plate use process, maintains the bending radian of bent area 13.
However, display panel as shown in figures 1 to 6, in actual bending process, usually the of traction flexible base board
Two non-bent areas 12 are simultaneously bent backward, so stress concentrated position when bending is more present in the first non-bent area 11 and curved
The tie line position of folding area 13, and relatively, the tie line position stress of the second non-bent area 12 and bent area 13 is relatively small,
Therefore second protective layer 32 can be set just for the tie line position of the first non-bent area 11 and bent area 13.For shown in Fig. 7
The first non-bent area 11 that display panel can first be fixed on flexible base board 10 in the process of bending, due to bending supporter, then
The second non-bent area 12 of flexible base board 10 is drawn, realizes the bending of bent area 13, bends support body supports bent area 13 at this time,
Therefore folding s tress is then at the more connecting line for concentrating on the second non-bent area 12 and bent area 13, therefore can be non-curved just for second
The second protective layer 32 is arranged in the tie line position of folding area 12 and bent area 13.
With continued reference to Fig. 7, the first non-bent area 11 includes viewing area 110, and first 41 of support plate deviates from flexible base board
10 side is equipped with heat dissipating layer 60, and heat dissipating layer 60 is located at viewing area 110;The portion 51 that is fixedly connected of bending supporter includes mutually carrying on the back
From first surface 511 and second surface 512, the first surface 511 and heat dissipating layer 60 for being fixedly connected with portion 51 be adhesively fixed, fixed
The second surface 512 of interconnecting piece 51 is adhesively fixed with second 42 of support plate.
Specifically, the first surface 511 for being fixedly connected with portion 51

is also set up respectively with the second surface 512 in the portion that is fixedly connected 51

There are the first glue-line 71 and the second glue-line 72, interconnecting piece 51 and heat dissipating layer 60, the second glue-line 72 bonding is adhesively fixed in the first glue-line 71

It is fixedly connected with second 42 of portion 51 and support plate.

The embodiment of the invention also provides a kind of display device, Fig. 8 is a kind of display device provided in an embodiment of the present invention

Structural schematic diagram, referring to Fig. 8, which includes any one display panel 100 provided in an embodiment of the present invention.Due to

The display device uses above-mentioned display panel 100, therefore display device equally has the beneficial of above-described embodiment display panel

Effect.It should be noted that display device provided in an embodiment of the present invention can also include other for supporting display device just

The circuit and device often to work.Above-mentioned display device can be one of mobile phone, tablet computer, Electronic Paper, digital photo frame.

Note that the above is only a better embodiment of the present invention and the applied technical principle.It will be appreciated by those skilled in the art that

The invention is not limited to the specific embodiments described herein, be able to carry out for a person skilled in the art it is various it is apparent variation,

It readjusts, be combined with each other and substitutes without departing from protection scope of the present invention.Therefore, although by above embodiments to this

Invention is described in further detail, but the present invention is not limited to the above embodiments only, is not departing from present inventive concept

In the case of, it can also include more other equivalent embodiments, and the scope of the invention is determined by the scope of the appended claims.

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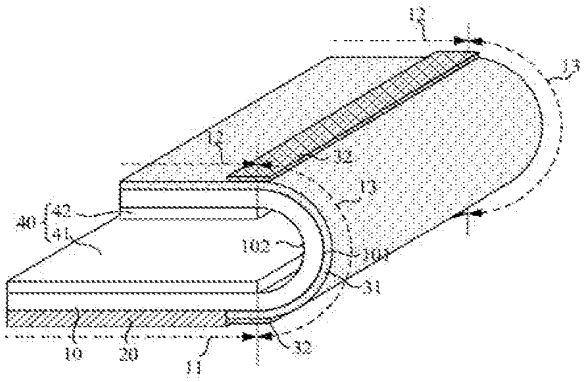
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(54)发明名称

一种显示面板和显示装置

(57)摘要

本发明实施例公开了一种显示面板和显示装置，该显示面板包括：柔性基板，包括第一非弯折区、第二非弯折区以及位于第一非弯折区和第二非弯折区之间的弯折区，柔性基板包括相互背离的第一表面和第二表面；显示层，显示层位于柔性基板的第一表面上，且位于第一非弯折区；第一保护层，第一保护层位于柔性基板的第一表面，且至少覆盖柔性基板的弯折区；第二保护层，位于第一保护层背离柔性基板的一侧，且至少覆盖弯折区和第一非弯折区的部分连接处，和/或至少覆盖弯折区和第二非弯折区的部分连接处，本发明改善了显示面板的耐弯折性，同时，避免了显示面板在应力集中位置由弯折应力而导致的显示不良，提高了显示面板的稳定性。



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1.一种显示面板，其特征在于，包括：

柔性基板，包括第一非弯折区、第二非弯折区以及位于所述第一非弯折区和所述第二非弯折区之间的弯折区，所述柔性基板包括相互背离的第一表面和第二表面；

显示层，所述显示层位于所述柔性基板的所述第一表面上，且位于所述第一非弯折区；

第一保护层，所述第一保护层位于所述柔性基板的第一表面，且至少覆盖所述柔性基板的所述弯折区；

第二保护层，位于所述第一保护层背离所述柔性基板的一侧，且至少覆盖所述弯折区和所述第一非弯折区的部分连接处，和/或至少覆盖所述弯折区和所述第二非弯折区的部分连接处。

2.根据权利要求1所述的显示面板，其特征在于，所述第二保护层的弹性模量大于所述第一保护层的弹性模量。

3.根据权利要求2所述的显示面板，其特征在于，沿平行于所述第一非弯折区或者所述第二非弯折区所在平面且远离所述第二保护层的最大厚度的方向，所述第二保护层的厚度逐渐减小。

4.根据权利要求3所述的显示面板，其特征在于，

所述弯折区和所述第一非弯折区的连接处与所述第二保护层的最大厚度位置在所述柔性基板上的投影的距离小于或等于100μm，和/或，所述弯折区和所述第二非弯折区的连接处与所述第二保护层的最大厚度位置在所述柔性基板上的投影的距离小于或等于100μm。

5.根据权利要求3所述的显示面板，其特征在于，在所述柔性基板平坦的状态下，由所述第一非弯折区指向所述弯折区的方向上，所述第二保护层的长度小于或等于500μm。

6.根据权利要求3所述的显示面板，其特征在于，所述第二保护层为长条状，且沿平行于所述弯折区和所述第一非弯折区的连接线的方向延伸，和/或沿平行于所述弯折区和所述第二非弯折区的连接线的方向延伸。

7.根据权利要求3所述的显示面板，其特征在于，所述第二保护层为多个离散的保护结构，所述多个离散的保护结构在平行于所述弯折区和所述第一非弯折区的连接线的方向上依次分布，和/或在平行于所述弯折区和所述第二弯折区的连接线的方向上依次分布。

8.根据权利要求1所述的显示面板，其特征在于，所述显示面板还包括支撑板，所述支撑板包括第一部和第二部，所述支撑板位于所述柔性基板的第二表面，且所述第一部位于所述第一非弯折区，所述第二部位于所述第二非弯折区。

9.根据权利要求8所述的显示面板，其特征在于，所述显示面板还包括弯折支撑体，所述弯折支撑体包括相互连接的固定连接部和弯折支撑部，所述固定连接部夹设于所述第一非弯折区和所述第二非弯折区之间；所述弯折支撑部邻近所述弯折区，且所述弯折支撑部朝向所述弯折区的一侧呈弧面。

10.根据权利要求9所述的显示面板，其特征在于，所述第一非弯折区包括显示区，所述支撑板的第一部背离所述柔性基板的一侧设有散热层，所述散热层位于所述显示区；

所述弯折支撑体的所述固定连接部包括相互背离的第一表面和第二表面，所述固定连接部的所述第一表面与所述散热层粘结固定，所述固定连接部的所述第二表面与所述支撑板的所述第二部粘结固定。

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11.根据权利要求10所述的显示面板，其特征在于，所述散热层包括泡棉层、石墨层和铜箔层；

所述固定连接部的所述第一表面和所述固定连接部的所述第二表面分别还设置有第一胶层和第二胶层，所述第一胶层粘结固定所述固定连接部和所述散热层，所述第二胶层粘结固定所述固定连接部和所述支撑板的所述第二部。

12.根据权利要求1所述的显示面板，其特征在于，所述第一保护层和所述第二保护层包括UV固化胶。

13.根据权利要求1所述的显示面板，其特征在于，所述第一保护层的厚度范围为30～150μm，所述第二保护层的厚度范围为30～150μm。

14.一种显示装置，其特征在于，包括如权利要求1-13任一所述的显示面板。

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一种显示面板和显示装置

技术领域

[0001] 本发明实施例涉及显示技术，尤其涉及一种显示面板和显示装置。

背景技术

[0002] 随着显示技术的发展，显示技术的应用越来越广泛，其中有机电致发光(Organic Light-Emitting Diode，OLED)显示器具有自发光、反应快、视角广、亮度高、色彩艳、轻薄等优点，因而OLED显示器的应用较为广泛。

[0003] 目前全屏化手机普及程度越来越高，高屏占比的屏幕越来越受欢迎，因而催生出很多窄边框方案，针对下边框面积提高屏占比的方案中，通常是将柔性基板位于下边框位置的部分弯折至显示区背面，以减少下边框的宽度。在显示面板弯折过程中，如何保证弯折区的弯折特性，提高显示面板良率，成为人们亟待解决的问题。

发明内容

[0004] 本发明提供一种显示面板和显示装置，以保护显示面板的弯折区，避免显示面板在应力集中位置由弯折应力而导致的显示不良。

[0005] 第一方面，本发明实施例提供了一种显示面板，包括：

[0006] 柔性基板，包括第一非弯折区、第二非弯折区以及位于所述第一非弯折区和所述第二非弯折区之间的弯折区，所述柔性基板包括相互背离的第一表面和第二表面；

[0007] 显示层，所述显示层位于所述柔性基板的所述第一表面上，且位于所述第一非弯折区；

[0008] 第一保护层，所述第一保护层位于所述柔性基板的第一表面，且至少覆盖所述柔性基板的所述弯折区；

[0009] 第二保护层，位于所述第一保护层背离所述柔性基板的一侧，且至少覆盖所述弯折区和所述第一非弯折区的部分连接处，和/或至少覆盖所述弯折区和所述第二非弯折区的部分连接处。

[0010] 可选地，所述第二保护层的弹性模量大于所述第一保护层的弹性模量。

[0011] 可选地，沿平行于所述第一非弯折区或者所述第二非弯折区所在平面且远离所述第二保护层的最大厚度的方向，所述第二保护层的厚度逐渐减小。

[0012] 可选地，所述弯折区和所述第一非弯折区的连接处与所述第二保护层的最大厚度位置在所述柔性基板上的投影的距离小于或等于100μm，和/或，所述弯折区和所述第二非弯折区的连接处与所述第二保护层的最大厚度位置在所述柔性基板上的投影的距离小于或等于100μm。

[0013] 可选地，在所述柔性基板平坦的状态下，由所述第一非弯折区指向所述弯折区的方向上，所述第二保护层的长度小于或等于500μm。

[0014] 可选地，所述第二保护层为长条状，且沿平行于所述弯折区和所述第一非弯折区的连接线的方向延伸，和/或沿平行于所述弯折区和所述第二非弯折区的连接线的方向延

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伸。

[0015] 可选地，所述第二保护层为多个离散的保护结构，所述多个离散的保护结构在平行于所述弯折区和所述第一非弯折区的连接线的方向上依次分布，和/或在平行于所述弯折区和所述第二弯折区的连接线的方向上依次分布。

[0016] 可选地，所述显示面板还包括支撑板，所述支撑板包括第一部和第二部，所述支撑板位于所述柔性基板的第二表面，且所述第一部位于所述第一非弯折区，所述第二部位于所述第二非弯折区。

[0017] 可选地，所述显示面板还包括弯折支撑体，所述弯折支撑体包括相互连接的固定连接部和弯折支撑部，所述固定连接部夹设于所述第一非弯折区和所述第二非弯折区之间；所述弯折支撑部邻近所述弯折区，且所述弯折支撑部朝向所述弯折区的一侧呈弧面。

[0018] 可选地，所述第一非弯折区包括显示区，所述支撑板的第一部背离所述柔性基板的一侧设有散热层，所述散热层位于所述显示区；

[0019] 所述弯折支撑体的所述固定连接部包括相互背离的第一表面和第二表面，所述固定连接部的所述第一表面与所述散热层粘结固定，所述固定连接部的所述第二表面与所述支撑板的所述第二部粘结固定。

[0020] 可选地，所述散热层包括泡棉层、石墨层和铜箔层；

[0021] 所述固定连接部的所述第一表面和所述固定连接部的所述第二表面分别还设置有第一胶层和第二胶层，所述第一胶层粘结固定所述固定连接部和所述散热层，所述第二胶层粘结固定所述固定连接部和所述支撑板的所述第二部。

[0022] 可选地，所述第一保护层和所述第二保护层包括UV固化胶。

[0023] 可选地，所述第一保护层的厚度范围为30～150μm，所述第二保护层的厚度范围为30～150μm。

[0024] 第二方面，本发明实施例还提供了一种显示装置，包括如第一方面任一所述的显示面板。

[0025] 本发明实施例提供的显示面板和显示装置，通过至少在柔性基板第一表面的弯折区覆盖第一保护层，继而在第一保护层背离柔性基板的一侧设置第二保护层，并且第二保护层至少覆盖柔性基板的弯折区和第一非弯折区的部分连接处，和/或至少覆盖柔性基板的弯折区和第二非弯折区的部分连接处，进一步保护弯折区，并且可以使柔性基板弯折时的应力集中位置应力减小，从而加强柔性基板弯折的应力集中位置的保护，避免了显示面板在应力集中位置由弯折应力而导致的显示不良，提高了显示面板的稳定性，保证了显示面板的良率。

附图说明

[0026] 图1是本发明实施例提供的一种显示面板的结构示意图；

[0027] 图2是图1所示的显示面板的正视图；

[0028] 图3是本发明实施例提供的又一种显示面板在平坦状态下的正视图；

[0029] 图4是图3所示的显示面板的俯视图；

[0030] 图5是本发明实施例提供的又一种显示面板在平坦状态下的俯视图；

[0031] 图6是本发明实施例提供的又一种显示面板的正视图；

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[0032] 图7是本发明实施例提供的又一种显示面板的正视图；

[0033] 图8为本发明实施例提供的一种显示装置的结构示意图。

具体实施方式

[0034] 下面结合附图和实施例对本发明作进一步的详细说明。可以理解的是，此处所描述的具体实施例仅仅用于解释本发明，而非对本发明的限定。另外还需要说明的是，为了便于描述，附图中仅示出了与本发明相关的部分而非全部结构。

[0035] 传统的显示面板在进行弯折时柔性基板会由于应力过大而造成弯折区弯折弧度过大，并且柔性基板在下边框位置的部分会设置布线，弯折区弯折弧度过大也可能导致弯折区的走线发生断裂。本发明实施例提供的显示面板和显示装置，通过至少在柔性基板第一表面的弯折区覆盖第一保护层，继而在第一保护层背离柔性基板的一侧设置第二保护层，并且第二保护层至少覆盖柔性基板的弯折区和第一非弯折区的部分连接处，和/或至少覆盖柔性基板的弯折区和第二非弯折区的部分连接处。本发明可以加强柔性基板弯折的应力集中位置的保护，避免了显示面板在应力集中位置由弯折应力而导致的显示不良，提高了显示面板的稳定性，保证了显示面板的良率。

[0036] 图1是本发明实施例提供的一种显示面板的结构示意图，图2是图1所示的显示面板的正视图，参考图1和图2，该显示面板包括：柔性基板10，包括第一非弯折区11、第二非弯折区12以及位于第一非弯折区11和第二非弯折区12之间的弯折区13，柔性基板10包括相互背离的第一表面101和第二表面102；显示层20，显示层20位于柔性基板10的第一表面101上，且位于第一非弯折区11；第一保护层31，第一保护层31位于柔性基板10的第一表面101，且至少覆盖柔性基板10的弯折区13；第二保护层32，位于第一保护层31背离柔性基板10的一侧，且至少覆盖弯折区13和第一非弯折区11的部分连接处，和/或至少覆盖弯折区13和第二非弯折区12的部分连接处。

[0037] 其中，在显示面板中，柔性基板10采用柔性材料制成，例如聚酰亚胺材料等，在柔性基板10上形成显示层20后，会将柔性基板10一侧边缘弯折至背面，以将柔性基板10上的走线与驱动电路连接，从而实现对显示层20的显示驱动。显示层20包括有机发光单元阵列，其中的有机发光单元则在驱动电路的驱动下发光，并通过发光颜色的配合形成显示面板的显示画面。柔性基板10中根据弯折位置可划分为弯折区13，柔性基板10中与弯折区13两侧相连的未弯折部分则分别称为第一非弯折区11和第二非弯折区12。通常弯折区13在进行弯折时，弯折角为圆角，但当弯折应力较大时，弯折弧度较大时，此时弯折区13上设置的走线可能会发生断裂，影响显示面板的正常工作。为了防止弯折区受应力集中位置的弯折应力的影响，本发明实施例在显示面板中设置了第一保护层31和第二保护层32，具体地，第一保护层31和第二保护层32可采用胶类材料粘结至弯折区13并进行保护。第一保护层31由于整体覆盖了弯折区13，因此可以整体缓解弯折区13的应力，对弯折区13进行整体保护，一定程度上降低弯折区13受应力集中位置的弯折应力影响的概率，然而，弯折区13在弯折时应力并不均匀，会产生应力集中位置，在覆盖第一保护层31的情况下，并不能针对性地对弯折区13进行保护；第二保护层32则针对柔性基板10在弯折区13弯折时的应力集中位置即弯折区和非弯折区的连接处进行保护，以图2所示的显示面板的剖面图所示，弯折区和非弯折区的连接处表示弯折区和非弯折区连接线及其附近的区域，连接处存在一定宽度。第一保护层

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31可以缓解弯折时其覆盖的应力集中位置的应力，从而可以避免覆盖位置的应力集中。

[0038] 本发明实施例提供的显示面板，通过至少在柔性基板第一表面的弯折区覆盖第一保护层，继而在第一保护层背离柔性基板的一侧设置第二保护层，并且第二保护层至少覆盖柔性基板的弯折区和第一非弯折区的部分连接处，和/或至少覆盖柔性基板的弯折区和第二非弯折区的部分连接处，可以对弯折区进行保护，并且可以使柔性基板弯折时的应力集中位置应力减小，从而加强柔性基板弯折的应力集中位置的保护，避免了显示面板在应力集中位置由弯折应力而导致的显示不良，提高了显示面板的稳定性，保证了显示面板的良率。

[0039] 此外需要说明的是，第一非弯折区11和第二非弯折区12不限于为平直结构，由于同样属于柔性基板10的一部分，故第一非弯折区11和第二非弯折区12也可以是柔性结构，当该显示面板为柔性显示面板时，第一非弯折区11和第二非弯折区12可根据用户的使用进行弯折，此处弯折区和非弯折区的划分仅用于区分柔性基板10弯折以连接背面驱动电路的部分。

[0040] 参考图2，其中，显示面板中还包括支撑板40，支撑板40包括第一部41和第二部42，支撑板40位于柔性基板10的第二表面102，且第一部41位于第一非弯折区11，第二部42位于第二非弯折区12。在制备刚性的显示面板时，需要对柔性基板10进行支撑，故在柔性基板10的第二表面102设置支撑板40，此时柔性基板10未被支撑板40的第一部41和第二部42所支撑的区域则为弯折区13。由于支撑板40为刚性结构，柔性基板10在弯折时应力会集中在支撑板40的边缘，故第一部41和第二部42的边缘位置即弯折区13分别与第一非弯折区11和第二非弯折区12的连接线处应力较为集中，容易受应力影响导致显示面板显示不良。

[0041] 可选地，第一保护层和第二保护层可采用包括紫外(UltraViolet，UV)固化胶的材料，相对于热固化胶和可见光固化胶，UV固化胶可以避开可见光，并且应力相对较小。但是由于UV固化胶的组分不同，其对弯折区的保护能力也存在差别，经实验数据统计，在相同实验条件下，不同的UV固化胶对显示面板的弯折良率存在明显不同，其中，杨氏模量较高的UV胶的弯折良率均最好，杨氏模量较低的UV胶的弯折良率最低。因此，第一保护层和第二保护层可采用相同的UV固化胶材料，也可以根据各自的作用采用不同组分的UV固化胶。另外，为了兼顾第一保护层和第二保护层的保护能力以及本身应力，第一保护层和第二保护层的膜厚不能过小也不能过厚，可选地，第一保护层的厚度范围为30～150μm，第二保护层的厚度范围为30～150μm。其中，设置第一保护层和第二保护层厚度大于或等于30μm，可以防止第一保护层和第二保护层因厚度过小不能缓解其覆盖位置的弯折应力的问题，而设置第一保护层和第二保护层厚度小于或等于150μm，可以避免厚度过大时保护层的刚性较强而边缘处重新产生新的应力集中位置的问题。

[0042] 由于非弯折区和弯折区的连接处应力相对较大，为了缓解此处的应力，优选地，可采用第二保护层的弹性模量大于第一保护层的弹性模量。其中，弹性模量是衡量材料产生弹性变形难易程度的指标，其值越大，使材料发生一定弹性变形的应力也越大，即材料刚度越大，亦即在一定应力作用下，发生弹性变形越小。因此，弹性模量较大的第二保护层的刚性较大，在弯折时会提高其覆盖位置的刚性强度，缓解该位置的应力，从而可保证第二保护层覆盖的非弯折区和弯折区在弯折状态下不会被应力影响而导致显示面板显示不良。

[0043] 图3是本发明实施例提供的又一种显示面板在平坦状态下的正视图，参考图3，其

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中，显示面板在弯折之前处于平坦状态，此时如图第二保护层32由于只覆盖非弯折区和弯折区的至少部分连接处，因此第二保护层32在弯折区13弯折时，会对弯折区13弯折时的应力分布产生影响，为了避免第二保护层32边缘成为应力集中的位置，可设置沿平行于第一非弯折区11或者第二非弯折区12所在平面且远离第二保护层32的最大厚度的方向，第二保护层32的厚度逐渐减小。此时，第二保护层32的厚度由中间位置到边缘位置逐渐变小，即第二保护层32的边缘不存在明显台阶，在弯折时弯折区应力不会集中在第二保护层32的边缘，除此之外，由于第二保护层32边缘位置没有明显台阶，因此在弯折过程中和弯折状态下，第二保护层32边缘位置能够与第一保护层31紧密粘结，避免边缘位置从第一保护层31上开裂。

[0044] 继续参考图3，在UV固化胶等材料形成第二保护层32时，会产生最大厚度的位置，为了保证第二保护层32对非弯折区和弯折区连接处的保护效果，需尽量保证第二保护层32的最大厚度位置对应位于非弯折区和弯折区的连接处。因此，可选地，弯折区13和第一非弯折区11的连接处与第二保护层32的最大厚度位置在柔性基板10上的投影的距离L1小于或等于100μm，和/或，弯折区13和第二非弯折区12的连接处与第二保护层32的最大厚度位置在柔性基板10上的投影的距离L2小于或等于100μm。此时第二保护层32的最大厚度位置邻近于非弯折区和弯折区的连接处即应力集中的位置，能够显著增加非弯折区和弯折区连接处位置的刚性强度，从而保证了第二保护层32重点保护应力集中位置的效果，防止连接处应力过大，导致显示面板显示不良。

[0045] 除此之外，为了保证第二保护层的保护效果，需要适当设置第二保护层的宽度已完全覆盖非弯折区和弯折区的连接处，因此可选地，在柔性基板10平坦的状态下，由第一非弯折区11指向弯折区13的方向上，第二保护层32的长度d小于或等于500μm。由于第一保护层整体覆盖了弯折区，可以一定程度上缓解弯折区的应力，因此对于第二保护层的设置不必过宽；通过设置第二保护层的宽度小于或等于500μm，可以防止宽度过宽时第二保护层的应力缓解分散于其他非连接处的位置，保证第二保护层只针对非弯折区和弯折区连接处进行应力保护。

[0046] 对于第二保护层的形状结构，本发明实施例还提供了两种可选方案，图4是图3所示的显示面板的仰视图，参考图4，其中可选地，第二保护层32可设置为长条状，且沿平行于弯折区13和第一非弯折区11的连接线的方向延伸，和/或沿平行于弯折区13和第二非弯折区12的连接线的方向延伸。长条状的第二保护层32可以在连接线延伸方向上完全覆盖连接线，从而可以保证连接线所在的应力集中位置得以保护。

[0047] 图5是本发明实施例提供的又一种显示面板在平坦状态下的仰视图，参考图5，可选地，第二保护层还可设置为多个离散的保护结构321，多个离散的保护结构321在平行于弯折区13和第一非弯折区11的连接线的方向上依次分布，和/或在平行于弯折区13和第二弯折区12的连接线的方向上依次分布。

[0048] 其中，当第二保护层32为UV胶材料制成时，离散的保护结构321可以是UV胶通过滴涂形成的胶点，或者经过涂抹形成的长度较短的长条状胶条。离散的保护结构321相对于如图4所示的长条状结构一方面减少了UV胶的使用量，另一方面可以避免长条状结构刚性能力较强，在缓解应力集中位置的应力时容易产生新的应力集中位置的问题。需要说明的是，在连接线延伸方向上，离散的保护结构321之间的间距不能过大，设置离散的保护结构321

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时需要考虑未被覆盖的连接线处可能弯折应力较大的问题，具体地本领域技术人员可以根据实际情况进行设计。

[0049] 本发明实施例还提供了一种具体的显示面板，图6是本发明实施例提供的又一种显示面板的正视图，参考图6，显示面板还包括连接体50，连接体50夹设于第一非弯折区11和第二非弯折区12之间，第一非弯折区11包括显示区110，支撑板的第一部41背离柔性基板10的一侧设有散热层60，散热层60位于显示区110，连接体50包括相互背离的第一表面501和第二表面502，连接体50的第一表面501与散热层60粘结固定，连接体50的第二表面502与支撑板的第二部42粘结固定。

[0050] 具体地，散热层可包括泡棉层、石墨层和铜箔层(图中未示出)；连接体50的第一表面501和第二表面502分别还设置有第一胶层71和第二胶层72，第一胶层71粘结连接体50和散热层60，第二胶层72粘结连接体50和支撑板的第二部42。

[0051] 其中，泡棉层多为泡棉网格胶，用于贴合在支撑板的第二部上，并且可以防止贴合产生的气泡，石墨层和铜箔层则用于散热，石墨层主要用于均热，而铜箔层在散热的同时，还可以起到屏蔽外界信号干扰的作用。当然，本领域技术人员可根据实际的设计，选择散热层中层叠的各功能层，本实施例在散热层中层叠设置泡棉层、石墨层和铜箔层仅为优选示例，此处不做限制。

[0052] 进一步地，为了保证弯折后的弯折区13弯折弧度能够得到支撑，防止显示面板在使用过程中弯折区13受外力变形，导致显示面板显示不良等情况，可以在显示面板中设置弯折支撑体。图7是本发明实施例提供的又一种显示面板的正视图，参考图7，显示面板还包括弯折支撑体，弯折支撑体包括相互连接的固定连接部51和弯折支撑部52，固定连接部51夹设于第一非弯折区11和第二非弯折区12之间；弯折支撑部52邻近弯折区13，且弯折支撑部52朝向弯折区13的一侧呈弧面。此时弯折支撑体可以在弯折区13弯折过程中以及显示面板使用过程中对弯折区13进行支撑，维持弯折区13的弯折弧度。

[0053] 然而，如图1-6所示的显示面板，在实际的弯折过程中，通常是牵引柔性基板的第二非弯折区12并向后弯折，所以弯折时的应力集中位置更多地存在于第一非弯折区11和弯折区13的连接线位置，而相对地，第二非弯折区12和弯折区13的连接线位置应力相对较小，故可只针对第一非弯折区11和弯折区13的连接线位置设置第二保护层32。对于图7所示的显示面板在弯折过程中，由于弯折支撑体会先固定于柔性基板10的第一非弯折区11，然后牵引柔性基板10的第二非弯折区12，实现弯折区13的弯折，此时弯折支撑体支撑弯折区13，因此弯折应力则较多集中于第二非弯折区12和弯折区13的连接线处，故可只针对第二非弯折区12和弯折区13的连接线位置设置第二保护层32。

[0054] 继续参考图7，第一非弯折区11包括显示区110，支撑板的第一部41背离柔性基板10的一侧设有散热层60，散热层60位于显示区110；弯折支撑体的固定连接部51包括相互背离的第一表面511和第二表面512，固定连接部51的第一表面511与散热层60粘结固定，固定连接部51的第二表面512与支撑板的第二部42粘结固定。

[0055] 具体地，固定连接部51的第一表面511和固定连接部51的第二表面512分别还设置有第一胶层71和第二胶层72，第一胶层71粘结固定连接部51和散热层60，第二胶层72粘结固定连接部51和支撑板的第二部42。

[0056] 本发明实施例还提供了一种显示装置，图8为本发明实施例提供的一种显示装置

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的结构示意图，参见图8，该显示装置包括本发明实施例提供的任意一种显示面板100。由于该显示装置采用了上述显示面板100，因此显示装置同样具有上述实施例显示面板的有益效果。需要说明的是，本发明实施例提供的显示装置还可以包括其他用于支持显示装置正常工作的电路及器件。上述的显示装置可以为手机、平板电脑、电子纸、电子相框中的一种。

[0057] 注意，上述仅为本发明的较佳实施例及所运用技术原理。本领域技术人员会理解，本发明不限于这里所述的特定实施例，对本领域技术人员来说能够进行各种明显的变化、重新调整、相互结合和替代而不会脱离本发明的保护范围。因此，虽然通过以上实施例对本发明进行了较为详细的说明，但是本发明不仅仅限于以上实施例，在不脱离本发明构思的情况下，还可以包括更多其他等效实施例，而本发明的范围由所附的权利要求范围决定。

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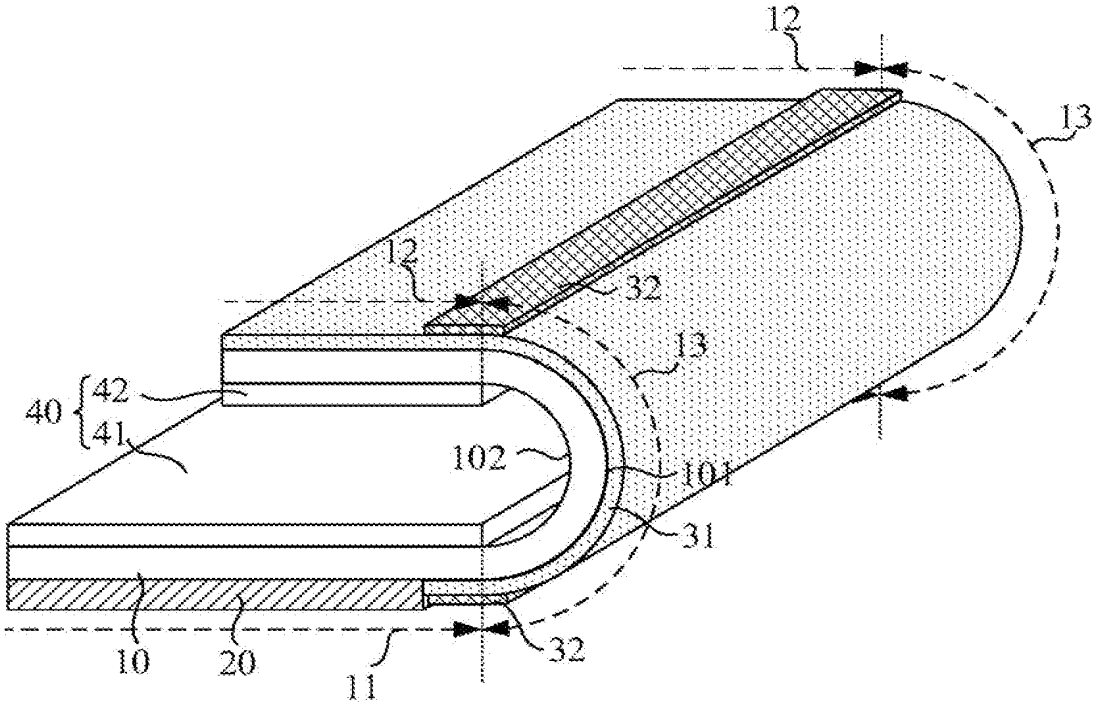


图1

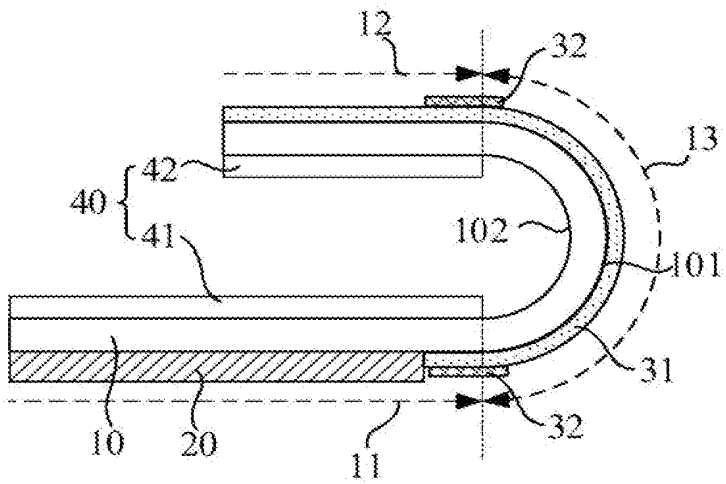


图2

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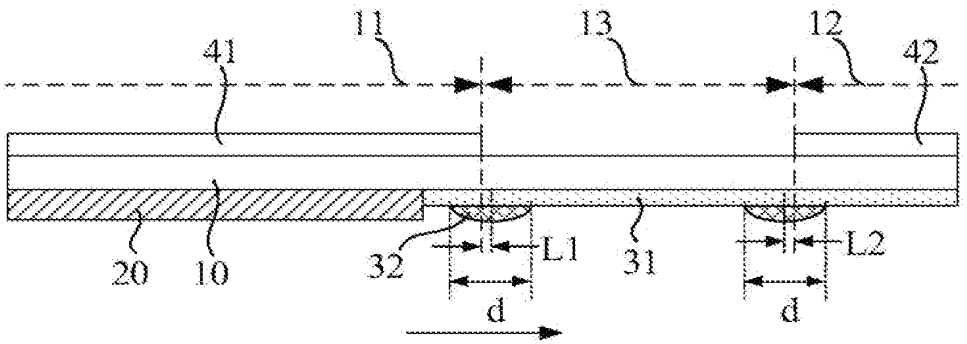


图3

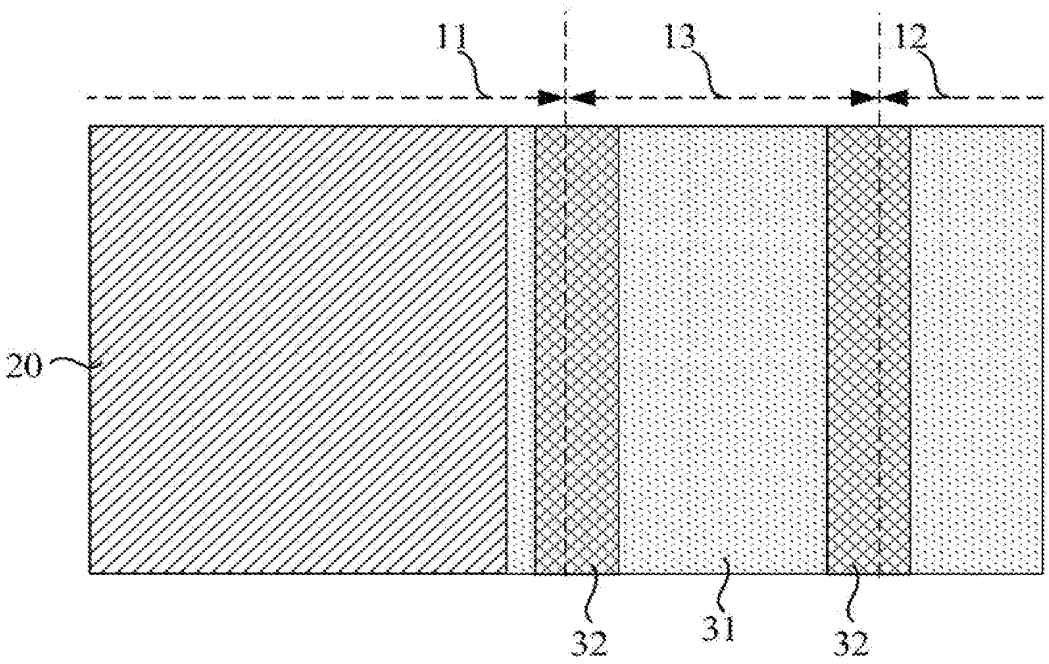


图4

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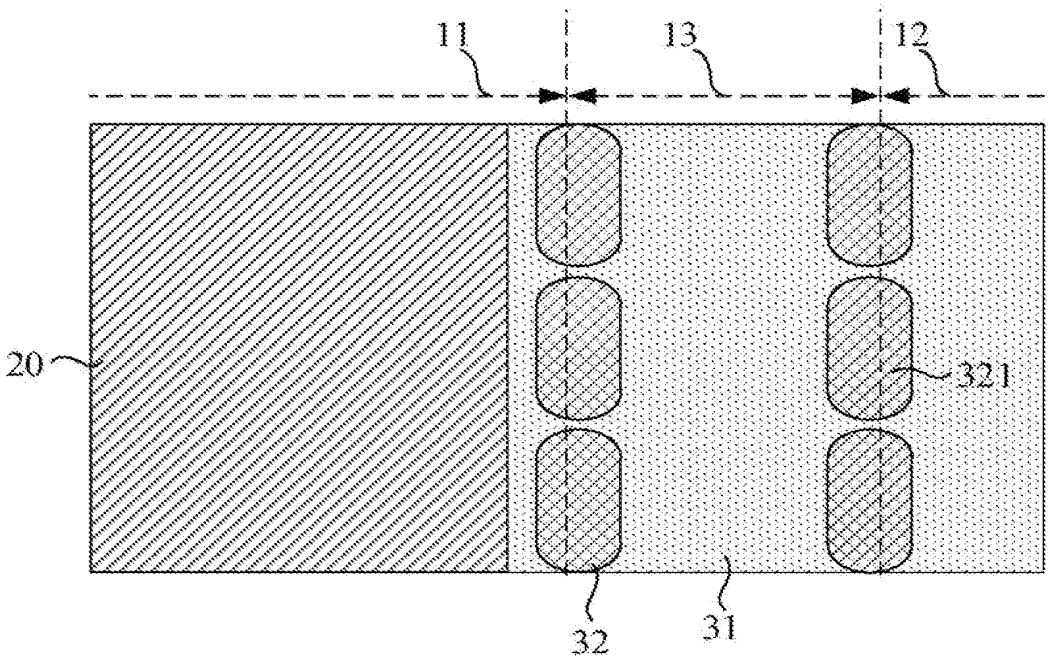


图5

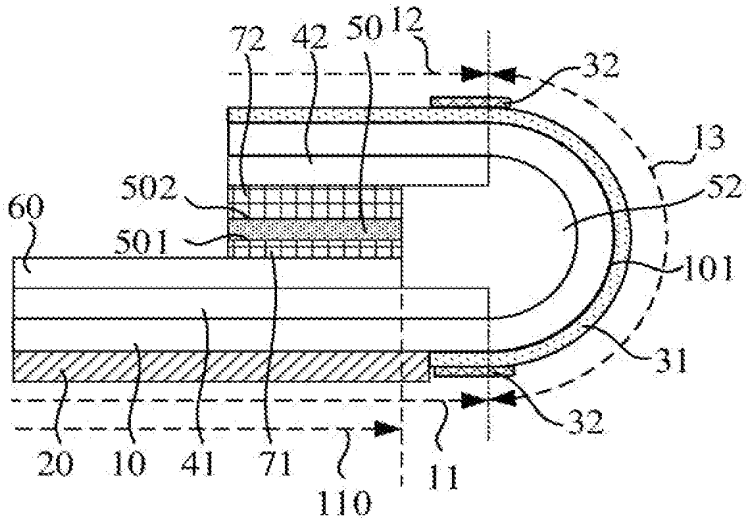


图6

Petitioner Samsung Ex-1004, 0263

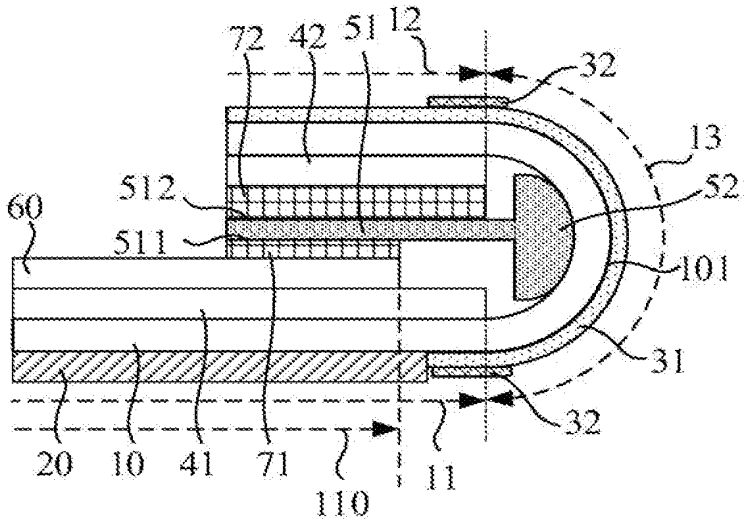


图7

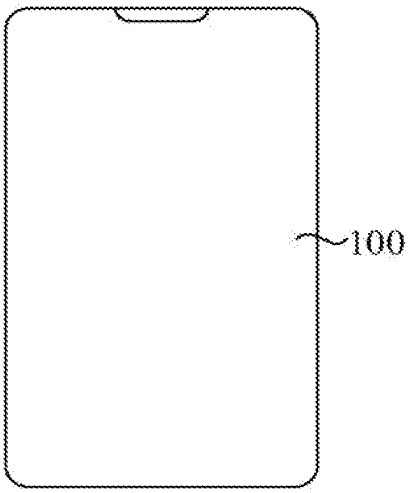


图8

Petitioner Samsung Ex-1004, 0264

Abstract of CN110224081 (A)
The invention discloses a kind of display module and display equipment, are related to field of display technology, have achieved the purpose that the bending yield for improving display module.Main technical schemes of the invention are as follows: include: display panel, display panel includes the effective display area being arranged successively, bent area and pad regions, adhesive layer and fixing layer are sequentially laminated on effective display area, protection glue-line is coated on bent area, electronic chip is provided on pad regions, chip protection film is covered on electronic chip, adhesive layer extends to protection glue-line and is covered in the edge of the first side of protection glue-line, the edge of adhesive layer is placed in the overlay area of fixing layer, chip protection film extends to protection glue-line, and it is covered in the edge of second side of protection glue-line, wherein, first side is the two sides for protecting glue-line opposite with second side, first side is adjacent with effective display area, second side is adjacent with pad regions.

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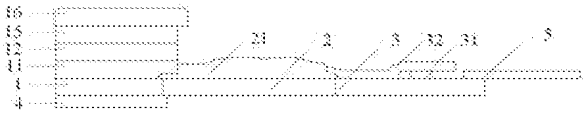
权利要求书2页 说明书5页 附图2页

(54)发明名称

一种显示模组和显示设备

(57)摘要

本发明公开了一种显示模组及显示设备，涉及显示技术领域，达到了提高显示模组的弯折良率的目的。本发明的主要技术方案为：包括：显示面板，显示面板包括依次排列的有效显示区、弯折区以及衬垫区，有效显示区上依次层叠有粘接层和固定层，弯折区上涂布有保护胶层，衬垫区上设置有电子芯片，电子芯片上覆盖有芯片保护膜，粘接层延伸至保护胶层并覆盖于保护胶层的第一侧的边缘，粘接层的边缘置于固定层的覆盖区域内，芯片保护膜延伸至保护胶层，并覆盖于保护胶层的第二侧的边缘，其中，第一侧与第二侧为保护胶层相对的两侧，第一侧与有效显示区相邻，第二侧与衬垫区相邻。



CN 110224081 A

1.一种显示模组，其特征在于，包括：

显示面板，所述显示面板包括依次排列的有效显示区、弯折区以及衬垫区，所述有效显示区上依次层叠有粘接层和固定层，所述弯折区上涂布有保护胶层，所述衬垫区上设置有电子芯片，所述电子芯片上覆盖有芯片保护膜，所述粘接层延伸至所述保护胶层并覆盖于所述保护胶层的第一侧的边缘，所述粘接层的边缘置于所述固定层的覆盖区域内，所述芯片保护膜延伸至所述保护胶层，并覆盖于保护胶层的第二侧的边缘，其中，所述第一侧与所述第二侧为所述保护胶层相对的两侧，所述第一侧与所述有效显示区相邻，所述第二侧与所述衬垫区相邻。

2.根据权利要求1所述的显示模组，其特征在于，

所述粘接层包括第一粘接层，所述第一粘接层上层叠有第一功能层，所述第一粘接层延伸至所述保护胶层并覆盖于所述第一侧的边缘，所述第一功能层的边界与所述第一粘接层的边界平齐，其中所述第一功能层作为所述固定层。

3.根据权利要求1所述的显示模组，其特征在于，

所述粘接层包括第二粘接层和第三粘接层，所述有效显示区上依次层叠有第二粘接层、第二功能层、第三粘接层和盖板，所述第三粘接层延伸至所述保护胶层并覆盖于所述第一侧的边缘，所述第三粘接层的边缘置于所述盖板的覆盖区域内，所述盖板作为所述固定层，所述第二粘接层与所述第二功能层均置于所述有效显示区内。

4.根据权利要求1所述的显示模组，其特征在于，

所述芯片保护膜包括绝缘胶带和绝缘层，所述绝缘胶带划分为芯片覆盖区和面板覆盖区，所述芯片覆盖区覆盖于所述电子芯片上，所述面板覆盖区覆盖于所述显示面板上，且所述面板覆盖区背离所述芯片覆盖区的一端覆盖于所述第二侧的边缘，所述芯片覆盖区上依次层叠有吸波层和导电层，所述面板覆盖区上层叠有强化胶层，所述绝缘层覆盖于所述导电层与所述强化胶层的表面。

5.根据权利要求1所述的显示模组，其特征在于，

所述显示面板背离所述第一绝缘层的一面层叠设置有散热层，所述散热层第三侧的边缘置于所述保护胶层的覆盖区域内，其中，所述第三侧为所述散热层靠近所述弯折区的一侧。

6.根据权利要求5所述的显示模组，其特征在于，

所述散热层背离所述显示面板的一面层叠设置有半径界定层，所述半径界定层用于界定所述弯折区的弯折半径。

7.根据权利要求1所述的显示模组，其特征在于，

还包括电路板，所述衬垫区背离所述弯折区的一端与所述电路板的边缘相贴合，所述电子芯片设置于所述电路板与所述弯折区之间。

8.根据权利要求2或3所述的显示模组，其特征在于，

所述第一功能层包括触控层和/或偏光片；

或所述第二功能层包括触控层和/或偏光片。

9.根据权利要求1所述的显示模组，其特征在于，

所述弯折区包括依次层叠的基板、填充层、金属走线层和保护层，所述保护层上涂布有所述保护胶层。

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10.一种显示设备,其特征在于,包括:

如权利要求1至9任一项所述的显示模组。

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一种显示模组和显示设备

技术领域

[0001] 本发明涉及显示技术领域，尤其涉及一种显示模组和显示设备。

背景技术

[0002] 目前OLED全面屏都采用Pad折叠方案来减小显示边框，Pad折叠涉及到弯折区界定，弯折区膜层结构有特殊处理，弯折区内金属走线具备较好耐弯折能力，而非弯折区上的各个膜层相对显示屏幕的封装区边界内缩0.2mm，不会覆盖到弯折区，当进行PAD弯折时，显示面板不仅处于弯折区的部分会发生弯折变形，非弯折区与弯折区临近的位置，甚至整个显示面板都会发生变形，非弯折区与弯折区临近的区域容易因PAD弯折而发生断裂，导致显示屏的显示不良，使得显示模组的弯折良率下降，因此如何提高显示模组的弯折良率是本领域技术人员亟需解决的技术问题。

发明内容

[0003] 有鉴于此，本发明实施例提供一种显示模组及显示设备，主要目的是提高显示模组的弯折良率。

[0004] 一方面，本发明实施例提供了一种显示模组，该显示模组包括：显示面板，所述显示面板包括依次排列的有效显示区、弯折区以及衬垫区，所述有效显示区上依次层叠有粘接层和固定层，所述弯折区上涂布有保护胶层，所述衬垫区上设置有电子芯片，所述电子芯片上覆盖有芯片保护膜，所述芯片保护膜延伸至所述保护胶层，并覆盖于保护胶层的第一侧的边缘，所述粘接层延伸至所述保护胶层并覆盖于所述保护胶层的第二侧的边缘，所述粘接层的边缘置于所述固定层的覆盖区域内，其中，所述第一侧与所述第二侧为所述保护胶层相对的两侧，所述第一侧与所述有效显示区相邻，所述第二侧与所述衬垫区相邻。

[0005] 本发明的目的及解决其技术问题还可采用以下技术措施进一步实现。

[0006] 具体地，所述粘接层包括第一粘接层，所述第一粘接层上层叠有第一功能层，所述第一粘接层延伸至所述保护胶层并覆盖于所述第一侧的边缘，所述第一功能层的边界与所述第一粘接层的边界平齐，其中所述第一功能层作为所述固定层。

[0007] 具体地，所述粘接层包括第二粘接层和第三粘接层，所述有效显示区上依次层叠有第二粘接层、第二功能层、第三粘接层和盖板，所述第三粘接层延伸至所述保护胶层并覆盖于所述第一侧的边缘，所述第三粘接层的边缘置于所述盖板的覆盖区域内，所述盖板作为所述固定层，所述第二粘接层与所述第二功能层均置于所述有效显示区内。

[0008] 具体地，所述芯片保护膜包括绝缘胶带和绝缘层，所述绝缘胶带划分为芯片覆盖区和面板覆盖区，所述芯片覆盖区覆盖于所述电子芯片上，所述面板覆盖区覆盖于所述显示面板上，且所述面板覆盖区背离所述芯片覆盖区的一端覆盖于所述第二侧的边缘，所述芯片覆盖区上依次层叠有吸波层和导电层，所述面板覆盖区上层叠有强化胶层，所述绝缘层覆盖于所述导电层与所述强化胶层的表面。

[0009] 具体地，所述显示面板背离所述第一绝缘层的一面层叠设置有散热层，所述散热

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层第三侧的边缘置于所述保护胶层的覆盖区域内，其中，所述第三侧为所述散热层靠近所述弯折区的一侧。

[0010] 具体地，所述散热层背离所述显示面板的一面层叠设置有半径界定层，所述半径界定层用于界定所述弯折区的弯折半径。

[0011] 具体地，还包括电路板，所述衬垫区背离所述弯折区的一端与所述电路板的边缘相贴合，所述电子芯片设置于所述电路板与所述弯折区之间。

[0012] 具体地，所述第一功能层包括触控层和/或偏光片；

[0013] 或所述第二功能层包括触控层和/或偏光片。

[0014] 具体地，所述弯折区包括依次层叠的基板、填充层、金属走线层和保护层，所述保护层上涂布有所述保护胶层。

[0015] 另一方面，本发明实施例还提供一种显示设备，该显示设备包括：以上任一实施例所提供的显示模组。

[0016] 本发明实施例提出的一种显示模组及显示设备，通过将粘接层和固定层均延伸至保护胶层的上方，粘接层能够覆盖保护胶层的第一侧的边缘，此时弯折区边界置于粘接层与保护胶层重叠的位置区域，由于粘接层的吸附作用，将韧性较强的固定层覆盖在弯折区的边缘处，此时固定层能够确定PAD弯折时发生变形的变形区的边界，同时，芯片保护膜延伸至第二侧的边缘，并且芯片保护膜能够将第二侧的边缘覆盖，此时，弯折区与衬垫区相邻的这一侧的边界置于芯片保护膜与保护胶层重叠的区域内，芯片保护膜具有较大的强度，不仅能够对衬垫区的强度进行补偿，还能够确定变形区的边界，在对显示面板进行PAD的弯折时，延伸长度后的固定层和芯片保护膜能够界定变形区的边界，使得变形区置于弯折区所在的区域内，由于弯折区内的结构经过特殊的制作，其抗弯折能力较强，因此弯折区域不会被拉坏，同时变形区在弯折区内，因此能够保证显示面板其他区域的金属走线不会被拉坏，避免金属线发生断裂，保证了显示面板的弯折良率。

[0017] 上述说明仅是本发明技术方案的概述，为了能够更清楚了解本发明的技术手段，并可依照说明书的内容予以实施，以下以本发明的较佳实施例并配合附图详细说明如后。

附图说明

[0018] 图1为本发明实施例提供的一种显示模组结构示意图；

[0019] 图2为本发明实施例提供的一种显示模组另一结构示意图；

[0020] 图3为本发明实施例提供的一种显示模组又一结构示意图；

[0021] 图4为本发明实施例提供的一种显示模组的芯片保护膜结构示意图；

[0022] 图5为本发明实施例提供的一种显示模组的弯折区结构示意图。

[0023] 附图标号：

[0024] 1-有效显示区，11-第一粘接层，12-第一功能层，13-第二粘接层，14-第二功能层，15-第三粘接层，16-盖板，2-弯折区，21-保护胶层，22-基板，23-填充层，24-金属走线层，25-保护层，3-衬垫区，31-电子芯片，32-芯片保护膜，321-绝缘胶带，3211-芯片覆盖区，3212-吸波层，3213-导电层，3214-面板覆盖区，3215-强化胶层，322-绝缘层，4-散热层，5-电路板，6-半径界定层。

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具体实施方式

[0025] 为更进一步阐述本发明为达成预定发明目的所采取的技术手段及功效,以下结合附图及较佳实施例,对依据本发明提出的一种显示模组及显示设备其具体实施方式、结构、特征及其功效,详细说明如后。

[0026] 一方面,本发明实施例提供了一种显示模组,该显示模组包括:显示面板,如图1至图3所示,显示面板包括依次排列的有效显示区1、弯折区2以及衬垫区3,有效显示区1上依次层叠有粘接层和固定层,弯折区2上涂布有保护胶层21,衬垫区3上设置有电子芯片31,电子芯片31上覆盖有芯片保护膜32,芯片保护膜32延伸至保护胶层21,并覆盖于保护胶层21的第一侧的边缘,粘接层延伸至保护胶层21并覆盖于保护胶层21的第二侧的边缘,粘接层的边缘置于固定层的覆盖区域内,其中,第一侧与第二侧为保护胶层21相对的两侧,第一侧与有效显示区1相邻,第二侧与衬垫区3相邻。

[0027] 其中,显示面板分为依次排列在有效显示区1、弯折区2以及衬垫区3,有效显示区1和衬垫区3分别位于弯折区2的两侧,其中,弯折区2的层结构是经过特殊制作的,其具有较强的抗拉能力,并且,弯折区2上涂布的保护胶层21能够发挥机械补强和信赖性保证的作用,保护胶层21将弯折区2全面覆盖,对弯折区2进行保护,进一步避免弯折区2内的金属走线在弯折时发生断裂。其中,保护胶层21可以为UV胶,且保护胶层21的覆盖区域可以略大于弯折区2。

[0028] 而有效显示区1上层叠设置有粘接层和固定层,粘接层与固定层向弯折区2延伸,粘接层能够覆盖固定胶层21的第一侧的边缘,粘接层的边缘置于固定层的覆盖区域内,此时可以有两种状况:第一种,粘接层的边缘与固定层的边缘平齐,第二种,粘接层的边缘距离固定层的边缘具有一定的距离,这两种状况均可。固定层具有较强的韧性以及强度等,并且固定层和粘接层能够将保护胶层21的第一侧的边缘覆盖,此时,能够将弯折区2的边界置于粘接层与保护胶层21的重叠区域内,并且,由于在有效显示区1的边缘覆盖上固定层,使得此处的强度得到补偿,设定粘接层超过弯折区2的边界的距离为第一预设距离,变形区的边界形成在距离弯折区2边界预设距离的区域内,在进行PAD弯折时,固定层能够界定变形区的边界,使得变形区靠近有效显示区1的边界置于弯折区2内,进而有效显示区1边缘不会发生弯折变形,避免有效显示区1内的金属走线发生断裂。其中变形区指的是在进行PAD弯折时,显示面板发生变形的区域。

[0029] 衬垫区3上设置有电子芯片31,芯片保护膜32能够覆盖电子芯片31以达到对屏蔽外部电磁干扰对电子芯片31的影响。芯片保护膜32向弯折区2扩展并且能够将保护胶层21第二侧的边缘覆盖,首先,芯片保护膜32覆盖在衬垫区3,衬垫区3整体膜层的强度得到补偿,因此不容易发生变形,同时,芯片保护膜32能够搭接在保护胶层21上,对变形区靠近衬垫区3的这一侧的边界进行界定,使得变形区靠近衬垫区3的边界置于弯折区2内,这样在进行PAD弯折时,此时,设定芯片保护膜32进入弯折区2的距离为第二预设距离,整个变形区置于弯折区2内,使得弯折区2以外的区域不会发生变形,进而能够避免有效显示区1以及衬垫区3的金属走线被拉断,提高了显示模组的弯折良率。

[0030] 本发明实施例提出的一种显示模组,通过将粘接层和固定层均延伸至保护胶层的上方,粘接层能够覆盖保护胶层的第一侧的边缘,此时弯折区边界置于粘接层与保护胶层重叠的位置区域,由于粘接层的吸附作用,将韧性较强的固定层覆盖在弯折区的边缘处,此

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时固定层能够确定PAD弯折时发生变形的变形区的边界，同时，芯片保护膜延伸至第二侧的边缘，并且芯片保护膜能够将第二侧的边缘覆盖，此时，变形区靠近衬垫区的这一侧的边界置于芯片保护膜与保护胶层重叠的区域内，芯片保护膜具有较大的强度，不仅能够对衬垫区的强度进行补偿，还能够确定变形区的边界，在对显示面板进行PAD的弯折时，延伸长度后的固定层和芯片保护膜能够界定变形区的边界，使得变形区置于弯折区所在的区域内，由于弯折区内的结构经过特殊的制作，其抗弯折能力较强，因此弯折区域不会被拉坏，同时变形区在弯折区内，因此能够保证显示面板其他区域的金属走线不会被拉坏，避免金属线发生断裂，保证了显示面板的弯折良率。

[0031] 本发明的目的及解决其技术问题还可采用以下技术措施进一步实现。

[0032] 具体地，如图1和图3所示，其中图3为显示模组进行PAD弯折时的结构示意图，粘接层包括第一粘接层11，第一粘接层11上层叠有第一功能层12，第一粘接层11延伸至保护胶层21并覆盖于第一侧的边缘，第一功能层12的边界与第一粘接层11的边界平齐，其中第一功能层12作为固定层。显示模组中的显示面板上层叠有第一粘接层11，通过第一粘接层11将第一功能层12固定在显示面板上，第一功能层12可以为偏光片或触摸层中的任一种，或者二者同时形成上述第一功能层12。第一粘接层11的材质可以为UV胶。在本实施例中，第一功能层12的韧性以及强度较大，其可以限定变形区的起始位置，以将变形区固定在弯折区2内。如图1所示，在第一功能层12的上还层叠有第三粘接层15，此时，还可以设计第三粘接层15的边缘与第一功能层12的边缘平齐，而设置在第三粘接层15上方的盖板16的边缘要突出于第三粘接层15。当然，在本实施例中，第三粘接层15无需向保护胶层21延伸。

[0033] 具体地，如图2所示，粘接层包括第二粘接层13和第三粘接层15，有效显示区1上依次层叠有第二粘接层13、第二功能层14、第三粘接层15和盖板16，第三粘接层15延伸至保护胶层21并覆盖于第一侧的边缘，第三粘接层15的边缘置于盖板16层的覆盖区域内，盖板16作为固定层，第二粘接层13与第二功能层14均置于有效显示区1内。显示面板的上方一次层叠有第二粘接层13、第二功能层14、第三粘接层15以及盖板16，其中，第二粘接层13与上述实施例中所提到的第一粘接层11相同，二者均是UV胶灯光学胶，第二功能层14与上述实施例所提到的第一功能层12相同，二者均可以包括偏光片和触摸层中的任一种，或者二者均设置在同一显示模组中，第三粘接层15与第二粘接层13的材质也可以同为UV胶，第一粘接层11、第二粘接层13以及第三粘接层15在现有技术中比较常见，在此不一一列举。将第三粘接层15延伸至保护胶层21的边缘，可以将盖板16覆盖于保护胶层21的边缘，盖板16具有较好的强度与韧性，当进行PAD弯折时，盖板16能够限定变形区的起始位置，即限定变形区的边界，将变形区控制在弯折区2内。当第三粘接层15向保护胶层21延伸时，第二粘接层13与第二功能层14无需再向保护胶层21延伸，第二粘接层13距离保护胶层21的距离可以为零，当然可以距离保护胶层21具有一定的距离。而第二功能层14的边缘可以与第二粘接层13平齐，也可以在第二粘接层13的边缘内缩一定距离。

[0034] 具体地，如图4所示，芯片保护膜32包括绝缘胶带321和绝缘层322，绝缘胶带321划分为芯片覆盖区3211和面板覆盖区3214，芯片覆盖区3211覆盖于电子芯片31上，面板覆盖区3214覆盖于显示面板上，且面板覆盖区3214背离芯片覆盖区3211的一端覆盖于第二侧的边缘，芯片覆盖区3211上依次层叠有吸波层3212和导电层3213，面板覆盖区3214上层叠有强化胶层3215，绝缘层322覆盖于导电层3213与强化胶层3215的表面。绝缘胶带321与电子

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芯片31以及显示面板进行连接，层叠于芯片覆盖区3211上膜层需要具有电磁屏蔽的作用，进而芯片覆盖区3211域上层叠有吸波层3212和导电层3213，其中吸波层3212由吸波材质制成，而导电层3213由导电材料制成。对应的，由于面板覆盖区3214不需要具有屏蔽电磁的作用，同时为了加强芯片覆盖区3211的强度和韧性，在芯片覆盖区3211上设置强化胶层3215，以增加面板覆盖区3214的强度，其中，强化胶层3215可以PET材料，还可以节约成本。在强化胶层3215与导电材料的上方均覆盖有绝缘层322，绝缘层322由绝缘材质制成。其中，面板覆盖区3214远离电子芯片31的一端覆盖于保护胶层21的边缘。

[0035] 具体地，如图1至图3所示，显示面板背离第一绝缘层322的一面层叠设置有散热层4，散热层4第三侧的边缘置于保护胶层21的覆盖区域内，其中，第三侧为散热层4靠近弯折区2的一侧。在显示面板的下方还层叠有散热层4，有助于显示面板的散热，使得散热层4的边缘延伸至保护胶层21的覆盖区域内，保护胶层21与散热层4设置在显示面板相对的两个面上，此处保护胶层21的覆盖区域指的是保护胶层21在显示面板上的正投影的区域。散热层4能够进一步的对变形区的边界进行限定，设定散热层4进入到弯折区2的距离为第三预设距离，进一步的将变形区的边界控制在弯折区2内，保证显示模组的弯折效果。

[0036] 具体地，如图3所示，散热层4背离显示面板的一面层叠设置有半径界定层6，半径界定层6用于界定弯折区2的弯折半径。半径界定层6可以由PET材质制成，当进行PAD弯折时，显示面板的衬垫区3背离电子芯片31的一面直接贴附在半径界定层6上，进而半径界定层6能够用来确定弯折区2的弯折半径。其中，半径界定层6在显示模组并未进行弯折时就已经设置在显示模组上。

[0037] 具体地，如图1至图3所示，还包括电路板5，衬垫区3背离弯折区2的一端与电路板5的边缘相贴合，电子芯片31设置于电路板5与弯折区2之间。电路板5为柔性电路板5，本实施例适用于柔性显示面板，电路板5的边缘与衬垫区3的边缘相贴合，以此对电路板5进行固定。

[0038] 具体地，第一功能层12包括触控层和/或偏光片；或第二功能层14包括触控层和/或偏光片。第一功能层12和第二功能层14相同，显示模组中可以设置触控层和偏光片层中的任一种，或者共同设置触控层与偏光片，其中触控层和偏光片的层叠顺序不做限定。

[0039] 具体地，如图5所示，弯折区2包括依次层叠的基板22、填充层23、金属走线层24和保护层25，保护层25上涂布有保护胶层21。其中基板22为PI基板22，填充层23由PI材质制成，保护层25同样由PI材质制成，弯折区2仅仅由这四层材质制成，将显示面板中的性质较脆的无机材质刻蚀去除，保留金属走线层24和有机PI材质，使得弯折具有较强的抗弯折能力，弯折区2的金属走线不会因弯折而发生断裂。

[0040] 另一方面，本发明实施例还提供一种显示设备，该显示设备包括：以上任一实施例所提供的显示模组。本实施例所提供的显示设备包括以上任一实施例所提供的显示模组的全部有益效果，在此不一一赘述。

[0041] 以上所述，仅为本发明的具体实施方式，但本发明的保护范围并不局限于此，任何熟悉本技术领域的技术人员在本发明揭露的技术范围内，可轻易想到变化或替换，都应涵盖在本发明的保护范围之内。因此，本发明的保护范围应以所述权利要求的保护范围为准。

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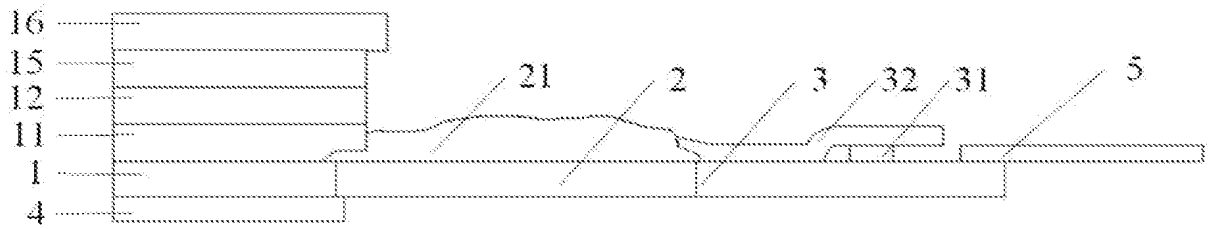


图1

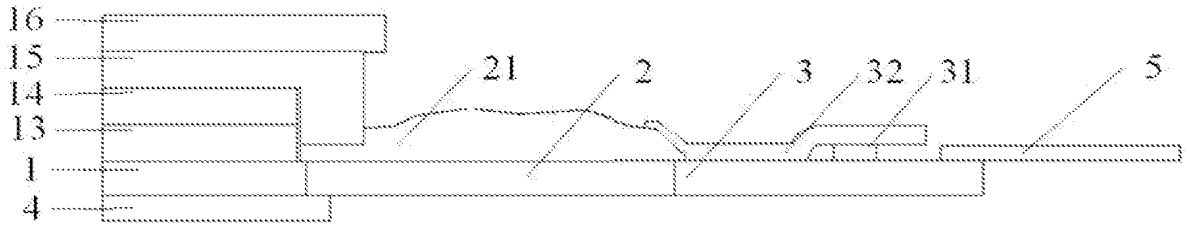


图2

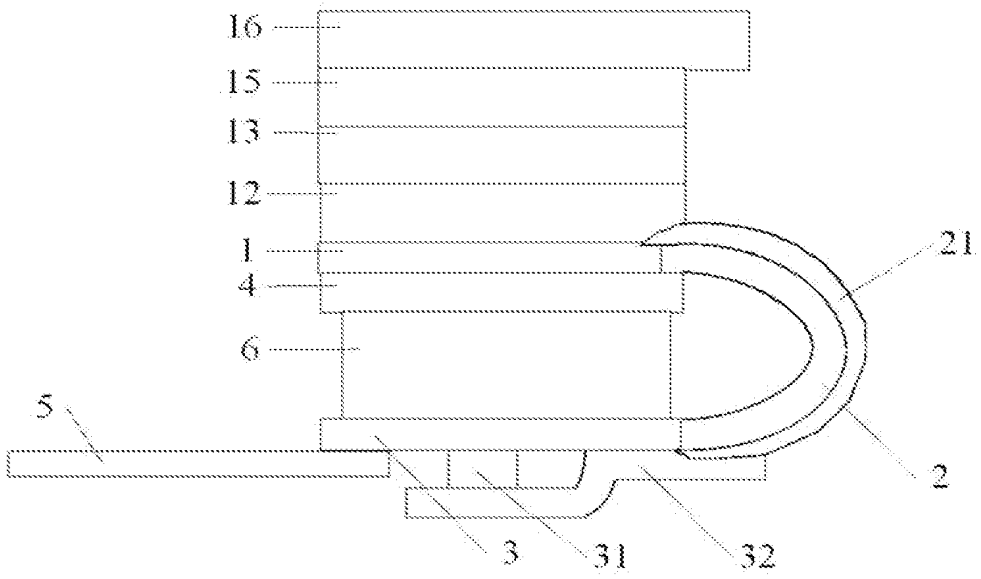


图3

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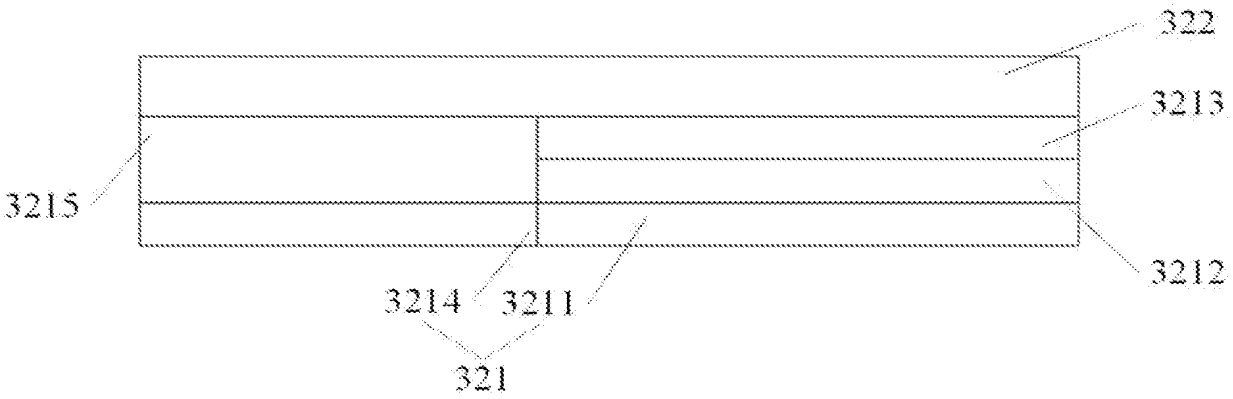


图4

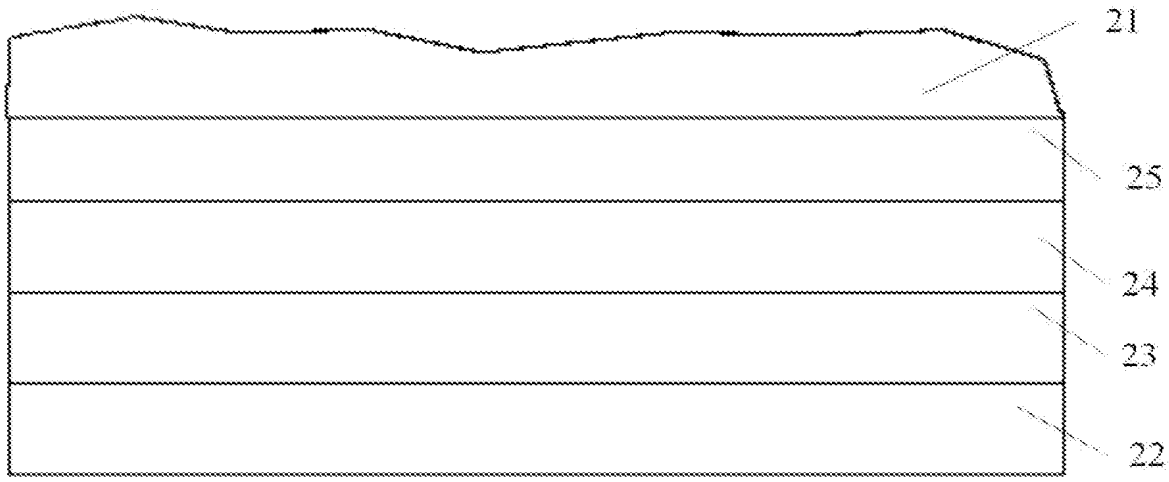


图5

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Abstract of CN111430426 (A)
The embodiment of the application provides a display panel and a manufacturing method thereof, the display panel comprises a pixel definition layer, a light emitting layer, an encapsulation layer and a color film functional layer, the pixel definition layer is provided with a first surface and a second surface which are oppositely arranged, the pixel definition layer is provided with a groove, the light emitting layer is arranged in the groove, the encapsulation layer is arranged on the first surface of the pixel definition layer and extends to cover the light emitting layer, and the color film functional layer is arranged in the encapsulation layer and corresponds to the groove. The color film functional layer is arranged in the packaging layer and corresponds to the light emitting layer in the groove, and the polarizer is replaced by the color film functional layer, so that the thickness of the display panel can be reduced, the display panel can be conveniently bent, and meanwhile, the color film functional layer is arranged in the packaging layer, so that the color film functional layer can be further close to the light emitting layer, the thickness of the display panel is further reduced, and the light emitting performance of the display panel is favorably improved.

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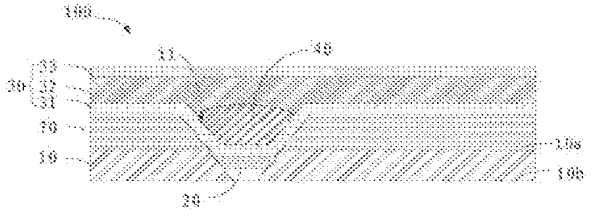
权利要求书1页 说明书5页 附图2页

(54)发明名称

一种显示面板及制程方法

(57)摘要

本申请实施例提供一种显示面板及制造方法，显示面板包括像素定义层、发光层、封装层以及彩膜功能层，像素定义层具有相对设置的第一面和第二面，所述像素定义层设置有凹槽，发光层设在所述凹槽内，封装层设置在所述像素定义层的第一面上，且延伸覆盖所述发光层，彩膜功能层设置在所述封装层内，且与所述凹槽对应。由于将彩膜功能层设置在封装层内，且彩膜功能层与位于凹槽内的发光层对应，通过彩膜功能层替代偏光片，这样可以降低显示面板的厚度，方便显示面板进行弯折，同时，由于将彩膜功能层设置在封装层内，因此，能够进一步的让彩膜功能层与发光层靠近，进一步降低显示面板厚度的同时，有利于提高显示面板的出光性能。



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1.一种显示面板，其特征在于，包括：

像素定义层，具有相对设置的第一面和第二面，所述像素定义层设置有凹槽；

发光层，设在所述凹槽内；

封装层，设置在所述像素定义层的第一面上，且延伸覆盖所述发光层；

彩膜功能层，设置在所述封装层内，且与所述凹槽对应。

2.根据权利要求1所述的显示面板，其特征在于，所述封装层包括第一子封装层、第二子封装层以及第三子封装层，所述第一子封装层设置在所述像素定义层的第一面，且延伸覆盖所述发光层，所述第二子封装层覆盖在所述第一子封装层和彩膜发光层远离所述像素定义层的一面，所述第三子封装层设置在所述第二子封装层远离所述第一封装层的一面。

3.根据权利要求2所述的显示面板，其特征在于，所述彩膜功能层设置在所述第一子封装层与所述第二子封装层之间，且位于所述凹槽内。

4.根据权利要求3所述的显示面板，其特征在于，所述彩膜功能层的顶部为弧形，所述彩膜功能层的顶部低于所述第二子封装层的平面。

5.根据权利要求3所述的显示面板，其特征在于，所述彩膜功能层通过喷墨打印形成到所述第一子封装层上。

6.根据权利要求3所述的显示面板，其特征在于，还包括阳极层、阴极层以及遮光层，所述遮光层位于所述像素定义层的第一面，且位于所述凹槽的两侧，所述阴极层位于所述遮光层与所述第一子封装层之间，且设置于所述凹槽内的发光层位于所述第一子封装层与发光层之间，所述阳极层设置在所述发光层远离所述阴极层的一面。

7.根据权利要求6所述的显示面板，其特征在于，还包括平坦化层、层间绝缘层、第一绝缘层以及第二绝缘层，所述平坦化层设置在所述第二面，所述第二绝缘层设置在平坦化层远离所述像素定义层的一面，所述第一绝缘层设置在所述第二绝缘层远离所述平坦化层的一面。

8.根据权利要求7所述的显示面板，其特征在于，还包括薄膜晶体管，所述薄膜晶体管包括第一端口和第二端口，所述平坦化层、层间绝缘层、第一绝缘层以及第二绝缘层设置有沟道，所述第一端口与所述阳极层连接，所述第一端口通过所述沟道与所述第二端口连通。

9.根据权利要求7所述的显示面板，其特征在于，还包括缓冲层和绝缘薄膜层，所述缓冲层设置在所述第一绝缘层远离所述第二绝缘层的一面，所述绝缘薄膜层设置在所述缓冲层远离所述第一绝缘层的第一面。

10.一种显示面板制程方法，其特征在于，包括：

提供一像素定义层，所述具有相对设置的第一面和第二面，所述像素定义层设置在凹槽；

在所述凹槽内设置有发光层；

在封装层之间设置彩膜功能层，所述彩膜功能层与所述凹槽对应；

将封装层与彩膜功能层设置在所述像素定义层的第一面，所述封装层延伸覆盖所述发光层。

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一种显示面板及制程方法

技术领域

[0001] 本申请涉及显示技术领域，具体涉及一种显示面板及制程方法。

背景技术

[0002] 偏光片(POL)能够有效地降低强光下面板的反射率，却损失了接近58％的出光。这对于OLED(OrganicLight-Emitting Diode，有机电激光显示)来说，极大地增加了其寿命负担。另一方面，偏光片厚度较大、材质脆，不利于应用到动态弯折的显示面板上。

[0003] 因此，提供一种能够实现动态弯折的显示面板，成为本领域技术人员亟待解决的技术问题。

发明内容

[0004] 本申请实施例提供一种显示面板及制程方法，能够使得显示面板实现动态弯折。

[0005] 本申请提供一种显示面板，包括：

[0006] 像素定义层，具有相对设置的第一面和第二面，所述像素定义层设置有凹槽；

[0007] 发光层，设在所述凹槽内；

[0008] 封装层，设置在所述像素定义层的第一面上，且延伸覆盖所述发光层；

[0009] 彩膜功能层，设置在所述封装层内，且与所述凹槽对应。

[0010] 在一些实施例中，所述封装层包括第一子封装层、第二子封装层以及第三子封装层，所述第一子封装层设置在所述像素定义层的第一面，且延伸覆盖所述发光层，所述第二子封装层覆盖在所述第一子封装层和彩膜发光层远离所述像素定义层的一面，所述第三子封装层设置在所述第二子封装层远离所述第一封装层的一面。

[0011] 在一些实施例中，所述彩膜功能层设置在所述第一子封装层与所述第二子封装层之间，且位于所述凹槽内。

[0012] 在一些实施例中，所述彩膜功能层的顶部为弧形，所述彩膜功能层的顶部低于所述第二子封装层的平面。

[0013] 在一些实施例中，所述彩膜功能层通过喷墨打印形成到所述第一子封装层上。

[0014] 在一些实施例中，还包括阳极层、阴极层以及遮光层，所述遮光层位于所述像素定义层的第一面，且位于所述凹槽的两侧，所述阴极层位于所述遮光层与所述第一子封装层之间，且设置于所述凹槽内的发光层位于所述第一子封装层与发光层之间，所述阳极层设置在所述发光层远离所述阴极层的一面。

[0015] 在一些实施例中，还包括平坦化层、层间绝缘层、第一绝缘层以及第二绝缘层，所述平坦化层设置在所述第二面，所述第二绝缘层设置在平坦化层远离所述像素定义层的一面，所述第一绝缘层设置在所述第二绝缘层远离所述平坦化层的一面。

[0016] 在一些实施例中，还包括薄膜晶体管，所述薄膜晶体管包括第一端口和第二端口，所述平坦化层、层间绝缘层、第一绝缘层以及第二绝缘层设置有沟道，所述第一端口与所述阳极层连接，所述第一端口通过所述沟道与所述第二端口连通。

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[0017] 在一些实施例中，还包括缓冲层和绝缘薄膜层，所述缓冲层设置在所述第一绝缘层远离所述第二绝缘层的一面，所述绝缘薄膜层设置在所述缓冲层远离所述第一绝缘层的第一面。

[0018] 本申请实施例还提供一种显示面板制程方法，包括：

[0019] 提供一像素定义层，所述具有相对设置的第一面和第二面，所述像素定义层设置在凹槽；

[0020] 在所述凹槽内设置有发光层；

[0021] 在封装层之间设置彩膜功能层，所述彩膜功能层与所述凹槽对应；

[0022] 将封装层与彩膜功能层设置在所述像素定义层的一面，所述封装层延伸覆盖所述发光层。

[0023] 本申请实施例所提供的显示面板包括像素定义层、发光层、封装层以及彩膜功能层，像素定义层具有相对设置的第一面和第二面，所述像素定义层设置有凹槽，发光层设在所述凹槽内，封装层设置在所述像素定义层的第一面上，且延伸覆盖所述发光层，彩膜功能层设置在所述封装层内，且与所述凹槽对应。由于将彩膜功能层设置在封装层内，且彩膜功能层与位于凹槽内的发光层对应，通过彩膜功能层替代偏光片，这样可以降低显示面板的厚度，方便显示面板进行弯折，同时，由于将彩膜功能层设置在封装层内，因此，能够进一步的让彩膜功能层与发光层靠近，进一步降低显示面板厚度的同时，有利于提高显示面板的出光性能。

附图说明

[0024] 为了更清楚地说明本申请实施例中的技术方案，下面将对实施例描述中所需要使用的附图作简单地介绍，显而易见地，下面描述中的附图仅仅是本申请的一些实施例，对于本领域技术人员来讲，在不付出创造性劳动的前提下，还可以根据这些附图获得其他的附图。

[0025] 图1为本申请实施例提供的显示面板的结构示意图。

[0026] 图2为本申请实施例提供一种显示面板的另一种结构示意图。

[0027] 图3为本申请实施例提供一种显示面板制程方法的流程示意图。

具体实施方式

[0028] 下面将结合本申请实施例中的附图，对本申请实施例中的技术方案进行清楚、完整地描述。显然，所描述的实施例仅仅是本申请一部分实施例，而不是全部的实施例。基于本申请中的实施例，本领域技术人员在没有作出创造性劳动前提下所获得的所有其他实施例，都属于本申请保护的范围。

[0029] 需要说明的是，在本申请的描述中，需要理解的是，术语“上”、“下”、“前”、“后”、“左”、“右”、“内”、“外”等指示的方位或位置关系为基于附图所示的方位或位置关系，仅是为了便于描述本申请和简化描述，而不是指示或暗示所指的装置或元件必须具有特定的方位、以特定的方位构造和操作，因此不能理解为对本申请的限制。

[0030] 本申请实施例提供一种显示面板及制程方法，以下对显示面板做详细介绍。

[0031] 请参阅图1，图1为本申请实施例提供的显示面板的结构示意图。其中，本申请实施

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例显示面板100包括像素定义层10、发光层20、封装层30以及彩膜功能层40，像素定义层10具有相对设置的第一面10a和第二面10b，所述像素定义层10设置有凹槽11，发光层20设在所述凹槽11内，封装层30设置在所述像素定义层10的第一面上，且延伸覆盖所述发光层20，彩膜功能层40设置在所述封装层30内，且与所述凹槽11对应。

[0032] 需要说明的是，第一面10a可以为像素定义层10的上表面，第二面10b可以为像素定义层10的下表面。当然，第一面10a也可以为像素定义层10的下表面，第二面10b可以为像素定义层10的上表面。本申请实施例中不做特殊说明的情况下，默认为第一面10a为像素定义层10的上表面，第二面10b为像素定义层10的下表面。

[0033] 其中，彩膜功能层40可以替代偏光片，通过使用彩膜(Color Filter)替代偏光片(POL)被归属为POL-less技术，它不仅能将功能层的厚度从大于100μm降低至小于5μm。而且能够将出光率从42％提高至60％。彩膜基本结构包括红色(R)、绿色(G)、蓝色(B)色阻以及黑色矩阵(BM)。基于OLED自发光的特点，色阻需要分别与OLED的红、绿和蓝子像素单元对应，形成彩膜功能层40。

[0034] 请参阅图2，图2为本申请实施例提供一种显示面板的另一种结构示意图。其中，所述封装层30包括第一子封装层31、第二子封装层32以及第三子封装层33，所述第一子封装层31设置在所述像素定义层10的第一面10a，且延伸覆盖所述发光层20，所述第二子封装层32覆盖在所述第一子封装层31和彩膜发光层20远离所述像素定义层10的一面，所述第三子封装层33设置在所述第二子封装层32远离所述第一封装层30的一面。

[0035] 需要说明的是，第一子封装层31可以是有机层，且第一子封装层31进行图案化。第二子封装层32通过喷墨打印的方式形成在所述第一子封装层31远离所述像素定义层10的一面。第三子封装层33可以是无机层，第三子封装层33也可以通过喷墨打印的方式形成到所述第二子封装层32远离所述第一封装层30的一面。具体的，第一子封装层31和第三子封装层33可以采用的材料为SiNx或SiOx等。

[0036] 其中，所述彩膜功能层40设置在所述第一子封装层31与所述第二子封装层32之间，且位于所述凹槽11内。

[0037] 其中，将彩膜功能层40设置在所述第一子封装层31与第二子封装层32之间，且彩膜功能层40位于凹槽11内，这样能够进一步的缩短彩膜功能层40和发光层20之间的距离。由于彩膜功能层40与发光层20之间的距离较近，因此，有利于发光层20通过所述彩膜功能层40出光，从而有利于提高显示面板100的出光性能。

[0038] 当然，也可以将彩膜功能层40设置在所述第二子封装层32内侧，或者将彩膜功能层40设置在所述第二子封装层32与第三子封装功能层之间。这两种方式，相较于现有技术，同样也能够降低彩膜功能层40和发光层20之间的距离，有利于提高显示面板100的出光性能。同时，由于不需要将彩膜功能层40设置到凹槽11内，在制造时工艺更加简单，制造成本更低。

[0039] 其中，所述彩膜功能层40的顶部为弧形，所述彩膜功能层40的顶部低于所述第二子封装层32的平面。

[0040] 需要说明的是，彩膜功能层40的顶部为弧形，这样彩膜功能层40能够增加出光角度。彩膜功能层40的顶部低于第二子封装层32的平面，这样能够确保彩膜功能层40能够与发光层20足够小的距离，保证显示面板100的出光效果。当然，在一些实施例中，彩膜功能层

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40的顶部也可以高于第二子封装层32的平面延伸至第二子封装层32或者第三子封装层33。

[0041] 其中，所述彩膜功能层40通过喷墨打印形成到所述第一子封装层31上。

[0042] 需要说明的是，通过喷墨打印将彩膜功能层40打印到第一子封装层31上，这种方式能够更加方便。

[0043] 其中，显示面板100还包括阳极层50、阴极层60以及遮光层70，所述遮光层70位于所述像素定义层10的第一面10a，且位于所述凹槽11的两侧，所述阴极层60位于所述遮光层70与所述第一子封装层31之间，且设置于所述凹槽11内的发光层20位于所述第一子封装层31与发光层20之间，所述阳极层50设置在所述发光层20远离所述阴极层60的一面。

[0044] 其中，显示面板100还包括平坦化层80、层间绝缘层90、第一绝缘层101以及第二绝缘层102，所述平坦化层80设置在所述第二面10b，所述第二绝缘层102设置在平坦化层80远离所述像素定义层10的一面，所述第一绝缘层101设置在所述第二绝缘层102远离所述平坦化层80的一面。

[0045] 其中，还包括薄膜晶体管103，所述薄膜晶体管103包括第一端口1031和第二端口1032，所述平坦化层80、层间绝缘层90、第一绝缘层101以及第二绝缘层102设置有沟道106，所述第一端口1031与所述阳极层50连接，所述第一端口1031通过所述沟道106与所述第二端口1032连通。

[0046] 其中，显示面板100还包括缓冲层104和绝缘薄膜层105，所述缓冲层104设置在所述第一绝缘层101远离所述第二绝缘层102的一面，所述绝缘薄膜层105设置在所述缓冲层104远离所述第一绝缘层101的第一面10a。

[0047] 本申请实施例所提供的显示面板100包括像素定义层10、发光层20、封装层30以及彩膜功能层40，像素定义层10具有相对设置的第一面10a和第二面10b，所述像素定义层10设置有凹槽11，发光层20设在所述凹槽11内，封装层30设置在所述像素定义层10的底一面上，且延伸覆盖所述发光层20，彩膜功能层40设置在所述封装层30内，且与所述凹槽11对应。由于将彩膜功能层40设置在封装层30内，且彩膜功能层40与位于凹槽11内的发光层20对应，通过彩膜功能层40替代所述偏光片，这样可以降低显示面板100的厚度，方便显示面板100进行弯折，同时，由于将彩膜功能层40设置在封装层30内，因此，能够进一步的让彩膜功能层40与发光层20靠近，进一步降低显示面板100厚度的同时，有利于提高显示面板100的出光性能。

[0048] 请参阅图3，图3为本申请实施例提供一种显示面板制程方法的流程示意图。其中，本申请实施例提供一种显示面板制程方法，包括步骤：

[0049] 201、提供一像素定义层，所述具有相对设置的第一面和第二面，所述像素定义层设置在凹槽。

[0050] 需要说明的是，第一面可以为像素定义层的上表面，第二面可以为像素定义层的下表面。当然，第一面也可以为像素定义层的下表面，第二面可以为像素定义层的上表面。本申请实施例中不做特殊说明的情况下，默认为第一面为像素定义层的上表面，第二面为像素定义层的下表面。

[0051] 202、在所述凹槽内设置有发光层。

[0052] 203、在封装层之间设置彩膜功能层，所述彩膜功能层与所述凹槽对应。

[0053] 需要说明的是，彩膜功能层可以替代偏光片，通过使用彩膜(Color Filter)替代

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偏光片(POL)被归属为POL-less技术，它不仅能将功能层的厚度从～100μm降低至＜5μm。而且能够将出光率从42％提高至60％。彩膜基本结构包括红色(R)、绿色(G)、蓝色(B)色阻以及黑色矩阵(BM)。基于OLED自发光的特点，色阻需要分别与OLED的红、绿和蓝子像素单元对应，形成彩膜功能层。

[0054] 204、将封装层与彩膜功能层设置在所述像素定义层的第一面，所述封装层延伸覆盖所述发光层。

[0055] 其中，所述封装层包括第一子封装层、第二子封装层以及第三子封装层，所述第一子封装层设置在所述像素定义层的第一面，且延伸覆盖所述发光层，所述第二子封装层覆盖在所述第一子封装层和彩膜发光层远离所述像素定义层的一面，所述第三子封装层设置在所述第二子封装层远离所述第一封装层的一面。

[0056] 具体的，，所述彩膜功能层设置在所述第一子封装层与所述第二子封装层之间，且位于所述凹槽内。

[0057] 其中，将彩膜功能层设置在所述第一子封装层与第二子封装层之间，且彩膜功能层位于凹槽内，这样能够进一步的缩短彩膜功能层和发光层之间的距离。由于彩膜功能层与发光层之间的距离较近，因此，有利于发光层通过所述彩膜功能层出光，从而有利于提高显示面板的出光性能。

[0058] 当然，也可以将彩膜功能层设置在所述第二子封装层内侧，或者将彩膜功能层设置在所述第二子封装层与第三子封装功能层之间。这两种方式，相较于现有技术，同样也能够降低彩膜功能层和发光层之间的距离，有利于提高显示面板的出光性能。同时由于不需要将彩膜功能层设置到凹槽内，在制造时，工艺更加简单，制造成本更低。

[0059] 本申请采用这种方法，由于将彩膜功能层设置在封装层内，且彩膜功能层与位于凹槽内的发光层对应，通过彩膜功能层替代偏光片，这样可以降低显示面板的厚度，方便显示面板进行弯折，同时，由于将彩膜功能层设置在封装层内，因此，能够进一步的让彩膜功能层与发光层靠近，进一步降低显示面板厚度的同时，有利于提高显示面板的出光性能。

[0060] 以上对本申请实施例提供的显示面板及制程方法进行了详细介绍，本文中应用了具体个例对本申请的原理及实施方式进行了阐述，以上实施例的说明只是用于帮助理解本申请。同时，对于本领域的技术人员，依据本申请的思想，在具体实施方式及应用范围上均会有改变之处，综上所述，本说明书内容不应理解为对本申请的限制。

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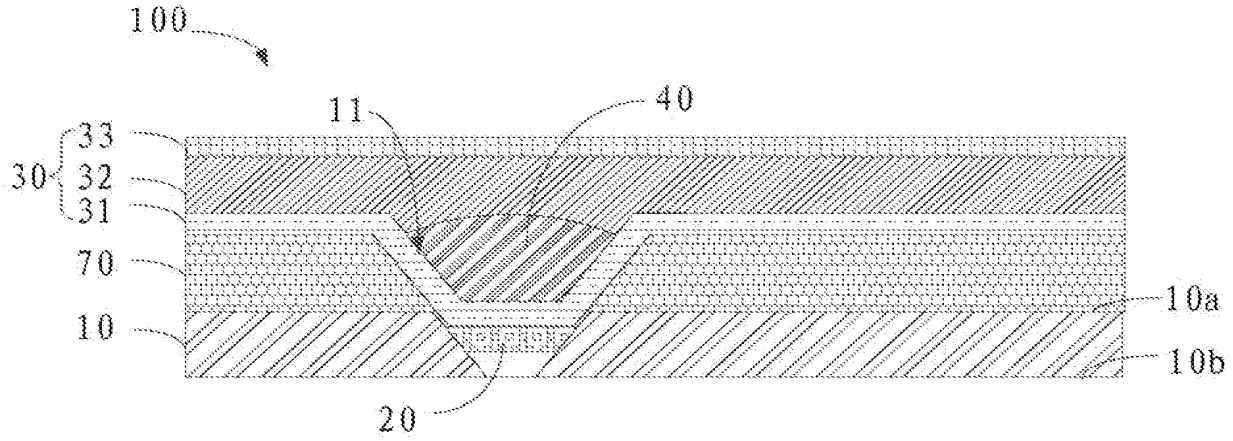


图1

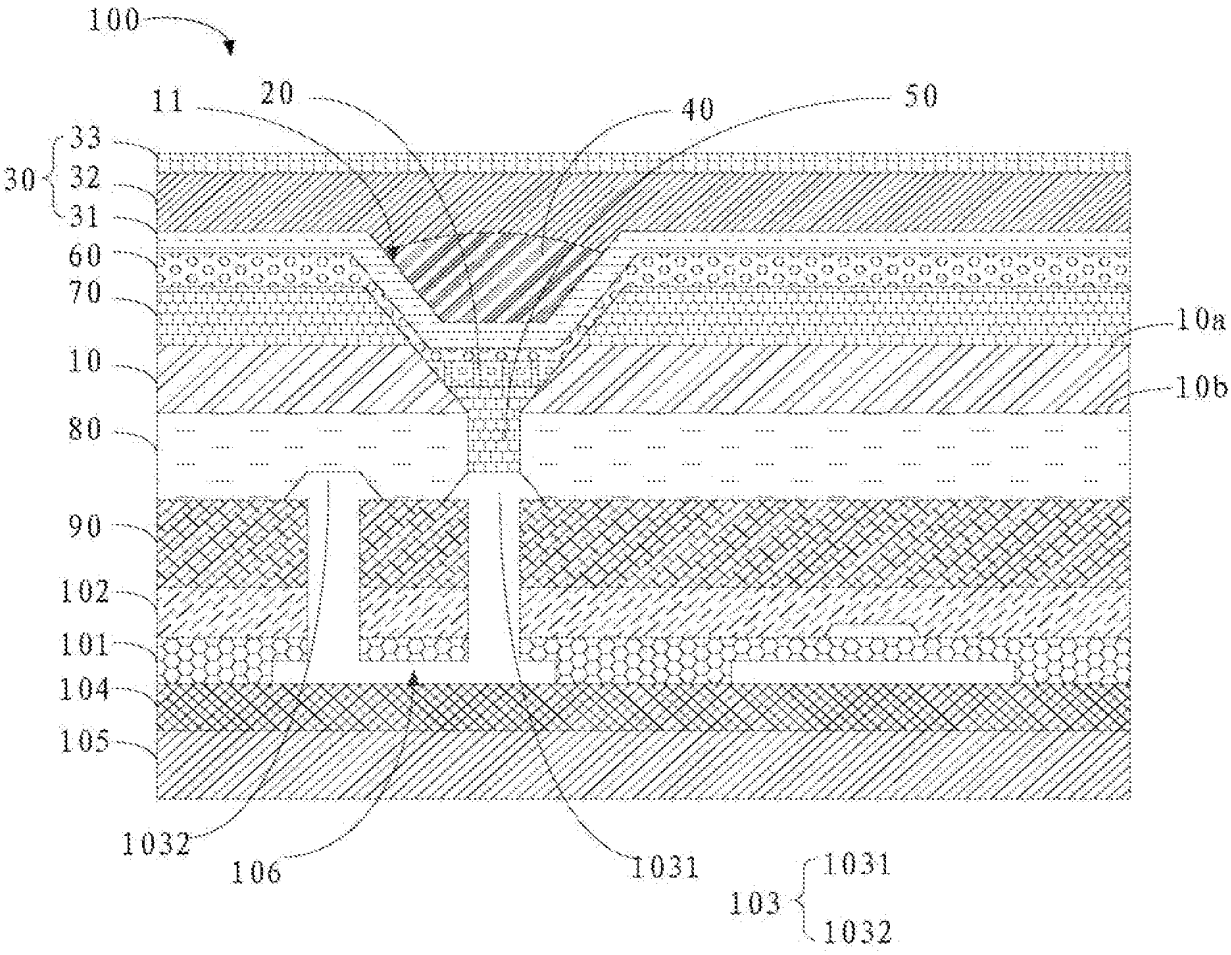


图2

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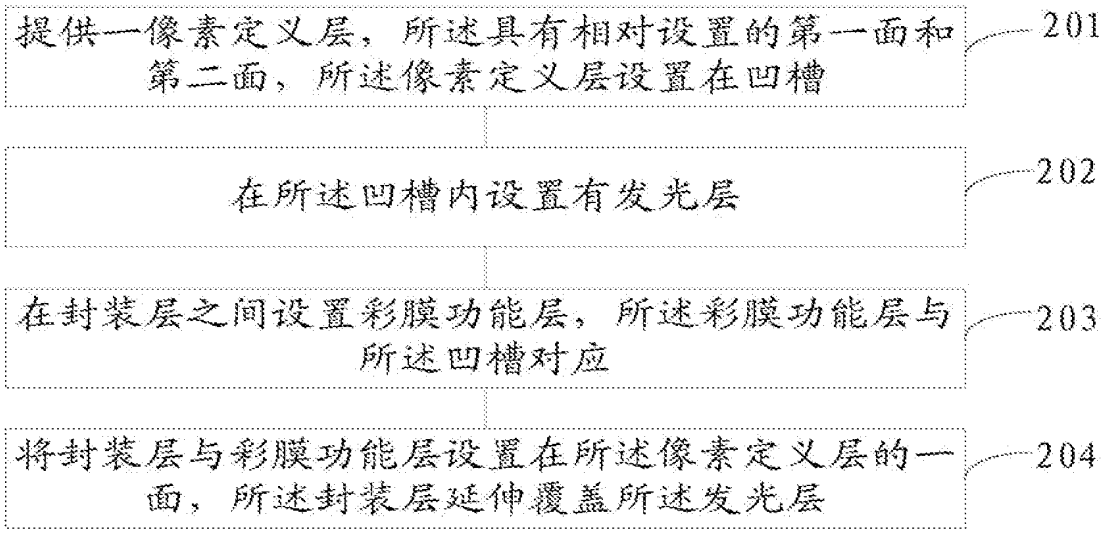


图3

Petitioner Samsung Ex-1004, 0285

Abstract of CN112289185 (A)

A display module comprises a display panel, a first back plate, an SCF assembly and a reinforcing plate, wherein the display panel comprises a display area and a binding end positioned on one side of the display area, one end of the binding end, which is far away from the display area, is connected with a driving chip, and the binding end is bent towards one side of a light emitting surface, which is far away from the display panel, so that the driving chip is positioned on one side of the display panel, which is far away from the light emitting surface; the first back plate is arranged on one side of the light emitting surface departing from the display panel; the SCF assembly and the reinforcing plate are both arranged on one side of the first back plate, which is far away from the display panel; wherein, one side of the SCF assembly departing from the display panel is provided with an accommodating groove, at least part of the components of the reinforcing plate are accommodated in the accommodating groove, and the driving chip is positioned on one side of the reinforcing plate departing from the display panel.

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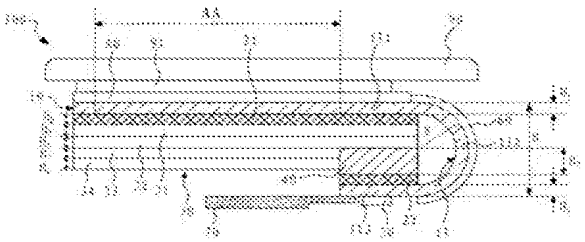
权利要求书1页 说明书6页 附图2页

(54)发明名称

显示模组

(57)摘要

一种显示模组，包括显示面板、第一背板、SCF组件以及加强板，所述显示面板包括显示区域和位于所述显示区域一侧的绑定端，所述绑定端的远离所述显示区域的一端连接有驱动芯片，所述绑定端朝背离所述显示面板的出光面一侧弯折，以使得所述驱动芯片位于所述显示面板的背离其出光面的一侧；所述第一背板设置于背离所述显示面板的出光面一侧；所述SCF组件和所述加强板均设置于所述第一背板背离所述显示面板的一侧；其中，所述SCF组件背离所述显示面板的一侧设置有容纳槽，所述加强板的至少部分组件容纳于所述容纳槽内，所述驱动芯片位于所述加强板背离所述显示面板的一侧。



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1.一种显示模组，其特征在于，包括：

显示面板，所述显示面板包括显示区域和位于所述显示区域一侧的绑定端，所述绑定端的远离所述显示区域的一端连接有驱动芯片，所述绑定端朝背离所述显示面板的出光面一侧弯折，以使得所述驱动芯片位于所述显示面板的背离其出光面的一侧；

第一背板，设置于背离所述显示面板的出光面一侧；

SCF组件，设置于所述第一背板背离所述显示面板的一侧；以及

加强板，设置于所述第一背板背离所述显示面板的一侧；其中，

所述SCF组件背离所述显示面板的一侧设置有容纳槽，所述加强板的至少部分组件容纳于所述容纳槽内，所述驱动芯片位于所述加强板背离所述显示面板的一侧。

2.根据权利要求1所述的显示模组，其特征在于，所述SCF组件包括依次层叠设置于所述第一背板背离所述显示面板一侧的粘结层、泡棉层、聚酰亚胺层以及金属层。

3.根据权利要求2所述的显示模组，其特征在于，所述聚酰亚胺层包括贯穿所述聚酰亚胺层的第一挖空区域，所述金属层包括贯穿所述金属层的第二挖空区域，所述第一挖空区域和所述第二挖空区域贯通以形成所述容纳槽。

4.根据权利要求3所述的显示模组，其特征在于，所述加强板包括散热层以及分别设置于所述散热层两相对侧的第一压敏胶层和第二压敏胶层。

5.根据权利要求4所述的显示模组，其特征在于，所述加强板的宽度和长度分别与所述容纳槽的宽度和长度相等，所述加强板的厚度大于所述容纳槽的深度。

6.根据权利要求4所说的显示模组，其特征在于，所述第一压敏胶层位于所述容纳槽内且与所述泡棉层粘合，所述第二压敏胶层背离所述散热层的一侧凸出于所述容纳槽。

7.根据权利要求4～6任一项所述的显示模组，其特征在于，所述绑定端包括第一端、第二端，以及连接所述第一端和所述第二端的弯折部，所述第一端连接所述显示区域，所述第二端连接所述驱动芯片，所述弯折部弯折呈圆弧状，所述第二端位于背离所述显示面板的出光面的一侧。

8.根据权利要求7所述的显示模组，其特征在于，所述加强板与所述第二端之间设置有第二背板，所述第二背板与所述第二压敏胶层粘合。

9.根据权利要求8所述的显示模组，其特征在于，所述第一端膜厚与所述第一背板膜厚、所述粘结层膜厚、所述泡棉膜厚、所述加强板膜厚以及所述第二背板膜厚之和为所述弯折部的弯折半径的两倍。

10.根据权利要求1所述的显示模组，其特征在于，所述弯折部表面贴附有UV胶。

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显示模组

技术领域

[0001] 本发明涉及显示技术领域，尤其涉及一种显示模组。

背景技术

[0002] 显示模组作为电子设备的显示部件已经广泛地应用于各种电子产品中，窄边框及超薄模组的设计也越来越受到终端厂商及消费者的青睐。终端消费者对显示模组的边框大小及显示模组的厚度的要求越来越严苛，如何设计一款窄边框及超薄厚度的模组结构是亟需解决的问题。

[0003] 窄边框方案的实现，主要是依靠绑定区域进行弯折，以使得驱动芯片弯折到显示模组的背面来实现。现有显示模组中的显示面板的背面一般贴附有SCF(Super Clean Foam，超净泡沫)结构和加强板，SCF结构起到缓冲作用，加强板起到固定作用，绑定区域的弯折区域高度一般由显示面板下方的膜层厚度决定，即由SCF结构的厚度和加强板的厚度决定。为了实现超薄模组，需要将弯折区域的弯折半径设计的较小，为了实现弯折半径0.2毫米以下的模组结构设计，需要降低弯折区域的高度，通常是选择降低加强板的厚度来实现。但加强板的厚度偏薄会导致其粘附性不足，影响绑定区域弯折的可靠度。

[0004] 因此，现有的显示模组的结构需要进行改进。

发明内容

[0005] 本发明实施例提供一种显示模组，以解决现有的显示模组中，为了实现窄边框和超薄模组设计，需要将弯折区域的弯折半径设计的较小，即需要降低弯折区域的高度，一般通过降低加强板的厚度来实现，但加强板的厚度偏薄会影响其粘附性，进而影响绑定区域弯折的可靠度的技术问题。

[0006] 为解决上述问题，本发明提供的技术方案如下：

[0007] 本发明实施例提供一种显示模组，包括显示面板、第一背板、SCF组件以及加强板，所述显示面板包括显示区域和位于所述显示区域一侧的绑定端，所述绑定端的远离所述显示区域的一端连接有驱动芯片，所述绑定端朝背离所述显示面板的出光面一侧弯折，以使得所述驱动芯片位于所述显示面板的背离其出光面的一侧；所述第一背板设置于背离所述显示面板的出光面一侧；所述SCF组件设置于所述第一背板背离所述显示面板的一侧；所述加强板设置于所述第一背板背离所述显示面板的一侧；其中，所述SCF组件背离所述显示面板的一侧设置有容纳槽，所述加强板的至少部分组件容纳于所述容纳槽内，所述驱动芯片位于所述加强板背离所述显示面板的一侧。

[0008] 在本发明的一种实施例中，所述SCF组件包括依次层叠设置于所述第一背板背离所述显示面板一侧的粘结层、泡棉层、聚酰亚胺层以及金属层。

[0009] 在本发明的一种实施例中，所述聚酰亚胺层包括贯穿所述聚酰亚胺层的第一挖空区域，所述金属层包括贯穿所述金属层的第二挖空区域，所述第一挖空区域和所述第二挖空区域贯通以形成所述容纳槽。

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[0010] 在本发明的一种实施例中，所述加强板包括散热层，以及分别设置于所述散热层两相对侧的第一压敏胶层和第二压敏胶层。

[0011] 在本发明的一种实施例中，所述加强板的宽度和长度分别与所述容纳槽的宽度和长度相等，所述加强板的厚度大于所述容纳槽的深度。

[0012] 在本发明的一种实施例中，所述第一压敏胶层位于所述容纳槽内且与所述泡棉层粘合，所述第二压敏胶层背离所述散热层的一侧凸出于所述容纳槽。

[0013] 在本发明的一种实施例中，所述绑定端包括第一端、第二端，以及连接所述第一端和所述第二端的弯折部，所述第一端连接所述显示区域，所述第二端连接所述驱动芯片，所述弯折部弯折呈圆弧状，所述第二端位于背离所述显示面板的出光面的一侧。

[0014] 在本发明的一种实施例中，所述加强板与所述第二端之间设置有第二背板，所述第二背板与所述第二压敏胶层粘合。

[0015] 在本发明的一种实施例中，所述第一端膜厚与所述第一背板膜厚、所述粘结层膜厚、所述泡棉膜厚、所述加强板膜厚以及所述第二背板膜厚之和为所述弯折部的弯折半径的两倍。

[0016] 在本发明的一种实施例中，所述弯折部表面贴附有UV胶。

[0017] 本发明的有益效果为：通过在SCF组件上设置容纳槽，使得加强板的至少部分膜层可位于容纳槽内，可极大限度地降低弯折区域的总高度，满足弯折半径在0.2毫米及以下的显示模组的结构设计需求；另外也能够解决在绑定端弯折的极限R角反弹力较大的情况下，提升加强板的粘性，提高绑定端弯折的可靠性。

附图说明

[0018] 图1为本发明实施例提供的显示模组的结构示意图。

[0019] 图2为本发明实施例提供的加强板的结构示意图。

[0020] 图3为本发明实施例提供的SCF组件的俯视图。

[0021] 图4为图3中AA’剖面的结构示意图。

[0022] 图5为本发明实施例提供的SCF组件的结构示意图。

具体实施方式

[0023] 以下各实施例的说明是参考附加的图示，用以例示本发明可用以实施的特定实施例。本发明所提到的方向用语，例如[上]、[下]、[前]、[后]、[左]、[右]、[内]、[外]、[侧面]等，仅是参考附加图式的方向。因此，使用的方向用语是用以说明及理解本发明，而非用以限制本发明。在图中，结构相似的单元是用以相同标号表示。

[0024] 本发明针对现有的显示模组，为了实现窄边框和超薄模组设计，将加强板的结构设计的偏薄，导致其粘附性不足，影响绑定区域弯折的可靠度的技术问题，本实施例能够解决该缺陷。

[0025] 请参阅图1，本发明实施例提供一种显示模组100，包括显示面板10、第一背板21、SCF组件30以及加强板40，其中，所述第一背板21设置于背离所述显示面板10的出光面一侧(即图示中显示面板10的下侧)，所述SCF组件30设置于所述第一背板21背离所述显示面板10的一侧，所述加强板40设置于所述第一背板21背离所述显示面板10的一侧。

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[0026] 请参阅图3，其中，所述SCF组件30背离所述显示面板10的一侧设置有容纳槽301，所述加强板40的至少部分组件容纳于所述容纳槽301内。

[0027] 请参阅图1，所述显示面板10包括显示区域AA，所述显示区域AA用以显示画面。为了实现窄边框设计，所述显示面板10还包括位于所述显示区域AA一侧的绑定端11。所述绑定端11可弯折。所述绑定端11用以将所述显示区域AA内的信号走线连接到驱动芯片50上，所述绑定端11的远离所述显示区域AA的一端连接有所述驱动芯片50，所述绑定端11可朝背离所述显示面板10的出光面的一侧弯折，以使得所述驱动芯片50位于所述显示面板10的背离其出光面的一侧。

[0028] 一种实施例中，所述驱动芯片50为源极驱动芯片，其他实施例中，所述驱动芯片50可为栅极驱动芯片，也可为所述源极驱动芯片和所述栅极驱动芯片的集成芯片。

[0029] 一种实施例中，所述SCF组件30为复合膜层结构，其容纳槽301可通过在其部分膜层结构上开槽实现，使得所述加强板40的至少部分膜层位于该容纳槽301内，即使所述绑定端11的弯折半径需要减小时，所述加强板40的厚度也不必减小，可增强所述加强板40的粘附力，进而保证所述绑定端11弯折的可靠性。

[0030] 具体地，一种实施例中，请参阅图1和图4，所述SCF组件30可包括依次层叠设置于所述第一背板21背离所述显示面板10一侧的粘结层31、泡棉层32、聚酰亚胺层33以及金属层34。

[0031] 其中，所述粘结层31与所述第一背板21粘合，所述粘结层31可为网格胶(Embo)，所述网格胶具有贴合排气的作用，且具有柔性，不会影响所述显示模组的柔性设计。在其他实施例中，所述粘结层31可为其他胶层。

[0032] 一种实施例中，所述泡棉层32可为泡棉，所述泡棉既能起到缓冲作用，也能起到遮光作用。

[0033] 所述聚酰亚胺层33能够起到补强作用，增加所述SCF组件30的可靠性。在其他实施例中，所述SCF组件30也可不包括所述聚酰亚胺层33。

[0034] 在其他实施例中，所述聚酰亚胺层33还可用石墨层来替代，所述石墨层的外表面还可用聚酰亚胺包覆。

[0035] 所述金属层34的材料可为铜、铝中的一种金属或其合金结构，所述金属层34可起到散热作用。具体地，所述金属层34可为铜箔或铝箔。

[0036] 由于所述泡棉层32起到遮光作用，因此所述泡棉层32需要整面设置，如对其进行挖空设计，会导致漏光现象产生，因此所述容纳槽301可通过对所述金属层34和所述聚酰亚胺层33进行挖空来实现。

[0037] 具体地，请参阅图5，所述聚酰亚胺层33包括贯穿所述聚酰亚胺层33的第一挖空区域331，所述金属层34包括贯穿所述金属层34的第二挖空区域341，所述第一挖空区域331和所述第二挖空区域341贯通以形成所述容纳槽301。

[0038] 所述第一挖空区域331和所述第二挖空区域341均靠近于其对应膜层的端部设置。具体地，所述第一挖空区域331可通过对所述聚酰亚胺层33的靠近所述绑定端11的一侧端部进行挖空得到，所述第二挖空区域341进行上述相同的处理。

[0039] 所述容纳槽301的底壁由所述泡棉层32的背离所述显示面板的一侧表面所组成。因此所述加强板40可通过其胶层与所述泡棉层32贴合来设置于所述容纳槽301内。

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[0040] 所述加强板40可与所述SCF组件可通过无缝拼接技术贴合，具体地，可将所述加强板40的宽度和长度设计为分别与所述容纳槽301的宽度和长度相等，进而使得所述加强板40与所述SCF组件贴合后与所述容纳槽301的侧壁和底壁之间没有缝隙。

[0041] 所述加强板40的厚度可依据实际设计需要来设计，在一种实施例中，所述加强板40的厚度大于所述容纳槽301的深度，在其他实施例中，请参阅图4，所述加强板40的厚度可等于容纳槽301的深度，即所述加强板40的厚度等于所述金属层34与所述聚酰亚胺层33的厚度之和。

[0042] 本发明实施例通过在SCF组件上开设容纳槽301，使得所述加强板40的至少部分膜层可容纳于所述容纳槽301内。与现有技术相比，在所述绑定端11相同的R角设计前提下，所述加强板40中的胶层厚度可设计的更厚，从而改善现有技术中加强板的粘性不足的问题，能够提高所述绑定端11弯折的可靠性。

[0043] 一种实施例中，请参阅图2，所述加强板40包括散热层42以及分别设置于所述散热层42两相对侧的第一压敏胶层43和所述第二压敏胶层41。

[0044] 其中，请参阅图1，所述第一压敏胶层43位于所述容纳槽301内，且与所述泡棉层32贴合。

[0045] 所述第二压敏胶层41背离所述散热层42的一侧凸出于所述容纳槽301，所述第二压敏胶层41与所述绑定端11弯折到所述显示面板10的背面部分的端部粘合，从而起到固定所述绑定端11的弯折部分。

[0046] 所述散热层42起到屏蔽和散热作用。一种实施例中，所述散热层42的材料为散热材料，具体可为金属材料，例如铜箔、铝箔等，或者PET(聚对苯二甲酸乙二醇酯)材料，还可为吸波材料。

[0047] 请继续参阅图1，本发明实施例中的所述绑定端11包括第一端111、第二端113，以及连接所述第一端111和所述第二端113的弯折部112。

[0048] 其中，所述第一端111连接所述显示区域AA，所述第二端113连接所述驱动芯片50。所述弯折部112可进行弯折，弯折呈圆弧状，使得所述第二端113位于背离所述显示面板10的出光面的一侧(即所述显示面板10的背面)。

[0049] 所述第二端113与所述第二压敏胶层41粘合，以实现对所述弯折部112的固定。

[0050] 一种实施例中，所述第二端113与所述第二压敏胶层41之间还设置有第二背板22，所述第二背板22与所述第二压敏胶层41粘合。

[0051] 所述第一背板21和所述第二背板22起到支撑所述显示面板10的作用，所述第一背板21和所述第二背板22可经过同一张背板图案化得到，在制备完所述绑定端11之后，将该背板进行图案化处理，将所述弯折部112对应区域的背板进行刻蚀，以避免该区域的背板影响所述弯折部112的弯折性能。

[0052] 一种实施例中，所述弯折部112的表面贴附有UV胶，以增强所述弯折部112的弯折性能，有利于所述弯折部112弯折成弧形。

[0053] 请参阅图1，所述第一端111的顶面与所述第二端113的底面之间的高度H等于所述弯折部112的弯折半径R(即圆弧半径)的两倍。

[0054] 具体地，所述第一端111膜厚与所述第一背板21膜厚、所述粘结层31膜厚、所述泡棉层32膜厚、所述加强板40膜厚以及所述第二背板22膜厚之和为所述弯折部112的弯折半

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径R的两倍。

[0055] 在需要满足所述绑定端11的弯折半径为0.2毫米及以下的设计需求时，对于现有技术，需要减薄所述加强板40的厚度来实现，会导致所述加强板40粘附性不足。请参阅图1，举例来说，所述第一端111膜厚和所述第二端113膜厚相等，为H_1，所述第一背板21膜厚和所述第二背板22膜厚相等，为H_2，所述粘结层31膜厚为H_3，所述泡棉层32膜厚为H_4，所述聚酰亚胺层33膜厚为H_5，所述金属层34膜厚为H_6，所述加强板40膜厚为H_7。对于传统的显示模组来说，由于其没有容纳槽301的设计，所述加强板40是与所述金属层34贴合的，因此所述SCF组件30的聚酰亚胺层33和金属层34依然是会占据一定的高度空间，因此传统的显示模组中，$H=2H_1+2H_2+H_3+H_4+H_5+H_6+H_7$；对于本实施例的显示模组来说，$H=2H_1+2H_2+H_3+H_4+H_7$，因此在H值相同情况下，本实施例中的加强板40的厚度可以做的更厚，能够增加所述第一压敏胶层43和所述第二压敏胶层41的厚度，进而增强所述加强板40与所述SCF层以及与所述绑定端11连接的稳定性，保证所述绑定端11结构的可靠性。

[0056] 所述第二端113还连接有柔性电路板(FPC,Flexible Printed Circuit)70。

[0057] 请参阅图4，所述SCF组件30在与所述显示面板10组装之前，所述SCF组件还包括设置于膜层两相对外侧的离型膜35和保护膜36。

[0058] 具体地，所述离型膜35设置于所述粘结层31远离所述泡棉层32一侧，所述保护膜36设置于所述金属层34远离所述聚酰亚胺层33的一侧。

[0059] 在所述粘结层31制备完后，在所述粘结层31外表面贴附所述离型膜35，以保护所述粘结层31。在所述聚酰亚胺层33和所述金属层34上的挖空区域设置好后，将所述加强板贴合在对应的所述容纳槽301内，之后在所述加强板40和所述金属层34上贴附所述保护膜36，以便于传送和后续制程。

[0060] 可以理解的是，所述SCF组件30与所述加强板40贴合后成为一整体，该整体与所述显示面板10进行贴合过程中需先后撕除所述离型膜35与所述保护膜36。

[0061] 具体地，先撕除所述离型膜35，将所述粘结层31与所述第一背板21贴合，再撕除所述保护膜36，将所述绑定端11进行弯折，使得所述第二端113、所述第二背板22以及所述驱动芯片50位于背离出光面的一侧，进而将所述第二背板22与所述第二压敏胶层41贴合。

[0062] 所述显示面板10的出光面一侧还贴附有偏光片80，所述偏光片80上还贴附有盖板90，所述盖板90通过光学胶层91与所述偏光片80贴合。

[0063] 一种实施例中，所述显示面板10可为OLED显示面板，可制备成柔性显示面板。

[0064] 通过在所述SCF组件30上设置容纳槽301，使得加强板40的至少部分膜层可位于所述容纳槽301内，可极大限度地降低弯折区域的总高度，满足弯折半径在0.2毫米及以下的显示模组的结构设计需求；另外也能够解决在绑定端11弯折的极限R角反弹力较大的情况下，提升加强板40的粘性，提高绑定端11弯折的可靠性。

[0065] 在上述实施例中，对各个实施例的描述都各有侧重，某个实施例中没有详述的部分，可以参见其他实施例的相关描述。

[0066] 以上对本发明实施例所提供的一种显示模组进行了详细介绍，本文中应用了具体个例对本发明的原理及实施方式进行了阐述，以上实施例的说明只是用于帮助理解本发明的技术方案及其核心思想；本领域的普通技术人员应当理解：其依然可以对前述各实施例所记载的技术方案进行修改，或者对其中部分技术特征进行等同替换；而这些修改或者替

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换，并不使相应技术方案的本质脱离本发明各实施例的技术方案的范围。

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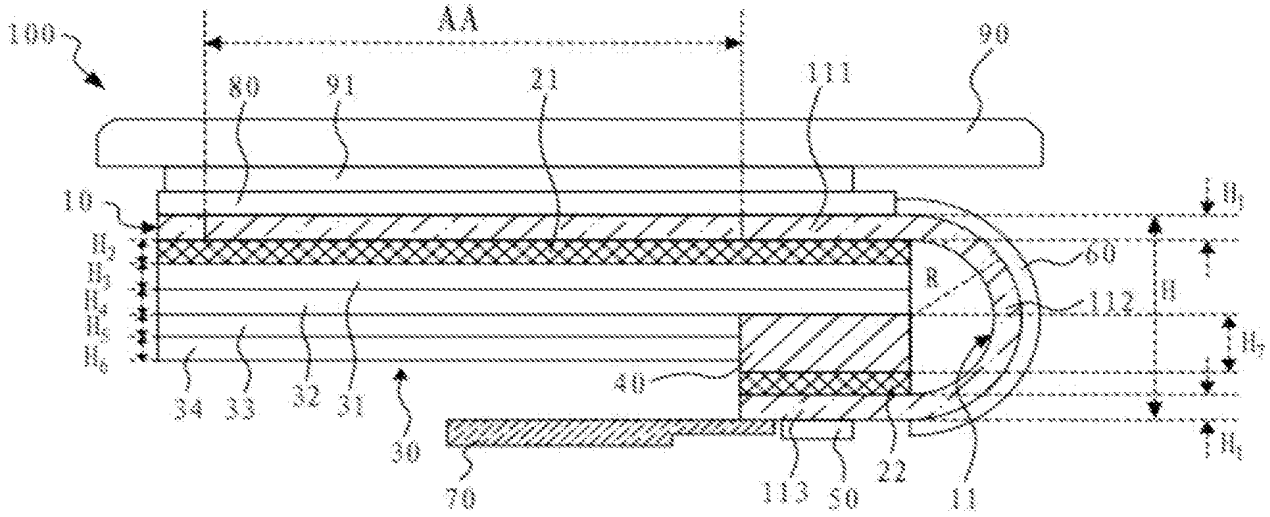


图1

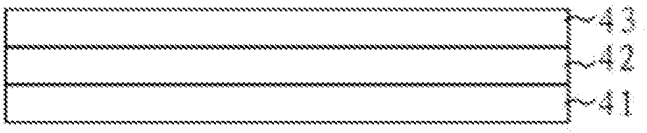


图2

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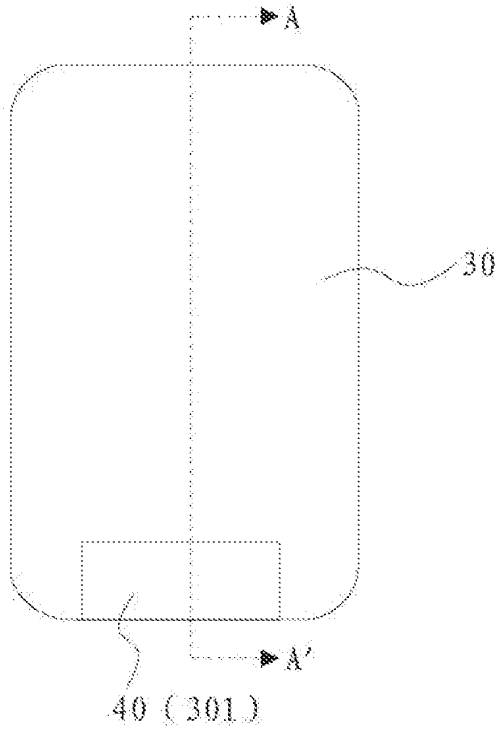


图3



图4

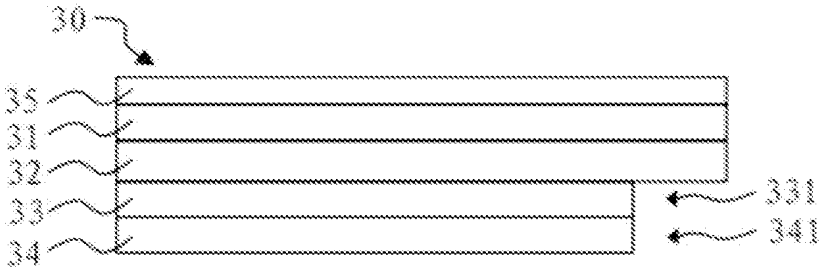


图5

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Abstract of CN112634764 (A)
The application provides a display device, including: the display device comprises a display panel, a first back plate, a supporting plate, an elastic heat dissipation layer, a second back plate, a flip chip film, a flexible circuit board, a polaroid and a cover plate. The elastic heat dissipation layer is arranged in the binding area and used for dissipating heat of the binding area of the display panel, so that binding stability can be improved. The elastic heat dissipation layer provided by the invention can be compressed and deformed, the small-range heights of the flip chip film, the flexible circuit board and the elastic heat dissipation layer are not flat, and the elastic heat dissipation layer does not need to be filled, can provide protection for the flip chip film and the flexible circuit board, further does not need to be filled with recycled materials, and can reduce preparation procedures.

Description

Display device

Technical Field
The application relates to the technical field of display, in particular to a display device.

Background
With the increasing use requirements of users for electronic display devices, the development of flexible display panels is receiving more and more attention, wherein full-screen and narrow-frame display is pursued, especially for hot and hot information.
As shown in fig. 1, the reinforcing support layer 11 for the bonding area is conventionally made of a PET adhesive material, and due to the height difference between the support layer 11 and the chip on film 12(COF) and

the circuit board 13(FPC), the support layer is designed to be a sectional type support, and meanwhile, the adhesive material is used for filling due to uneven height, a support layer 14 is further disposed between the circuit board 13 and the upper board, and a filling layer 15 (adhesive material) is disposed between the chip on film 12 and the support layer 11, which increases the steps of manufacturing and complicates the process.

Therefore, it is necessary to provide a display device to reduce the number of times of using the adhesive material and reduce the number of manufacturing processes.

Disclosure of Invention

The embodiment of the application provides a display device, can replace traditional reinforcement support material and can increase the heat dissipation function in bonding region by the elasticity heat dissipation layer.

Specifically, the present invention provides a display device comprising: the display panel is defined with a display area, a bending area and a binding area; the first back plate is arranged on one side of the display panel and correspondingly shot in the display area; the supporting plate is arranged on one side, far away from the display panel, of the first back plate; the elastic heat dissipation layer is arranged on one side, far away from the first back plate, of the supporting plate; the second back plate is arranged on one side, far away from the supporting plate, of the elastic heat dissipation layer; and the binding region of the display panel is bent downwards to one side of the second back plate far away from the elastic heat dissipation layer through the bending region.

Further, the material of the elastic heat dissipation layer comprises: heat-dissipating silicone, rubber, or a thermoplastic elastomer.

Further, the display device further comprises: the chip on film is arranged on one side of the binding area, which is far away from the second back plate; the edge of the chip on film is bound to the binding area.

Further, the maximum width of the elastic heat dissipation layer is smaller

than the minimum width of the support plate; the maximum width of the second back plate is smaller than the minimum width of the elastic heat dissipation layer.

Furthermore, a gap is arranged between the chip on film and the second back plate.

Further, the display device further comprises: the flexible circuit board is arranged on one side of the chip on film, which is far away from the binding area; the edge of the flexible circuit board is connected with the chip on film.

Furthermore, the sum of the widths of the chip on film, the flexible circuit board and the binding area is less than the width of the elastic heat dissipation layer.

Further, the display device further comprises: the polaroid is arranged on one side of the display panel, which is far away from the first back plate; and the cover plate is arranged on one side of the polaroid, which is far away from the display panel.

Furthermore, the display device further comprises a first adhesive layer arranged between the first back plate and the support plate; and the second adhesive layer is attached to the bending area of the display panel.

Further, the material of the second glue layer comprises UV curing glue.

The display device provided by the embodiment of the application is used for dissipating heat of the binding area of the display panel by arranging the elastic heat dissipation layer in the binding area, so that the binding stability can be improved. The elastic heat dissipation layer provided by the invention can be compressed and deformed, the small-range uneven height of the flip chip film, the flexible circuit board and the elastic heat dissipation layer can be overcome, gap filling is not needed, and further, material filling is not needed to be recycled, so that the preparation procedures can be reduced.

Drawings

The technical solution and other advantages of the present application will

become apparent from the detailed description of the embodiments of the present application with reference to the accompanying drawings.

FIG. 1 is a schematic structural diagram of a display device provided in the prior art

Fig. 2 is a schematic structural diagram of a display device according to an embodiment of the present application.

A display device 100;

a display panel 101; a first backplane 104; a support plate 106;

an elastic heat dissipation layer 107; a second back plate 108; a chip on film 109;

a flexible circuit board 111; a polarizer 102; a cover plate 103;

a display area 110; a bending region 120; a binding region 130;

a first glue layer 105; and a second adhesive layer 121.

Detailed Description

The technical solutions in the embodiments of the present application will be clearly and completely described below with reference to the drawings in the embodiments of the present application. It is to be understood that the embodiments described are only a few embodiments of the present application and not all embodiments. All other embodiments, which can be derived by a person skilled in the art from the embodiments given herein without making any creative effort, shall fall within the protection scope of the present application.

In the description of the present application, it is to be noted that, unless otherwise explicitly specified or limited, the terms "mounted," "connected," and "connected" are to be construed broadly, e.g., as meaning either a fixed connection, a removable connection, or an integral connection; may be mechanically connected, may be electrically connected or may be in communication with each other; either directly or indirectly through intervening media, either internally or in any other relationship. The specific meaning of the above terms in the present application can be understood by those of ordinary skill in the art as appropriate.

In this application, unless expressly stated or limited otherwise, the first feature "on" or "under" the second feature may comprise direct contact of the first and second features, or may comprise contact of the first and second features not directly but through another feature in between. Also, the first feature being "on," "above" and "over" the second feature includes the first feature being directly on and obliquely above the second feature, or merely indicating that the first feature is at a higher level than the second feature. A first feature being "under," "below," and "beneath" a second feature includes the first feature being directly under and obliquely below the second feature, or simply meaning that the first feature is at a lesser elevation than the second feature.

As shown in fig. 2, the present application provides a display device 100 comprising: the display device comprises a display panel 101, a first back plate 104, a support plate 106, an elastic heat dissipation layer 107, a second back plate 108, a flip-chip film 109, a flexible circuit board 111, a polarizer 102 and a cover plate 103.

The display panel 101 defines a display area 110, a bending area 120 and a binding area 130. The display area 110 of the display panel 101 is used for displaying images, and the bending area 120 of the display panel 101 is used for bending downwards so that the binding area 130 is arranged on the back of the display area 110, which is beneficial to the arrangement of a narrow frame. The bending region 120 connects the display region 110 and the binding region 130. The bending region 120 has a curved shape.

The first back plate 104 is disposed on one side of the display panel 101 and correspondingly disposed in the display area 110.

The supporting plate 106 is disposed on a side of the first back plate 104 away from the display panel 101.

The elastic heat dissipation layer 107 is disposed on a side of the supporting plate 106 away from the first back plate 104.

The second back plate 108 is disposed on a side of the elastic heat dissipation layer 107 away from the supporting plate 106.

The bonding region 130 of the display panel 101 is bent downward to a side of the second back plate 108 away from the elastic heat dissipation layer

107 through the bending region 120.

The elastic heat dissipation layer 107 is used for dissipating heat of the bonding region 130 of the display panel 101, which may increase the stability of bonding.

The material of the elastic heat dissipation layer 107 includes: heat-dissipating silicone, rubber, or a thermoplastic elastomer.

The flip-chip film 109 is disposed on one side of the bonding region 130 away from the second backplane 108; the edge of the flip chip 109 is bonded to the bonding area 130.

The maximum width of the elastic heat dissipation layer 107 is smaller than the minimum width of the support plate 106; the maximum width of the second back plate 108 is smaller than the minimum width of the elastic heat dissipation layer 107.

A gap is formed between the flip-chip film 109 and the second back plate 108.

The flexible circuit board 111 is arranged on one side of the chip on film 109 away from the bonding region 130; the edge of the flexible circuit board 111 is connected to the flip-chip film 109.

The sum of the widths of the flip-chip film 109, the flexible circuit board 111 and the bonding area 130 is smaller than the width of the elastic heat dissipation layer 107.

Because the elastic heat dissipation layer 107 provided by the invention can be compressed and deformed, the small-range height unevenness of the flip chip film 109, the flexible circuit board 111 and the elastic heat dissipation layer 107 can be overcome, gap filling is not needed, and further, material filling is not needed to be recycled, so that the preparation procedures can be reduced.

In addition, for the bending process of some static flexible products, the pressing impression appears on the display surface after the binding region 130 is pressed, and the elastic heat dissipation layer 107 can play a role in buffering during pressing, so that the impression can be effectively inhibited from being generated.

The polarizer 102 is disposed on a side of the display panel 101 away from

the first backplane 104.

The cover plate 103 is disposed on a side of the polarizer 102 away from the display panel 101.

In an embodiment, the display device 100 further includes a first adhesive layer 105 and a second adhesive layer 121.

The first glue layer 105 is disposed between the first back plate 104 and the support plate 106, and the material of the first glue layer includes photoresist.

The second adhesive layer 121 is attached to the bending region 120 of the display panel 101 to provide protection for the bending region 120, so as to increase the stress borne by the bending region. The two ends of the second adhesive layer 121 extend to the edge of the display area 110 and the binding area 130, respectively, which can better protect the edge of the display area 110 and the binding area 130.

The material of the second adhesive layer 121 includes a UV curable adhesive.

In the foregoing embodiments, the descriptions of the respective embodiments have respective emphasis, and for parts that are not described in detail in a certain embodiment, reference may be made to related descriptions of other embodiments.

The foregoing describes in detail an electronic device provided in an embodiment of the present application, and a specific example is applied to illustrate the principle and the implementation of the present application, and the description of the foregoing embodiment is only used to help understanding the technical solution and the core idea of the present application; those of ordinary skill in the art will understand that: the technical solutions described in the foregoing embodiments may still be modified, or some technical features may be equivalently replaced; such modifications or substitutions do not depart from the spirit and scope of the present disclosure as defined by the appended claims.

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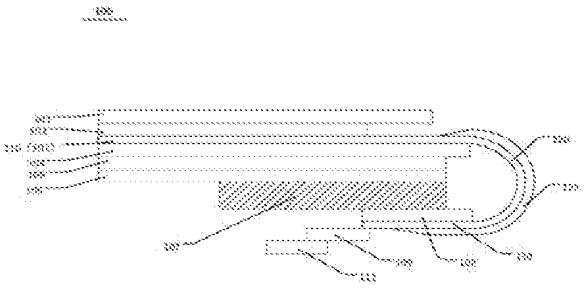
权利要求书1页 说明书3页 附图1页

(54)发明名称

显示装置

(57)摘要

本申请提供一种显示装置，包括：显示面板、第一背板、支撑板、弹性散热层、第二背板、覆晶薄膜、柔性电路板、偏光片以及盖板。通过在绑定区设置弹性散热层，用以对所述显示面板的绑定区进行散热，这可以增加绑定的稳定性。本发明提供的弹性散热层可压缩变形，所述覆晶薄膜以及所述柔性电路板与弹性散热层小范围的高度不平不需要进行填充，弹性散热层可以为覆晶薄膜以及柔性电路板提供保护，进而不需要重复利用材料填充，可以减少制备工序。



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1.一种显示装置,其特征在于,包括:

显示面板,定义有显示区、弯折区以及绑定区;

第一背板,设于所述显示面板的一侧,且对应地设置于所述显示区;

支撑板,设于所述第一背板远离所述显示面板的一侧;

弹性散热层,设于所述支撑板远离所述第一背板的一侧;以及

第二背板,设于所述弹性散热层远离所述支撑板的一侧;

其中,所述显示面板的绑定区通过所述弯折区向下弯折至所述第二背板远离所述弹性散热层的一侧。

2.如权利要求1所述的显示装置,其特征在于,

所述弹性散热层的材料包括:散热硅胶、橡胶或热塑性弹性体。

3.如权利要求1所述的显示装置,其特征在于,还包括:

覆晶薄膜,设于所述绑定区远离所述第二背板的一侧;

所述覆晶薄膜的边缘处绑定于所述绑定区。

4.如权利要求3所述的显示装置,其特征在于,

所述弹性散热层的最大宽度小于所述支撑板的最小宽度;

所述第二背板的最大宽度小于所述弹性散热层的最小宽度。

5.如权利要求3所述的显示装置,其特征在于,

所述覆晶薄膜与所述第二背板之间设有一间隙。

6.如权利要求3所述的显示装置,其特征在于,还包括:

柔性电路板,设于所述覆晶薄膜远离所述绑定区的一侧;

所述柔性电路板的边缘处连接所述覆晶薄膜。

7.如权利要求6所述的显示装置,其特征在于,

所述覆晶薄膜、所述柔性电路板以及所述绑定区的宽度之和小于所述弹性散热层的宽度。

8.如权利要求1所述的显示装置,其特征在于,还包括:

偏光片,设于所述显示面板远离所述第一背板的一侧;以及

盖板,设于所述偏光片远离所述显示面板的一侧。

9.如权利要求1所述的显示装置,其特征在于,还包括

第一胶层,设于所述第一背板与所述支撑板之间;

第二胶层,附于所述显示面板的弯折区。

10.如权利要求9所述的显示装置,其特征在于,

所述第二胶层的材料包括UV固化胶。

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显示装置

技术领域

[0001] 本申请涉及一种显示技术领域，尤其涉及一种显示装置。

背景技术

[0002] 随着用户对电子显示装置使用要求的提高，柔性弯折显示面板的开发越来越受到关注，其中追求全屏和窄边框显示尤为火热。

[0003] 如图1所示，常规设计用于绑定区的加固支撑层11的材料为PET胶材，由于支撑层11和覆晶薄膜12(COF)以及电路板13(FPC)的高度差会使支撑层采用分段式支撑设计，同时因为高度不平会使用胶材进行填充，电路板13与上层板材之间还会设有支撑层14，覆晶薄膜12与支撑层11设有填充层15(胶材)，这会增加制备的步骤，工序繁琐。

[0004] 因此，有必要提出一种显示装置，用以减小胶材的多次使用，减小制备工序。

发明内容

[0005] 本申请实施例提供一种显示装置，可以弹性散热层代替传统的加固支撑材料并且可以增加绑定区的散热功能。

[0006] 具体地，本发明提供一种显示装置，包括：显示面板，定义有显示区、弯折区以及绑定区；第一背板，设于所述显示面板的一侧，且对应地摄制于所述显示区；支撑板，设于所述第一背板远离所述显示面板的一侧；弹性散热层，设于所述支撑板远离所述第一背板的一侧；以及第二背板，设于所述弹性散热层远离所述支撑板的一侧；其中，所述显示面板的绑定区通过所述弯折区向下弯折至所述第二背板远离所述弹性散热层的一侧。

[0007] 进一步地，所述弹性散热层的材料包括：散热硅胶、橡胶或热塑性弹性体。

[0008] 进一步地，所述的显示装置还包括：覆晶薄膜，设于所述绑定区远离所述第二背板的一侧；所述覆晶薄膜的边缘处绑定于所述绑定区。

[0009] 进一步地，所述弹性散热层的最大宽度小于所述支撑板的最小宽度；所述第二背板的最大宽度小于所述弹性散热层的最小宽度。

[0010] 进一步地，所述覆晶薄膜与所述第二背板之间设有一间隙。

[0011] 进一步地，所述的显示装置还包括：柔性电路板，设于所述覆晶薄膜远离所述绑定区的一侧；所述柔性电路板的边缘处连接所述覆晶薄膜。

[0012] 进一步地，所述覆晶薄膜、所述柔性电路板以及所述绑定区的宽度之和小于所述弹性散热层的宽度。

[0013] 进一步地，所述的显示装置还包括：偏光片，设于所述显示面板远离所述第一背板的一侧；以及盖板，设于所述偏光片远离所述显示面板的一侧。

[0014] 进一步地，所述的显示装置还包括第一胶层，设于所述第一背板与所述支撑板之间；第二胶层，附于所述显示面板的弯折区。

[0015] 进一步地，所述第二胶层的材料包括UV固化胶。

[0016] 本申请实施例提供的显示装置，通过在绑定区设置弹性散热层，用以对所述显示

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面板的绑定区进行散热，这可以增加绑定的稳定性。本发明提供的弹性散热层可压缩变形，所述覆晶薄膜以及所述柔性电路板与弹性散热层小范围的高度不平可以克服，不需要再进行间隙填充，进而不需要重复利用材料填充，可以减少制备工序。

附图说明

[0017] 下面结合附图，通过对本申请的具体实施方式详细描述，将使本申请的技术方案及其它有益效果显而易见。

[0018] 图1为现有技术提供的显示装置的结构示意图

[0019] 图2为本申请一实施例提供的显示装置的结构示意图。

[0020] 显示装置100；

[0021] 显示面板101；第一背板104；支撑板106；

[0022] 弹性散热层107；第二背板108；覆晶薄膜109；

[0023] 柔性电路板111；偏光片102；盖板103；

[0024] 显示区110；弯折区120；绑定区130；

[0025] 第一胶层105；第二胶层121。

具体实施方式

[0026] 下面将结合本申请实施例中的附图，对本申请实施例中的技术方案进行清楚、完整地描述。显然，所描述的实施例仅仅是本申请一部分实施例，而不是全部的实施例。基于本申请中的实施例，本领域技术人员在没有作出创造性劳动前提下所获得的所有其他实施例，都属于本申请保护的范围。

[0027] 在本申请的描述中，需要说明的是，除非另有明确的规定和限定，术语“安装”、“相连”、“连接”应做广义理解，例如，可以是固定连接，也可以是可拆卸连接，或一体地连接；可以是机械连接，也可以是电连接或可以相互通讯；可以是直接相连，也可以通过中间媒介间接相连，可以是两个元件内部的连通或两个元件的相互作用关系。对于本领域的普通技术人员而言，可以根据具体情况理解上述术语在本申请中的具体含义。

[0028] 在本申请中，除非另有明确的规定和限定，第一特征在第二特征之“上”或之“下”可以包括第一和第二特征直接接触，也可以包括第一和第二特征不是直接接触而是通过它们之间的另外的特征接触。而且，第一特征在第二特征“之上”、“上方”和“上面”包括第一特征在第二特征正上方和斜上方，或仅仅表示第一特征水平高度高于第二特征。第一特征在第二特征“之下”、“下方”和“下面”包括第一特征在第二特征正下方和斜下方，或仅仅表示第一特征水平高度小于第二特征。

[0029] 如图2所示，本申请提供一种显示装置100，包括：显示面板101、第一背板104、支撑板106、弹性散热层107、第二背板108、覆晶薄膜109、柔性电路板111、偏光片102以及盖板103。

[0030] 所述显示面板101定义有显示区110、弯折区120以及绑定区130。所述显示面板101的显示区110用以进行画面显示，所述显示面板101的弯折区120用以向下弯折使所述绑定区130设置在所述显示区110的背面，这有利于窄边框的设置。所述弯折区120连接所述显示区110以及所述绑定区130。所述弯折区120呈弯曲形状。

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[0031] 所述第一背板104设于所述显示面板101的一侧，且对应地设置于所述显示区110。

[0032] 所述支撑板106设于所述第一背板104远离所述显示面板101的一侧。

[0033] 所述弹性散热层107设于所述支撑板106远离所述第一背板104的一侧。

[0034] 所述第二背板108设于所述弹性散热层107远离所述支撑板106的一侧。

[0035] 其中，所述显示面板101的绑定区130通过所述弯折区120向下弯折至所述第二背板108远离所述弹性散热层107的一侧。

[0036] 所述弹性散热层107用以对所述显示面板101的绑定区130进行散热，这可以增加绑定的稳定性。

[0037] 所述弹性散热层107的材料包括：散热硅胶、橡胶或热塑性弹性体。

[0038] 所述覆晶薄膜109设于所述绑定区130远离所述第二背板108的一侧；所述覆晶薄膜109的边缘处绑定于所述绑定区130。

[0039] 所述弹性散热层107的最大宽度小于所述支撑板106的最小宽度；所述第二背板108的最大宽度小于所述弹性散热层107的最小宽度。

[0040] 所述覆晶薄膜109与所述第二背板108之间设有一间隙。

[0041] 所述柔性电路板111设于所述覆晶薄膜109远离所述绑定区130的一侧；所述柔性电路板111的边缘处连接所述覆晶薄膜109。

[0042] 所述覆晶薄膜109、所述柔性电路板111以及所述绑定区130的宽度之和小于所述弹性散热层107的宽度。

[0043] 因为本发明提供的弹性散热层107可压缩变形，所述覆晶薄膜109以及所述柔性电路板111与弹性散热层107小范围的高度不平可以克服，不需要再进行间隙填充，进而不需要重复利用材料填充，可以减少制备工序。

[0044] 另外，针对一些静态柔性产品的弯折过程，经常出现绑定区130压合后在显示面出现压合印痕，采用弹性散热层107可以在压合时起到缓冲作用，有效抑制印痕的产生。

[0045] 所述偏光片102设于所述显示面板101远离所述第一背板104的一侧。

[0046] 所述盖板103设于所述偏光片102远离所述显示面板101的一侧。

[0047] 在一实施例中，所述的显示装置100还包括第一胶层105以及第二胶层121。

[0048] 所述第一胶层105设于所述第一背板104与所述支撑板106之间，其材料包括光刻胶。

[0049] 所述第二胶层121附于所述显示面板101的弯折区120，用以为所述弯折区120提供保护，使其承受的应力增加。所述第二胶层121两端分别向所述显示区110的边缘与所述绑定区130延伸，这可以更好的保护所述显示区110的边缘以及所述绑定区130。

[0050] 所述第二胶层121的材料包括UV固化胶。

[0051] 在上述实施例中，对各个实施例的描述都各有侧重，某个实施例中没有详述的部分，可以参见其他实施例的相关描述。

[0052] 以上对本申请实施例所提供的一种电子装置进行了详细介绍，本文中应用了具体个例对本申请的原理及实施方式进行了阐述，以上实施例的说明只是用于帮助理解本申请的技术方案及其核心思想；本领域的普通技术人员应当理解：其依然可以对前述各实施例所记载的技术方案进行修改，或者对其中部分技术特征进行等同替换；而这些修改或者替换，并不使相应技术方案的本质脱离本申请各实施例的技术方案的范围。

Petitioner Samsung Ex-1004, 0308

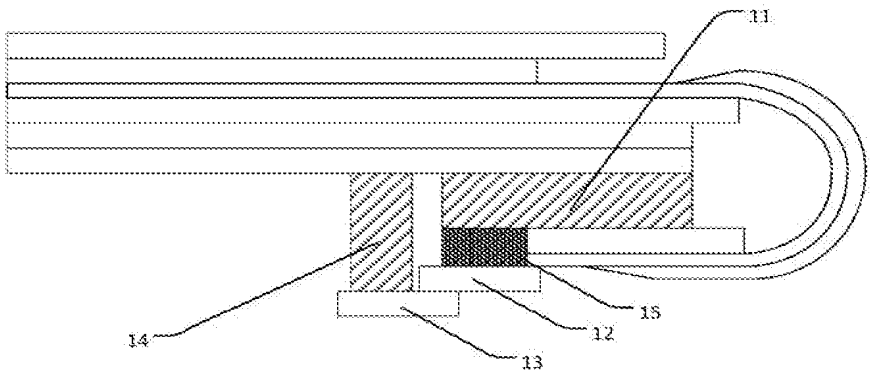


图1

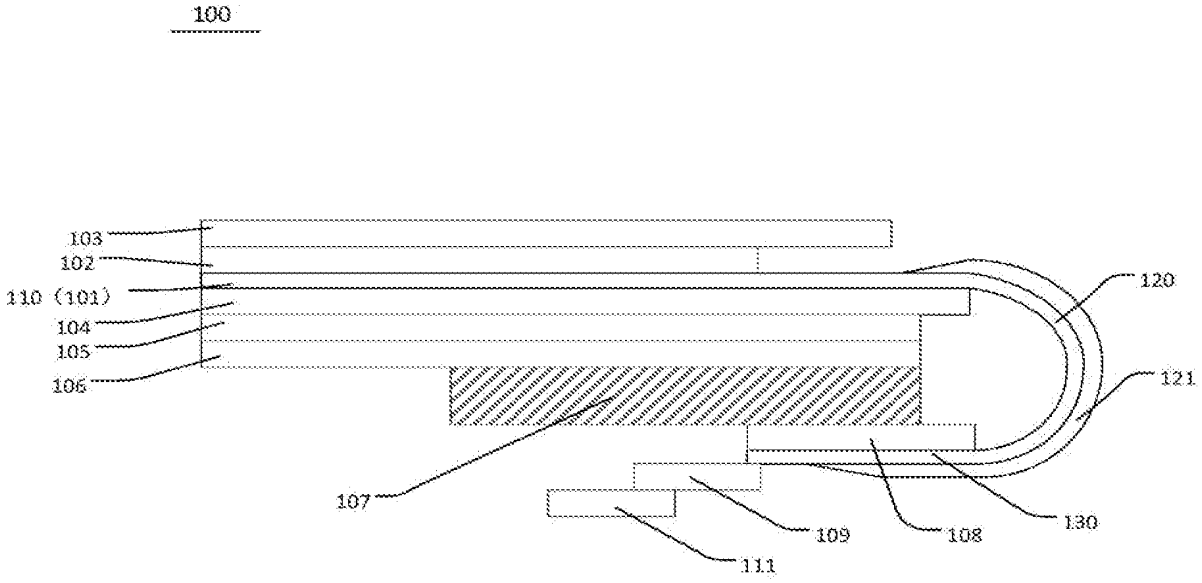


图2

Petitioner Samsung Ex-1004, 0309

Abstract of CN112786807 (A)
The invention discloses a flexible display device and a preparation method thereof, wherein the flexible display device comprises: the flexible display panel comprises a first area, a second area and a third area, wherein the second area is arranged on one side of the first area in an adjacent mode, the third area is arranged between the first area and the second area, and an optical adhesive layer is arranged on one side of the first area of the flexible display panel; the cover plate is arranged on the optical adhesive layer; the protective adhesive layer is arranged on the outer surface of the second area of the flexible display panel and is on the same side as the optical adhesive layer; and the auxiliary glue layer completely covers the surface of one side, close to the cover plate, of the third area. According to the invention, the auxiliary adhesive layer is arranged to fill the gap, so that the cover plate and the flexible display panel are supported, the flexible display panel is prevented from being deformed greatly, the risk of damage is reduced, and the product quality and reliability of the flexible display device are improved.

Description

Flexible display device and preparation method thereof

Technical Field
The invention relates to the technical field of display, in particular to a flexible display device and a preparation method thereof.

Background
With the development of Organic Light-Emitting Diode (OLED) display technology, flexible OLED technology is gradually mature. The curled OLED display module is used as a module of a new display technology, and will be the direction of innovation and development of global panel and

module manufacturers in the future. The flexible screen is an important application technology of the OLED light curing glue, and has been developed significantly in recent years.

Compared with the traditional screen, the flexible screen has significant advantages, such as a lighter and thinner volume, and the stack structure generally comprises a Cover plate (CG), an optical Adhesive layer (OCA), a Polarizer layer (Pol), a display panel, a Back plate layer (BP), a composite material, and the like. Wherein, CG layer and OCA glue film adopt full laminating. To further reduce the thickness and cost of the OLED module, the development of the technology without polarizer layer is started. As shown in fig. 1, fig. 1 is a schematic structural diagram of a flexible display device in the prior art. The flexible display device comprises a display panel 11, a light curing adhesive layer 12, an optical adhesive layer 13, a cover plate 14, a first back plate layer 15, a support layer 16, a heat dissipation composite layer 17 and a second back plate layer 18. However, the non-polarizer layer has the following problem, as shown in fig. 2, and fig. 2 is a top view of the prior art flexible display device (the cover plate is not shown). When the optical adhesive 13 is attached, a certain tolerance exists, and a certain gap exists between the optical adhesive 13 and the light-curing adhesive layer 12, so that the optical adhesive is very fragile. When the display panel is subjected to Pad-bonding (Bending regions of the terminal regions are folded to the back of the display panel), certain external force is applied to the display panel, and the gap is easily damaged, so that the display panel is scrapped.

In summary, in the prior art, because the optical cement is attached to the cover plate with a certain tolerance, a gap exists between the cover plate and the display panel, and the display panel is bent with the technical problems of easy damage and poor product reliability.

Disclosure of Invention

The embodiment of the invention provides a flexible display device and a preparation method of the flexible display device, and aims to solve the

technical problems that in the prior art, due to the fact that a certain tolerance exists in the gluing of optical cement, a gap exists between a cover plate and a display panel, when the display panel is bent, the display panel is easy to damage, and the reliability of a product is poor.

In order to solve the above problem, in a first aspect, the present invention provides a flexible display device, comprising:

the flexible display panel comprises a first area, a second area and a third area, wherein the second area is arranged adjacent to one side of the first area, and the third area is positioned between the first area and the second area;

the optical adhesive layer is arranged on one side of the first area of the flexible display panel;

the cover plate is arranged on the optical adhesive layer;

the protective adhesive layer is arranged on the outer surface of the second area of the flexible display panel and is on the same side as the optical adhesive layer;

and the auxiliary glue layer completely covers the surface of one side, close to the cover plate, of the third area.

In some embodiments of the present invention, the second region includes a transition portion, a bending portion, and an extension portion, the transition portion is connected to the third region, the bending portion is connected to a side of the transition portion away from the third region, the extension portion is connected to a side of the bending portion away from the transition portion, and the extension portion is located on a back surface of the first region.

In some embodiments of the present invention, at least a portion of the protective adhesive layer and the optical adhesive layer are disposed in the same layer, and a thickness of the optical adhesive layer is greater than a thickness of the protective adhesive layer.

In some embodiments of the present invention, the auxiliary adhesive layer includes a first auxiliary adhesive layer and a second auxiliary adhesive layer, the first auxiliary adhesive layer is located on a side surface of the third region close to the cover plate, and the second auxiliary adhesive

layer is located on a surface of the protection adhesive layer above the transition portion of the second region.

In some embodiments of the present invention, the auxiliary adhesive layer bonds the third region of the flexible display panel and the cover plate, and the protective adhesive layer and the cover plate, respectively, a thickness of the first auxiliary adhesive layer is equal to a thickness of the optical adhesive layer, and a sum of a thickness of the second auxiliary adhesive layer and a thickness of the protective adhesive layer is equal to a thickness of the optical adhesive layer.

In some embodiments of the present invention, the auxiliary adhesive layer is an organic transparent material including at least one of a pressure-sensitive adhesive layer, a photo-curing adhesive layer, an acrylic adhesive layer, and a polyurethane adhesive layer.

In some embodiments of the present invention, the adhesive further includes support particles, the support particles are doped in the auxiliary adhesive layer, and a material strength of the support particles is greater than a material strength of the auxiliary adhesive layer.

In a second aspect, the present invention provides a method for manufacturing a flexible display device, the method for manufacturing a flexible display device according to any one of the first aspect, comprising the steps of:

providing a flexible display panel, which comprises a first area, a second area and a third area;

preparing an optical adhesive layer in the first area of the flexible display panel;

preparing a protective adhesive layer in the second area of the flexible display panel;

providing a cover plate, and preparing an auxiliary adhesive layer at the position, corresponding to the third area of the flexible display panel, of the cover plate;

and attaching the flexible display panel to the cover plate.

In some embodiments of the present invention, the second region includes a transition portion, a bending portion and an extension portion, and the

preparing the auxiliary adhesive layer includes: the apron corresponds first supplementary glue film of laminating, correspondence of third region department the second region the supplementary glue film of laminating of transition portion department, first supplementary glue film with the supplementary glue film of second is pressure sensitive adhesive layer, the thickness of first supplementary glue film is greater than the thickness of the supplementary glue film of second.

In some embodiments of the present invention, preparing the auxiliary glue layer comprises: the apron corresponds third region department is applyed supplementary glue, supplementary glue is glued for sol-like photocuring and is glued, flexible display panel with when the apron is laminated, supplementary glue fill the third region with clearance between the apron flows and extends to the transition portion top in second region is right supplementary glue carries out the ultraviolet irradiation solidification and forms supplementary glue layer.

Compared with the conventional flexible display device and the manufacturing method of the flexible display device, the auxiliary adhesive layer is arranged on the surface of the third area of the flexible display panel, which is close to one side of the cover plate, so that the gap between the optical adhesive layer and the protective adhesive layer is filled, and the auxiliary adhesive layer has certain mechanical strength after being attached or cured, so that the bonding strength between the cover plate and the flexible display panel is enhanced, the cover plate and the flexible display panel are supported, the flexible display panel is prevented from being greatly deformed at the gap when being subjected to external force, the risk of damage of the flexible display panel is reduced, and the product quality and the reliability of the flexible display device are improved.

Drawings

In order to more clearly illustrate the technical solutions in the embodiments of the present invention, the drawings needed to be used in the description of the embodiments will be briefly introduced below, and it

is obvious that the drawings in the following description are only some embodiments of the present invention, and it is obvious for those skilled in the art to obtain other drawings based on these drawings without creative efforts.

Fig. 1 is a schematic structural diagram of a flexible display device in the prior art;

FIG. 2 is a top view of a prior art flexible display device;

FIG. 3 is a schematic structural diagram of a flexible display device according to an embodiment of the present invention;

FIG. 4 is a flow chart of a method of preparation according to one embodiment of the present invention;

FIG. 5 is a top view of a flexible display device in an embodiment of the invention;

fig. 6 is a top view of a flexible display device in another embodiment of the invention.

Detailed Description

The technical solution in the embodiments of the present invention will be clearly and completely described below with reference to the accompanying drawings in the embodiments of the present invention. It is to be understood that the described embodiments are merely exemplary of the invention, and not restrictive of the full scope of the invention. All other embodiments, which can be derived by a person skilled in the art from the embodiments given herein without making any creative effort, shall fall within the protection scope of the present invention.

In the description of the present invention, it is to be understood that the terms "center", "longitudinal", "lateral", "length", "width", "thickness", "upper", "lower", "front", "rear", "left", "right", "vertical", "horizontal", "top", "bottom", "inner", "outer", "clockwise", "counterclockwise", and the like, indicate orientations and positional relationships based on those shown in the drawings, and are used only for convenience of description and simplicity of description, and do not indicate or imply that the device or

element being referred to must have a particular orientation, be constructed and operated in a particular orientation, and thus, should not be considered as limiting the present invention. Furthermore, the terms "first", "second" and "first" are used for descriptive purposes only and are not to be construed as indicating or implying relative importance or implicitly indicating the number of technical features indicated. Thus, features defined as "first", "second", may explicitly or implicitly include one or more of the described features. In the description of the present invention, "a plurality" means two or more unless specifically defined otherwise. In this application, the word "exemplary" is used to mean "serving as an example, instance, or illustration. Any embodiment described herein as "exemplary" is not necessarily to be construed as preferred or advantageous over other embodiments. The following description is presented to enable any person skilled in the art to make and use the invention. In the following description, details are set forth for the purpose of explanation. It will be apparent to one of ordinary skill in the art that the present invention may be practiced without these specific details. In other instances, well-known structures and processes are not shown in detail to avoid obscuring the description of the invention with unnecessary detail. Thus, the present invention is not intended to be limited to the embodiments shown, but is to be accorded the widest scope consistent with the principles and features disclosed herein.

Because the laminating of optical cement has certain tolerance among the prior art, there is the clearance between apron and the display panel, there is easy damaged, the relatively poor technical problem of product reliability when display panel bends.

Accordingly, the embodiment of the invention provides a flexible display device and a preparation method of the flexible display device. The following are detailed below.

First, an embodiment of the invention provides a flexible display device, as shown in fig. 3, and fig. 3 is a schematic structural diagram of the flexible display device in an embodiment of the invention. The flexible display device includes: the flexible display panel 21 comprises a first region 211, a

second region 212 adjacent to one side of the first region 211, and a third region 213 between the first region 211 and the second region 212, and the optical adhesive layer 23 is disposed on one side of the first region 211 of the flexible display panel 21; the cover plate 24 is arranged on the optical adhesive layer 23; the protective adhesive layer 22 is arranged on the outer surface of the second area 212 of the flexible display panel 21 and is on the same side as the optical adhesive layer 23; and the auxiliary glue layer 29 completely covers the surface of the third area 213 close to one side of the cover plate 24.

Compared with the conventional flexible display device and the manufacturing method of the flexible display device, the auxiliary adhesive layer 29 is arranged on the surface of the third area 213 of the flexible display panel 21 close to one side of the cover plate 24 to fill the gap between the optical adhesive layer 23 and the protective adhesive layer 22, and the auxiliary adhesive layer 29 has certain mechanical strength after being attached or cured, so that the bonding strength between the cover plate 24 and the flexible display panel 21 is enhanced, the cover plate 24 and the flexible display panel 21 are supported, the flexible display panel 21 is prevented from being deformed greatly at the gap when being subjected to an external force, the risk of breakage of the flexible display panel 21 is reduced, and the product quality and reliability of the flexible display device are improved.

On the basis of the above embodiment, the second region 212 includes a transition portion 212a, a bending portion 212b and an extension portion 212c, the transition portion 212a is connected with the third region 213, the bending portion 212b is connected with a side of the transition portion 212a away from the third region 213, the extension portion 212c is connected with a side of the bending portion 212b away from the transition portion 212a, and the extension portion 212c is located on the back of the first region 211. In this embodiment, the flexible display device may be applied to a Pad-bonding structure, and the auxiliary adhesive layer 29 is arranged to relieve stress applied to the flexible display panel 21 when the flexible display panel is bent, and further, the material of the auxiliary

adhesive layer 29 may be an organic light-transmitting material, so as to further disperse the stress applied to the auxiliary adhesive layer 29, and increase reliability of the flexible display device.

Generally, the first region 211 of the flexible display panel 21 is a display region, the cover 24 corresponding to the first region 211 is a light-transmitting region, the second region 212 and the third region 213 of the flexible display panel 21 may be display regions or non-display regions, and the cover 24 corresponding to the second region 212 and the third region 213 may be light-transmitting regions or non-light-transmitting regions. For example, in the conventional product, the lower frame is usually a non-light-transmitting region, and the frames on the other three sides are usually light-transmitting regions, which are described herein by way of example only and are not particularly limited.

In one class of embodiments of the present invention, at least a portion of the protective adhesive layer 22 is disposed in the same layer as the optical adhesive layer 23, and the thickness D2 of the optical adhesive layer 23 is greater than the thickness D1 of the protective adhesive layer 22. In this embodiment, a gap exists not only between the flexible display panel 21 and the cover 24 in the third region 213, but also between the cover 24 and the protective adhesive layer 22 in the transition portion 212a of the second region 212. When the optimization design is subsequently performed, not only the auxiliary adhesive layer 29 can cover the third region 213, but also the gap above the transition portion 212a can be improved. In a specific embodiment, the auxiliary adhesive layer 29 is further optimized, the auxiliary adhesive layer 29 includes a first auxiliary adhesive layer 291 and a second auxiliary adhesive layer 292, the first auxiliary adhesive layer 291 is located on a side surface of the third region 213 close to the cover plate 24, and the second auxiliary adhesive layer 292 is located on a surface of the protective adhesive layer 22 above the transition portion 212a of the second region 212. Compared with the above embodiments, in this embodiment, not only the first auxiliary adhesive layer 291 but also the second auxiliary adhesive layer 292 are newly disposed, so that the gap between the cover plate 24 and the protection adhesive layer 22 is also

improved, and the reliability of the flexible display device is further improved.

It is understood that this embodiment is directed to the case where the thickness D1 of the protective adhesive layer 22 is smaller than the thickness D2 of the optical adhesive layer, and in other embodiments, the thickness D1 of the protective adhesive layer 22 is equal to the thickness D2 of the optical adhesive layer, so that no gap exists between the cover plate 24 and the protective adhesive layer 22 without the second auxiliary adhesive layer 292. Similarly, when the thickness D1 of the protective adhesive layer 22 is greater than the thickness D2 of the optical adhesive layer 23, the protective adhesive layer 22 directly contacts with the cover plate 24, a gap exists between the optical adhesive layer 23 and the cover plate 24, and the second auxiliary adhesive layer 292 may also be disposed between the cover plate 24 and the optical adhesive layer 23 to fill the gap and bond the cover plate 24 and the optical adhesive layer 23. The thickness D1 of the protective adhesive layer 22 and the thickness D2 of the optical adhesive layer 23 are both thicknesses extending from the transition portion 212a of the first region 211, the third region 213, and the second region 212 of the flexible display panel 21 toward the cover plate 24, and the protective adhesive layer 22 is not considered herein because it is not in the same layer as the optical adhesive layer 23 at the bending portion 212b and the extending portion 212c of the second region 212.

The auxiliary glue layer 29 with any thickness is arranged above the third region 213 and the transition part 212a, so that the improvement effect exists in the gap reduction. In a preferred embodiment, the auxiliary glue layer 29 bonds the third region 213 of the flexible display panel 21 and the cover plate 24, the protective glue layer 22 and the cover plate 24, respectively, the thickness D3 of the first auxiliary glue layer 291 is equal to the thickness D2 of the optical glue layer D2, and the sum of the thickness D4 of the second auxiliary glue layer 292 and the thickness D1 of the protective glue layer 22 is equal to the thickness D2 of the optical glue layer 23. At this time, in this embodiment, gaps between the flexible display panel 21 and the cover plate 24 and between the optical adhesive layer 23

and the cover plate 24 are filled, the optical adhesive layer 23/the auxiliary adhesive layer 29/the protective adhesive layer 22 tightly attach the cover plate 24 and the flexible display panel 21, the gap inside the film layer is completely eliminated, and the stress on the flexible display device does not concentrate at a certain gap to cause a hidden danger.

Preferably, the auxiliary adhesive layer 29 is an organic transparent material and includes at least one of a pressure-sensitive adhesive layer, a photo-curing adhesive layer, an acrylic adhesive layer, and a polyurethane adhesive layer. In one embodiment, the auxiliary adhesive layer 29 is a double-sided pressure sensitive adhesive tape coated with a pressure sensitive adhesive on one side of the substrate before the application, the double-sided pressure sensitive adhesive tape is applied to the cover plate 24, the substrate is peeled off, and the flexible display panel 21 is applied. In another embodiment, the auxiliary adhesive layer 29 is a liquid uv curable adhesive before bonding.

In order to further enhance the supporting strength of the auxiliary glue layer 29, the flexible display device 29 further comprises supporting particles, the supporting particles are doped in the auxiliary glue layer 29, and the material strength of the supporting particles is greater than that of the auxiliary glue layer 29. In some embodiments, the supporting particles are uniformly dispersed in the auxiliary adhesive layer 29, and in other embodiments, the flexible display device is subjected to a stress analysis, and more supporting particles are distributed at a position where the stress is more concentrated. If the supporting particles are made of opaque materials, the supporting particles need to be distributed in the orthographic projection of the black matrix so as to avoid influencing the aperture opening ratio of the flexible display device.

The flexible display device 29 further includes a first back plate layer 25, a support layer 26, a composite heat dissipation layer 27, and a second back plate layer 28 stacked in sequence from bottom to top, wherein the first back plate layer 25, the support layer 26, the composite heat dissipation layer 27, and the second back plate layer 28 are disposed on the flexible display panel 21 between the first region 211 and the extension portion 212

c.

In order to better implement the flexible display device in the embodiments of the present invention, on the basis of the flexible display device, a manufacturing method of the flexible display device is further provided in the embodiments of the present invention, and the manufacturing method is used for manufacturing the flexible display device as described in the above embodiments. By using the preparation method described in the following examples, the performance of the flexible display device is further improved.

Fig. 4 is a flowchart illustrating a method for manufacturing a flexible display device according to an embodiment of the present invention, as shown in fig. 4. The preparation method comprises the following steps:

s1, providing a flexible display panel 21 including a first region 211, a second region 212, and a third region 213;

s2, preparing an optical adhesive layer 23 in the first region 211 of the flexible display panel 21;

s3, preparing a protective adhesive layer 22 in the second region 212 of the flexible display panel 21;

s4, providing a cover plate 24, and preparing an auxiliary glue layer 29 at a position of the cover plate 24 corresponding to the third area 213 of the flexible display panel 21;

and S5, adhering the flexible display panel 21 and the cover plate 29.

In a specific embodiment of the present invention, the second region 212 includes a transition portion 212a, a bending portion 212b and an extension portion 212c, and in step S4, the preparing the auxiliary adhesive layer 29 includes: the cover plate 24 is attached with a first auxiliary adhesive layer 291 at the position corresponding to the third area 213 and attached with a second auxiliary adhesive layer 292 at the position corresponding to the transition portion 212b of the second area 212, the first auxiliary adhesive layer 291 and the second auxiliary adhesive layer 292 are both pressure-sensitive adhesive layers, and the thickness D3 of the first auxiliary adhesive layer 291 is greater than the thickness D4 of the second auxiliary adhesive layer 292. Fig. 5 is a top view of a flexible display

device according to an embodiment of the invention, as shown in fig. 5. The first auxiliary adhesive layer 291 and the second auxiliary adhesive layer 292 are respectively attached to the cover plate 24, and the widths of the first auxiliary adhesive layer 291 and the second auxiliary adhesive layer 292 may be the same or different, depending on actual production requirements.

In another specific embodiment of the present invention, the second region 212 includes a transition portion 212a, a bending portion 212b and an extension portion 212c, and in step S4, the preparing the auxiliary adhesive layer 29 includes: the cover plate 24 corresponds to the third area 213 to apply the auxiliary adhesive 29, the auxiliary adhesive 29 is sol-like light-curing adhesive, and when the flexible display panel 21 is attached to the cover plate 24, the auxiliary adhesive 29 fills the gap between the third area 213 and the cover plate 24 and flows to the second area 212 above the transition portion 212a, so as to perform ultraviolet irradiation curing on the auxiliary adhesive 29 to form the auxiliary adhesive layer 29. Fig. 6 is a top view of a flexible display device according to another embodiment of the invention, as shown in fig. 6. The apron 24 corresponds third region 213 department applies sol-like supplementary glue 29, supplementary glue 29 both has certain mobility, can not drip in advance when the laminating, and the extrusion of pressure in the laminating process, supplementary glue 29 fills third region 213 with the clearance between the apron 24 flows and extends to fill above transition portion 212a apron 24 with the clearance between the protection glue layer 22 forms after the solidification supplementary glue layer 29. In this embodiment, the first auxiliary adhesive layer 291 and the second auxiliary adhesive layer 292 are not strictly distinguished, and both are made of the same material and are connected to each other to form a whole.

In the above embodiments, the descriptions of the respective embodiments have respective emphasis, and parts that are not described in detail in a certain embodiment may refer to the above detailed descriptions of other embodiments, and are not described herein again. In a specific implementation, each unit or structure may be implemented as

an independent entity, or may be combined arbitrarily to be implemented as one or several entities, and specific implementations of each unit, structure, or operation may refer to the foregoing method embodiments, which are not described herein again.

The above embodiments of the present invention are described in detail, and the principle and the implementation of the present invention are explained by applying specific embodiments, and the above description of the embodiments is only used to help understanding the method of the present invention and the core idea thereof; meanwhile, for those skilled in the art, according to the idea of the present invention, there may be variations in the specific embodiments and the application scope, and in summary, the content of the present specification should not be construed as a limitation to the present invention.

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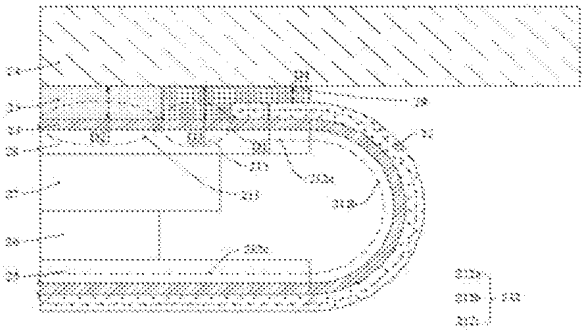
权利要求书2页 说明书6页 附图5页

(54)发明名称

柔性显示装置及其制备方法

(57)摘要

本发明公开了一种柔性显示装置及其制备方法，所述柔性显示装置包括：柔性显示面板，包括第一区域、邻设于所述第一区域一侧的第二区域以及位于所述第一区域和所述第二区域之间的第三区域，光学胶层，设置于所述柔性显示面板的所述第一区域一侧；盖板，设置于所述光学胶层上；保护胶层，设置于所述柔性显示面板的所述第二区域的外表面并与所述光学胶层同侧；辅助胶层，完全覆盖所述第三区域靠近所述盖板一侧的表面。本发明通过设置所述辅助胶层，填充了间隙，从而对所述盖板和所述柔性显示面板起到支撑作用，进而防止所述柔性显示面板产生较大形变，减小了破损的风险，提升了所述柔性显示装置的产品质量和可靠性。



CN 112786807 A

1.一种柔性显示装置，其特征在于，包括：

柔性显示面板，包括第一区域、邻设于所述第一区域一侧的第二区域以及位于所述第一区域和所述第二区域之间的第三区域；

光学胶层，设置于所述柔性显示面板的所述第一区域一侧；

盖板，设置于所述光学胶层上；

保护胶层，设置于所述柔性显示面板的所述第二区域的外表面并与所述光学胶层同侧；

辅助胶层，完全覆盖所述第三区域靠近所述盖板一侧的表面。

2.根据权利要求1所述的柔性显示装置，其特征在于，所述第二区域包括过渡部、弯折部和延伸部，所述过渡部与所述第三区域连接，所述弯折部与所述过渡部远离所述第三区域的一侧连接，所述延伸部与所述弯折部远离所述过渡部的一侧连接且所述延伸部位于所述第一区域的背面。

3.根据权利要求2所述的柔性显示装置，其特征在于，至少部分所述保护胶层与所述光学胶层同层设置，且所述光学胶层的厚度大于所述保护胶层的厚度。

4.根据权利要求3所述的柔性显示装置，其特征在于，所述辅助胶层包括第一辅助胶层和第二辅助胶层，所述第一辅助胶层位于所述第三区域靠近所述盖板的一侧表面，所述第二辅助胶层位于所述第二区域的所述过渡部上方所述保护胶层的表面。

5.根据权利要求4所述的柔性显示装置，其特征在于，所述辅助胶层分别粘合所述柔性显示面板的所述第三区域与所述盖板、所述保护胶层与所述盖板，所述第一辅助胶层的厚度与所述光学胶层的厚度相等，且所述第二辅助胶层的厚度和所述保护胶层的厚度之和与所述光学胶层的厚度相等。

6.根据权利要求1所述的柔性显示装置，其特征在于，所述辅助胶层为有机透明材料，包括压敏胶层、光固化胶层、亚克力胶层和聚氨脂胶层中的至少一种。

7.根据权利要求1所述的柔性显示装置，其特征在于，还包括支撑粒子，所述支撑粒子掺杂于所述辅助胶层中，所述支撑粒子的材料强度大于所述辅助胶层的材料强度。

8.一种柔性显示装置的制作方法，其特征在于，包括以下步骤：

提供一柔性显示面板，包括第一区域、第二区域和第三区域；

在所述柔性显示面板的所述第一区域制备光学胶层；

在所述柔性显示面板的所述第二区域制备保护胶层；

提供一盖板，在所述盖板对应所述柔性显示面板的所述第三区域处制备辅助胶层；

将所述柔性显示面板与所述盖板进行贴合。

9.根据权利要求8所述的制备方法，其特征在于，所述第二区域包括过渡部、弯折部和延伸部，制备所述辅助胶层包括：在所述盖板对应所述第三区域处贴合第一辅助胶层、对应所述第二区域的所述过渡部处贴合第二辅助胶层，所述第一辅助胶层和所述第二辅助胶层均为压敏胶层，所述第一辅助胶层的厚度大于所述第二辅助胶层的厚度。

10.根据权利要求8所述的制备方法，其特征在于，所述第二区域包括过渡部、弯折部和延伸部，制备所述辅助胶层包括：在所述盖板对应所述第三区域处施加所述辅助胶，所述辅助胶为溶胶状的光固化胶，所述柔性显示面板与所述盖板贴合时，所述辅助胶填充所述第三区域与所述盖板之间的间隙并流动延伸至所述第二区域的所述过渡部上方，对所述辅助

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胶进行紫外光照射固化形成所述辅助胶层。

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柔性显示装置及其制备方法

技术领域

[0001] 本发明涉及显示技术领域，具体涉及一种柔性显示装置及其制备方法。

背景技术

[0002] 随着有机电致发光二极管(Organic Light-Emitting Diode，OLED)显示技术的发展，柔性OLED技术逐渐成熟。卷曲OLED显示模组作为一种新型显示科技的模组，未来将是全球面板及模组厂商创新发展的方向。柔性屏幕作为OLED光固化胶的一种重要应用技术，在近年来得到了重要的发展。

[0003] 与传统屏幕相比，柔性屏幕具有显著的优势，如其体积更加轻薄，且叠构一般为盖板(Cover Glass，CG)、光学胶层(Optically Clear Adhesive，OCA)、偏光片层(Polarizer，Pol)、显示面板，背板层(Back Plane，BP)，复合材料等组成。其中，CG层和OCA胶层采用全贴合。为进一步减少OLED模组的厚度及成本，开始向无偏光片层的技术方向发展。如图1所示，图1为现有技术中柔性显示装置的结构示意图。所述柔性显示装置包括显示面板11、光固化胶层12、光学胶层13、盖板14、第一背板层15、支撑层16、散热复合层17和第二背板层18。但是，无偏光片层有以下问题，如图2所示，图2为现有技术中柔性显示装置的俯视图(盖板未画出)。所述光学胶13贴合时存在一定公差，所述光学胶13与所述光固化胶层12有一定间隙，造成此处非常脆弱。所述显示面板在Pad-Bending(将端子区的弯折区翻折到显示面板背面)时会受到一定外力，所述间隙处容易发生破损，导致报废。

[0004] 综上所述，现有技术中由于光学胶贴合有一定公差，盖板与显示面板之间存在间隙，当显示面板在进行折弯时存在容易破损、产品可靠性较差的技术问题。

发明内容

[0005] 本发明实施例提供一种柔性显示装置及柔性显示装置的制备方法，用于解决现有技术中由于光学胶贴合有一定公差，盖板与显示面板之间存在间隙，当显示面板在进行折弯时存在容易破损、产品可靠性较差的技术问题。

[0006] 为解决上述问题，第一方面，本发明提供一种柔性显示装置，其中，包括：

[0007] 柔性显示面板，包括第一区域、邻设于所述第一区域一侧的第二区域以及位于所述第一区域和所述第二区域之间的第三区域；

[0008] 光学胶层，设置于所述柔性显示面板的所述第一区域一侧；

[0009] 盖板，设置于所述光学胶层上；

[0010] 保护胶层，设置于所述柔性显示面板的所述第二区域的外表面并与所述光学胶层同侧；

[0011] 辅助胶层，完全覆盖所述第三区域靠近所述盖板一侧的表面。

[0012] 在本发明的一些实施例中，所述第二区域包括过渡部、弯折部和延伸部，所述过渡部与所述第三区域连接，所述弯折部与所述过渡部远离所述第三区域的一侧连接，所述延伸部与所述弯折部远离所述过渡部的一侧连接且所述延伸部位于所述第一区域的背面。

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[0013] 在本发明的一些实施例中，至少部分所述保护胶层与所述光学胶层同层设置，且所述光学胶层的厚度大于所述保护胶层的厚度。

[0014] 在本发明的一些实施例中，所述辅助胶层包括第一辅助胶层和第二辅助胶层，所述第一辅助胶层位于所述第三区域靠近所述盖板的一侧表面，所述第二辅助胶层位于所述第二区域的所述过渡部上方所述保护胶层的表面。

[0015] 在本发明的一些实施例中，所述辅助胶层分别粘合所述柔性显示面板的所述第三区域与所述盖板、所述保护胶层与所述盖板，所述第一辅助胶层的厚度与所述光学胶层的厚度相等，且所述第二辅助胶层的厚度和所述保护胶层的厚度之和与所述光学胶层的厚度相等。

[0016] 在本发明的一些实施例中，所述辅助胶层为有机透明材料，包括压敏胶层、光固化胶层、亚克力胶层和聚氨脂胶层中的至少一种。

[0017] 在本发明的一些实施例中，还包括支撑粒子，所述支撑粒子掺杂于所述辅助胶层中，所述支撑粒子的材料强度大于所述辅助胶层的材料强度。

[0018] 第二方面，本发明提供一种柔性显示装置的制备方法，所述制备方法用于制备如第一方面中任一所述的柔性显示装置，包括以下步骤：

[0019] 提供一柔性显示面板，包括第一区域、第二区域和第三区域；

[0020] 在所述柔性显示面板的所述第一区域制备光学胶层；

[0021] 在所述柔性显示面板的所述第二区域制备保护胶层；

[0022] 提供一盖板，在所述盖板对应所述柔性显示面板的所述第三区域处制备辅助胶层；

[0023] 将所述柔性显示面板与所述盖板进行贴合。

[0024] 在本发明的一些实施例中，所述第二区域包括过渡部、弯折部和延伸部，制备所述辅助胶层包括：在所述盖板对应所述第三区域处贴合第一辅助胶层、对应所述第二区域的所述过渡部处贴合第二辅助胶层，所述第一辅助胶层和所述第二辅助胶层均为压敏胶层，所述第一辅助胶层的厚度大于所述第二辅助胶层的厚度。

[0025] 在本发明的一些实施例中，制备所述辅助胶层包括：在所述盖板对应所述第三区域处施加所述辅助胶，所述辅助胶为溶胶状的光固化胶，所述柔性显示面板与所述盖板贴合时，所述辅助胶填充所述第三区域与所述盖板之间的间隙并流动延伸至所述第二区域的过渡部上方，对所述辅助胶进行紫外光照射固化形成所述辅助胶层。

[0026] 相较于现有的柔性显示装置及柔性显示装置的制备方法，本发明通过在所述柔性显示面板的所述第三区域靠近所述盖板一侧的表面设置所述辅助胶层，填充了所述光学胶层与保护胶层之间的间隙，由于所述辅助胶层在贴合或固化后具有一定机械强度，从而加强了所述盖板与所述柔性显示面板的粘结强度，同时对所述盖板和所述柔性显示面板起到支撑作用，进而防止所述柔性显示面板受到外力时在所述间隙处产生较大形变，减小了所述柔性显示面板出现破损的风险，提升了所述柔性显示装置的产品质量和可靠性。

附图说明

[0027] 为了更清楚地说明本发明实施例中的技术方案，下面将对实施例描述中所需要使用的附图作简单地介绍，显而易见地，下面描述中的附图仅仅是本发明的一些实施例，对于

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本领域技术人员来讲，在不付出创造性劳动的前提下，还可以根据这些附图获得其他的附图。

[0028] 图1为现有技术中柔性显示装置的结构示意图；

[0029] 图2为现有技术中柔性显示装置的俯视图；

[0030] 图3为本发明一个实施例中柔性显示装置的结构示意图；

[0031] 图4为本发明一个实施例中制备方法的流程图；

[0032] 图5为本发明一个实施例中柔性显示装置的俯视图；

[0033] 图6为本发明另一个实施例中柔性显示装置的俯视图。

具体实施方式

[0034] 下面将结合本发明实施例中的附图，对本发明实施例中的技术方案进行清楚、完整地描述。显然，所描述的实施例仅仅是本发明一部分实施例，而不是全部的实施例。基于本发明中的实施例，本领域技术人员在没有作出创造性劳动前提下所获得的所有其他实施例，都属于本发明保护的范围。

[0035] 在本发明的描述中，需要理解的是，术语“中心”、“纵向”、“横向”、“长度”、“宽度”、“厚度”、“上”、“下”、“前”、“后”、“左”、“右”、“竖直”、“水平”、“顶”、“底”、“内”、“外”、“顺时针”、“逆时针”等指示的方位或位置关系为基于附图所示的方位或位置关系，仅是为了便于描述本发明和简化描述，而不是指示或暗示所指的装置或元件必须具有特定的方位、以特定的方位构造和操作，因此不能理解为对本发明的限制。此外，术语“第一”、“第二”仅用于描述目的，而不能理解为指示或暗示相对重要性或者隐含指明所指示的技术特征的数量。由此，限定有“第一”、“第二”的特征可以明示或者隐含地包括一个或者更多个所述特征。在本发明的描述中，“多个”的含义是两个或两个以上，除非另有明确具体的限定。在本申请中，“示例性”一词用来表示“用作例子、例证或说明”。本申请中被描述为“示例性”的任何实施例不一定被解释为比其它实施例更优选或更具优势。为了使本领域任何技术人员能够实现和使用本发明，给出了以下描述。在以下描述中，为了解释的目的而列出了细节。应当明白的是，本领域普通技术人员可以认识到，在不使用这些特定细节的情况下也可以实现本发明。在其它实例中，不会对公知的结构和过程进行详细阐述，以避免不必要的细节使本发明的描述变得晦涩。因此，本发明并非旨在限于所示的实施例，而是与符合本申请所公开的原理和特征的最广范围相一致。

[0036] 现有技术中由于光学胶贴合有一定公差，盖板与显示面板之间存在间隙，当显示面板在进行折弯时存在容易破损、产品可靠性较差的技术问题。

[0037] 基于此，本发明实施例提供一种柔性显示装置及柔性显示装置的制备方法。以下分别进行详细说明。

[0038] 首先，本发明实施例提供一种柔性显示装置，如图3所示，图3为本发明一个实施例中柔性显示装置的结构示意图。所述柔性显示装置包括：柔性显示面板21，包括第一区域211、邻设于所述第一区域211一侧的第二区域212以及位于所述第一区域211和所述第二区域212之间的第三区域213，光学胶层23，设置于所述柔性显示面板21的所述第一区域211一侧；盖板24，设置于所述光学胶层23上；保护胶层22，设置于所述柔性显示面板21的所述第二区域212的外表面并与所述光学胶层23同侧；辅助胶层29，完全覆盖所述第三区域213靠

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近所述盖板24一侧的表面。

[0039] 相较于现有的柔性显示装置及柔性显示装置的制备方法，本发明通过在所述柔性显示面板21的所述第三区域213靠近所述盖板24一侧的表面设置所述辅助胶层29，填充了所述光学胶层23与保护胶层22之间的间隙，由于所述辅助胶层29在贴合或固化后具有一定机械强度，从而加强了所述盖板24与所述柔性显示面板21的粘结强度，同时对所述盖板24和所述柔性显示面板21起到支撑作用，进而防止所述柔性显示面板21受到外力时在所述间隙处产生较大形变，减小了所述柔性显示面板21出现破损的风险，提升了所述柔性显示装置的产品质量和可靠性。

[0040] 在上述实施例的基础上，所述第二区域212包括过渡部212a、弯折部212b和延伸部212c，所述过渡部212a与所述第三区域213连接，所述弯折部212b与所述过渡部212a远离所述第三区域213的一侧连接，所述延伸部212c与所述弯折部212b远离所述过渡部212a的一侧连接且所述延伸部212c位于所述第一区域211的背面。在本实施例中，所述柔性显示装置可以适用于Pad-Bending结构中，通过设置所述辅助胶层29缓解所述柔性显示面板21折弯时所受到的应力，进一步的，所述辅助胶层29的材料可以选用有机透光材料，进一步分散所述辅助胶层29所受到的应力，增加所述柔性显示装置的可靠性。

[0041] 一般情况下，所述柔性显示面板21的所述第一区域211为显示区，所述盖板24对应所述第一区域211处为透光区域，所述柔性显示面板21的所述第二区域212和所述第三区域213可以为显示区，也可以为非显示区，所述盖板24对应所述第二区域212处和所述第三区域213处可以为透光区，也可以为非透光区。如现有产品中下边框通常为非透光区，其他三侧的边框通常为透光区，此处仅为举例描述，不做具体限定。

[0042] 在本发明的一类实施例中，至少部分所述保护胶层22与所述光学胶层23同层设置，且所述光学胶层23的厚度D2大于所述保护胶层22的厚度D1。在本实施例中，不仅在所述第三区域213上所述柔性显示面板21与所述盖板24之间存在间隙，在所述第二区域212的所述过渡部212a上，所述盖板24与所述保护胶层22之间也存在间隙。后续进行优化设计时，不仅可以使得所述辅助胶层29覆盖所述第三区域213，也可以对所述过渡部212a上方的间隙进行改进。在一个具体的实施例中，对所述辅助胶层29进行进一步优化，所述辅助胶层29包括第一辅助胶层291和第二辅助胶层292，所述第一辅助胶层291位于所述第三区域213靠近所述盖板24的一侧表面，所述第二辅助胶层292位于所述第二区域212的所述过渡部212a上方所述保护胶层22的表面。相较于上述实施例，在本实施例中，不仅设置了所述第一辅助胶层291，还新设置了所述第二辅助胶层292，使得所述盖板24与所述保护胶层22之间的空隙也同样得到改善，所述柔性显示装置的可靠性得到进一步提升。

[0043] 可以理解的是，此实施例针对的是所述保护胶层22的厚度D1小于所述光学胶层的厚度D2的情况，在另一些实施例中，所述保护胶层22的厚度D1等于所述光学胶层的厚度D2，无需设置所述第二辅助胶层292即可使得所述盖板24与所述保护胶层22之间不存在空隙。同理可得，当所述保护胶层22的厚度D1大于所述光学胶层23的厚度D2时，所述保护胶层22与所述盖板24之间直接接触，所述光学胶层23与所述盖板24之间存在间隙，所述第二辅助胶层292也可以设置于所述盖板24与所述光学胶层23之间，填充上述空隙，粘合所述盖板24与所述光学胶层23。此处所说的所述保护胶层22的厚度D1和所述光学胶层23的厚度D2均是指由所述柔性显示面板21的所述第一区域211、所述第三区域213和所述第二区域212的所

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述过渡部212a上朝向所述盖板24一侧延伸的厚度，所述保护胶层22位于所述第二区域212的所述弯折部212b和所述延伸部212c处由于不与所述光学胶层23同层，此处并不考虑在内。

[0044] 在所述第三区域213和所述过渡部212a上方设置任意厚度的所述辅助胶层29，使得间隙变小均已存在改善效果。在一个优选的实施例中，所述辅助胶层29分别粘合所述柔性显示面板21的所述第三区域213与所述盖板24、所述保护胶层22与所述盖板24，所述第一辅助胶层291的厚度D3与所述光学胶层D2的厚度相等，且所述第二辅助胶层292的厚度D4和所述保护胶层22的厚度D1之和与所述光学胶层23的厚度D2相等。此时，在本实施例中，所述柔性显示面板21与所述盖板24之间、所述光学胶层23与所述盖板24之间的间隙均得以填充，所述光学胶层23/所述辅助胶层29/所述保护胶层22将所述盖板24与所述柔性显示面板21紧密贴合，膜层内部的间隙得以完全消除，所述柔性显示装置受到应力则不会在某一间隙处集中造成隐患。

[0045] 优选的，所述辅助胶层29为有机透明材料，包括压敏胶层、光固化胶层、亚克力胶层和聚氨脂胶层中的至少一种。在一个实施例中，所述辅助胶层29在贴合之前为将压敏胶涂布于基材一侧的双面压敏胶带，将所述双面压敏胶带贴合于所述盖板24上，撕去基材，再与所述柔性显示面板21贴合。在另一个实施例中，所述辅助胶层29在贴合之前为液态的紫外光固化胶。

[0046] 为了进一步加强所述辅助胶层29的支撑强度，所述柔性显示装置29还包括支撑粒子，所述支撑粒子掺杂于所述辅助胶层29中，所述支撑粒子的材料强度大于所述辅助胶层29的材料强度。在一些实施例中，所述支撑粒子均匀的分散于所述辅助胶层29中，在另一些实施例中，对所述柔性显示装置进行受力分析，在所受应力较为集中处分布有较多的所述支撑粒子。若所述支撑粒子的材质为不透光材料，所述支撑粒子需分布于黑色矩阵的正投影中，以避免影响所述柔性显示装置的开口率。

[0047] 所述柔性显示装置29还包括从下到上依次层叠的第一背板层25、支撑层26、复合散热层27和第二背板层28，所述第一背板层25、所述支撑层26、所述复合散热层27和所述第二背板层28均设置于所述柔性显示面板21的所述第一区域211与所述延伸部212c之间。

[0048] 为了更好地实施本发明实施例中的柔性显示装置，在所述柔性显示装置的基础之上，本发明实施例中还提供一种柔性显示装置的制备方法，所述制备方法用于制备如上述实施例中所述的柔性显示装置。通过采用如下实施例中描述的所述制备方法，进一步提升了所述柔性显示装置的性能。

[0049] 如图4所示，图4为本发明一个实施例中柔性显示装置的制备方法的流程图。所述制备方法包括以下步骤：

[0050] S1、提供一柔性显示面板21，包括第一区域211、第二区域212和第三区域213；

[0051] S2、在所述柔性显示面板21的所述第一区域211制备光学胶层23；

[0052] S3、在所述柔性显示面板21的所述第二区域212制备保护胶层22；

[0053] S4、提供一盖板24，在所述盖板24对应所述柔性显示面板21的所述第三区域213处制备辅助胶层29；

[0054] S5、将所述柔性显示面板21与所述盖板29进行贴合。

[0055] 在本发明一个具体的实施例中，所述第二区域212包括过渡部212a、弯折部212b和

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延伸部212c，在步骤S4中，制备所述辅助胶层29包括：在所述盖板24对应所述第三区域213处贴合第一辅助胶层291、对应所述第二区域212的所述过渡部212b处贴合第二辅助胶层292，所述第一辅助胶层291和所述第二辅助胶层292均为压敏胶层，所述第一辅助胶层291的厚度D3大于所述第二辅助胶层292的厚度D4。如图5所示，图5为本发明一个实施例中柔性显示装置的俯视图。在所述盖板24上分别贴合所述第一辅助胶层291和所述第二辅助胶层292，所述第一辅助胶层291和所述第二辅助胶层292宽度可以相同也可以不同，视实际生产需求而定。

[0056] 在本发明另一个具体的实施例中，所述第二区域212包括过渡部212a、弯折部212b和延伸部212c，在步骤S4中，制备所述辅助胶层29包括：在所述盖板24对应所述第三区域213处施加所述辅助胶29，所述辅助胶29为溶胶状的光固化胶，所述柔性显示面板21与所述盖板24贴合时，所述辅助胶29填充所述第三区域213与所述盖板24之间的间隙并流动延伸至所述第二区域212的所述过渡部212a上方，对所述辅助胶29进行紫外光照射固化形成所述辅助胶层29。如图6所示，图6为本发明另一个实施例中柔性显示装置的俯视图。在所述盖板24对应所述第三区域213处施加溶胶状的所述辅助胶29，所述辅助胶29既具有一定的流动性，又不能在贴合时提前滴落，在贴合过程中经压力挤压，所述辅助胶29填充所述第三区域213与所述盖板24之间的间隙并流动延伸至所述过渡部212a上方填充所述盖板24与所述保护胶层22之间的间隙，固化后形成所述辅助胶层29。此实施例中，不用严格区分所述第一辅助胶层291和所述第二辅助胶层292，两者为同一材质同时制备，互相连接为一整体。

[0057] 在上述实施例中，对各个实施例的描述都各有侧重，某个实施例中没有详述的部分，可以参见上文针对其他实施例的详细描述，此处不再赘述。具体实施时，以上各个单元或结构可以作为独立的实体来实现，也可以进行任意组合，作为同一或若干个实体来实现，以上各个单元、结构或操作的具体实施可参见前面的方法实施例，在此不再赘述。

[0058] 以上对本发明实施例进行了详细介绍，本文中应用了具体个例对本发明的原理及实施方式进行了阐述，以上实施例的说明只是用于帮助理解本发明的方法及其核心思想；同时，对于本领域的技术人员，依据本发明的思想，在具体实施方式及应用范围上均会有改变之处，综上所述，本说明书内容不应理解为对本发明的限制。

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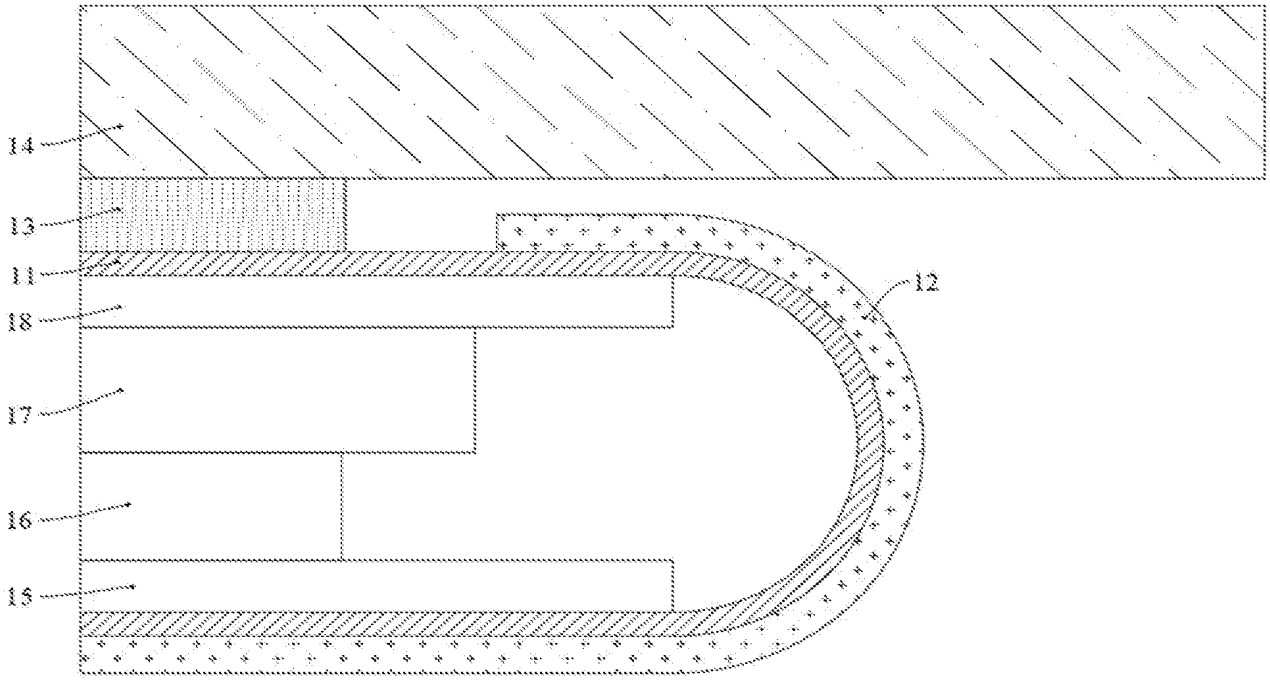


图1

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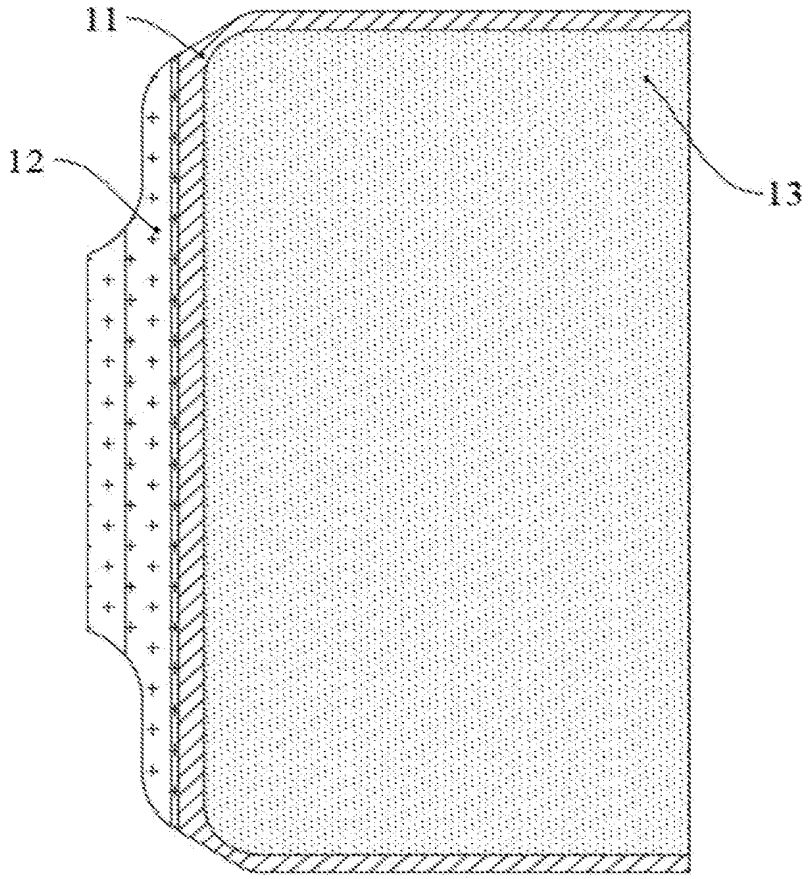


图2

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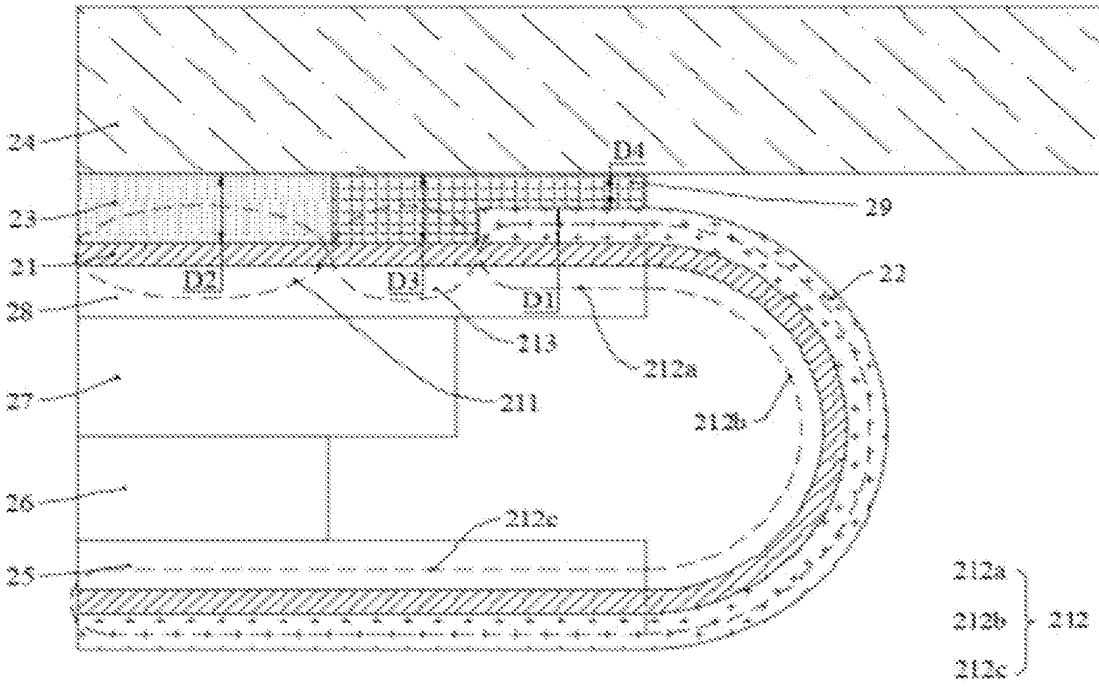


图3

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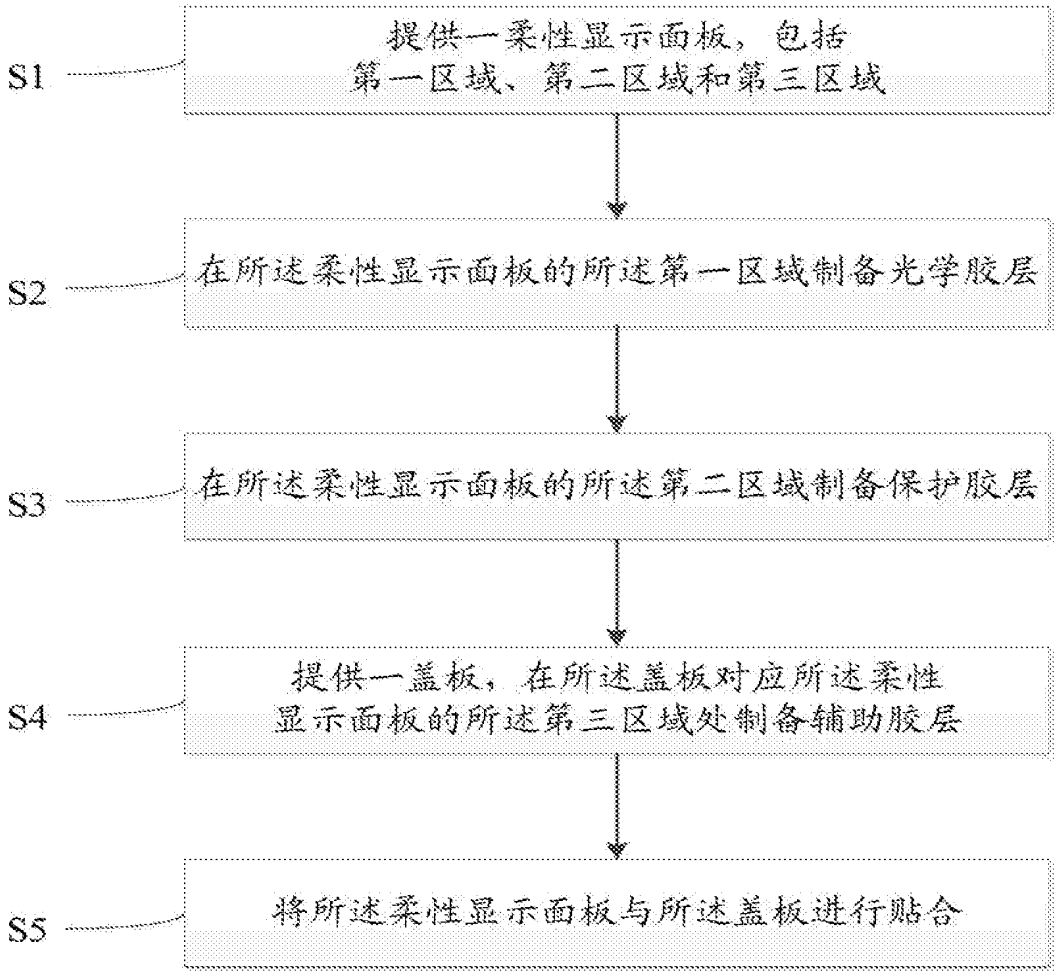


图4

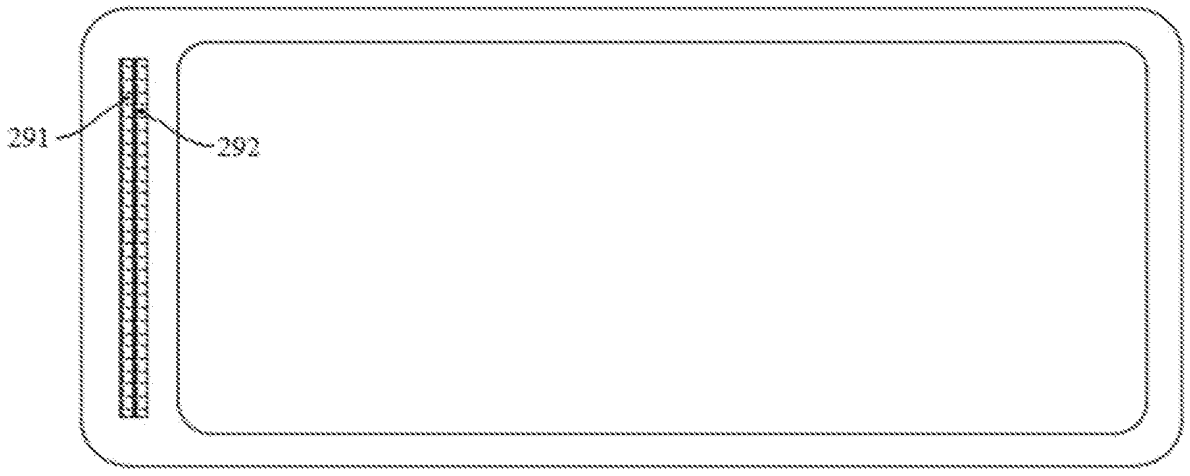


图5

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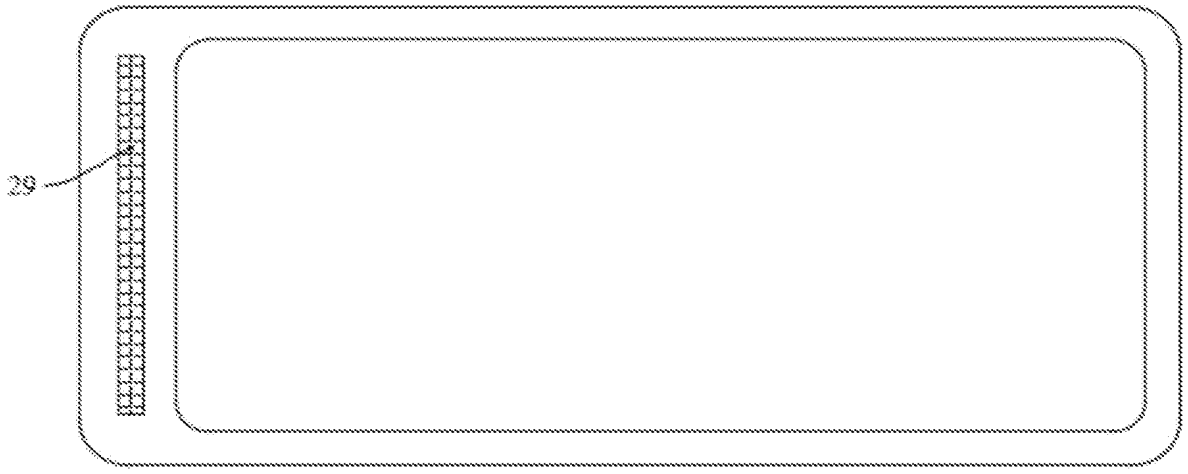


图6

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Warnings:

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Information:					
2	Foreign Reference	1.pdf	4606481 d779dc51774bd23c2fbd38735ce0a92676466c8d	no	21
Warnings:					
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3	Foreign Reference	2.pdf	5669546 659de0ea9b08b9a63a8b47355549f85652ae7a3a	no	28
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If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

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(12) 按照专利合作条约所公布的国际申请

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本国际公布:
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(54) **Title:** DISPLAY DEVICE

(54) 发明名称: 显示装置

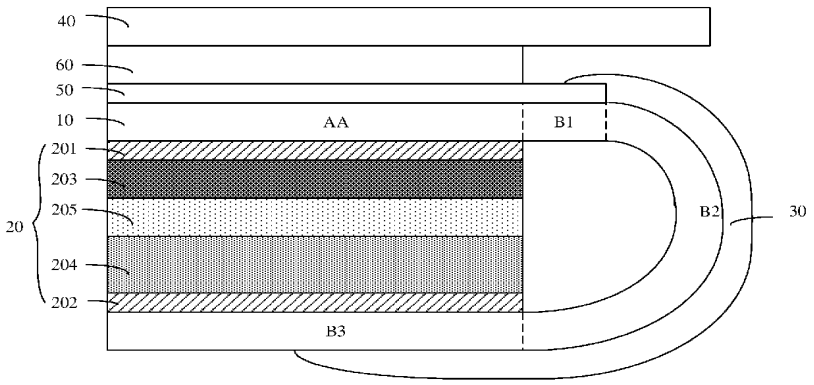


图 1

(57) **Abstract:** The present application provides a display device. The distance between a protective layer and a cover plate is greater than or equal to a preset value in a region where the protective layer overlaps with the cover plate, such that the cover plate does not extrude the protective layer, thereby eliminating the cracking risk of the display device.

(57) 摘要: 本申请提供一种显示装置，通过在保护层与盖板重叠的区域内，使保护层与盖板之间的距离大于或等于预设值，如此，盖板不会挤压保护层，消除了显示装置的开裂风险。

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显示装置

技术领域

[0001] 本申请涉及显示技术领域，尤其涉及一种显示装置。

背景技术

[0002] 对于有机发光二极管（Organic Light-Emitting Diode，OLED）显示面板而言，偏光片能够有效降低强光下OLED显示面板的反射率，却导致OLED显示面板损失了将近58%的出光，这极大地增加了OLED显示面板的使用寿命负担，并且，偏光片的厚度约为100μm，其厚度较大且材质脆，不利于动态弯折产品的开发。

[0003] 为了开发基于OLED显示面板的动态弯折产品，通常采用无偏光片（POL-less）技术制作OLED显示面板，POL-less技术指的是采用彩膜（Color Filter，CF）替代偏光片的技术。其中，彩膜由红色色阻、绿色色阻、蓝色色阻和黑色矩阵（Black Matrix，BM）组成，在OLED显示面板中，红色色阻、绿色色阻和蓝色色阻分别承担着红色子像素单元、绿色子像素单元和蓝色子像素单元的出光，黑色矩阵主要承担着防止OLED显示面板漏光以及降低OLED显示面板的反射率的作用。彩膜不仅能够在一定程度上降低强光下OLED显示面板的反射率，还能够将OLED显示面板的出光率从42%提高到60%，并且，彩膜的厚度约为5μm，其远小于偏光片的厚度且柔韧性高，能够降低OLED显示面板的整体厚度，有利于动态弯折产品的开发。

[0004] 进一步地，为了实现OLED显示面板的窄边框设计，通常将OLED显示面板的弯折区弯折到OLED显示面板的背面，从而减小边框的宽度。然而，OLED显示面板的弯折区的弯折容易导致OLED显示面板内的线路断裂，为了防止弯折导致的线路断裂，通常将UV胶覆盖于OLED显示面板的弯折区，缓解OLED显示面板的弯折区的弯折应力。

[0005] 然而，UV胶的厚度约为95μm，当盖板与彩膜通过光学胶粘接时，由于彩膜与光学胶的厚度均较薄，因此盖板会挤压UV胶，导致OLED显示面板存在开裂风险。

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发明概述

技术问题

[0006] 本申请提供一种显示装置，以解决现有的OLED显示面板存在开裂风险的问题。

问题的解决方案

技术解决方案

[0007] 本申请提供一种显示装置，其中，所述显示装置包括：

[0008] 柔性屏体，包括平面区以及与所述平面区连接的弯折区；

[0009] 彩膜，设置在所述柔性屏体上且至少覆盖所述平面区；

[0010] 保护层，设置在所述柔性屏体上且至少覆盖部分所述弯折区；

[0011] 盖板，设置在所述彩膜上且至少覆盖所述平面区；

[0012] 其中，在所述保护层与所述盖板重叠的区域内，所述保护层与所述盖板之间的距离大于或等于预设值。

[0013] 在一些实施例中，所述保护层仅设置在所述柔性屏体的表面，所述柔性屏体的表面的所述保护层的厚度小于或等于所述盖板靠近所述柔性屏体的一侧到所述柔性屏体靠近所述盖板的一侧之间的距离。

[0014] 在一些实施例中，所述显示装置还包括设置在所述柔性屏体与所述彩膜之间的触控层，以及设置在所述触控层与所述彩膜之间的绝缘层，所述保护层仅设置在所述绝缘层的表面，所述绝缘层的表面的所述保护层的厚度小于或等于所述盖板靠近所述绝缘层的一侧到所述绝缘层靠近所述盖板的一侧之间的距离。

[0015] 在一些实施例中，所述保护层还设置在所述彩膜的表面，所述彩膜的表面的所述保护层的厚度小于或等于所述盖板靠近所述彩膜的一侧到所述彩膜靠近所述盖板的一侧之间的距离。

[0016] 在一些实施例中，所述弯折区包括与所述平面区连接并依次设置的弯折过渡子区、弯折子区以及弯折延伸子区，所述弯折过渡子区与所述平面区平齐；

[0017] 所述保护层完全覆盖所述弯折子区，并至少覆盖部分所述弯折过渡子区；

[0018] 盖板，所述盖板通过光学胶与所述彩膜连接，所述盖板完全覆盖所述平面区，并至少覆盖部分所述弯折过渡子区。

[0019] 在一些实施例中，所述光学胶的厚度大于所述保护层在所述弯折过渡子区的最

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大厚度。

[0020] 在一些实施例中，所述保护层还至少覆盖部分所述弯折延伸子区。

[0021] 在一些实施例中，所述保护层为UV胶。

[0022] 在一些实施例中，所述显示装置还包括：

[0023] 支撑层，所述支撑层的一侧支撑所述平面区和所述弯折过渡子区，所述支撑层远离所述平面区的一侧支撑所述弯折延伸子区。

[0024] 在一些实施例中，所述支撑层包括设置在所述平面区和所述弯折过渡子区远离所述盖板的一侧的第一背板以及设置在所述弯折过渡子区远离所述保护层的一侧的第二背板。

[0025] 在一些实施例中，所述第一背板和所述第二背板之间设置有泡棉。

[0026] 在一些实施例中，所述泡棉和所述第二背板之间设置有补强板。

[0027] 在一些实施例中，所述泡棉和所述补强板之间设置有散热层。

[0028] 在一些实施例中，所述预设值大于0。

[0029] 在一些实施例中，所述保护层靠近所述平面区的侧边与所述柔性屏体的初始弯折位置之间的距离大于第一预设值，所述第一预设值大于或等于0，其中，所述初始弯折位置为所述弯折子区和所述弯折过渡子区衔接的位置。

[0030] 在一些实施例中，所述保护层靠近所述弯折延伸子区的侧边与所述柔性屏体的末端弯折位置之间的距离大于第二预设值，所述第二预设值大于或等于0。

[0031] 在一些实施例中，所述平面区包括红色子像素单元、绿色子像素单元和蓝色子像素单元，所述彩膜包括多个彩色色阻以及设置在不同的所述彩色色阻之间的黑色矩阵，多个所述彩色色阻包括红色色阻、绿色色阻和蓝色色阻，所述红色色阻对应所述红色子像素单元设置，所述绿色色阻对应所述绿色子像素单元设置，所述蓝色色阻对应所述蓝色子像素单元设置。

[0032] 在一些实施例中，所述光学胶为OCA光学胶。

[0033] 在一些实施例中，所述散热层的材料为金属材料或石墨，其中，所述金属材料包括铜箔、铝箔和不锈钢箔中的任意一种或多种的组合。

[0034] 在一些实施例中，所述显示装置还包括驱动单元，所述驱动单元设置在所述弯折延伸子区远离所述支撑层的表面。

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发明的有益效果

有益效果

[0035] 本申请提供的显示装置，通过在保护层与盖板重叠的区域内，使保护层与盖板之间的距离大于或等于预设值，如此，盖板不会挤压保护层，消除了显示装置的开裂风险。

对附图的简要说明

附图说明

[0036] 图1为本申请实施例提供的显示装置的结构示意图。

[0037] 图2为本申请另一实施例提供的显示装置的结构示意图。

[0038] 图3为本申请再一实施例提供的显示装置的结构示意图。

[0039] 图4为本申请又一实施例提供的显示装置的结构示意图。

[0040] 图5为本申请实施例提供的显示装置的制作方法流程图。

发明实施例

本发明的实施方式

[0041] 为使本申请的目的、技术方案及效果更加清楚、明确，以下参照附图并举实施例对本申请进一步详细说明。应当理解，此处所描述的具体实施例仅用以解释本申请，并不用于限定本申请。

[0042] 本申请实施例提供一种显示装置，显示装置可以为可穿戴设备，例如智能手环、智能手表或虚拟现实（Virtual Reality，VR）等设备，也可以为移动电话机、电子书、电子报纸、电视机或个人便携电脑，还可以为可弯曲和可折叠的柔性OLED显示或照明设备，本申请实施例对显示装置的具体形式不作具体限定。

[0043] 图1为本申请实施例提供的显示装置的结构示意图，如图1所示，显示装置包括柔性屏体10、彩膜50、保护层30和盖板40，可选地，显示装置还可以包括支撑层20和光学胶60，以下分别对柔性屏体10、支撑层20、保护层30、盖板40、彩膜50和光学胶60进行具体说明。

[0044] 柔性屏体10指的是能够进行弯曲和折叠的柔韧性高的屏幕，柔性屏体10可以划分为平面区AA和自平面区AA延伸的弯折区，平面区AA指的是能够进行显示的区

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域，弯折区指的是不能够进行显示的区域。弯折区可以包括依次设置的弯折过渡子区B1、弯折子区B2和弯折延伸子区B3，其中，弯折过渡子区B1的相对两端分别与平面区AA和弯折子区B2连接，弯折子区B2的相对两端分别与弯折过渡子区B1和弯折延伸子区B3连接。其中，弯折过渡子区B1与平面区AA平齐，也即弯折过渡子区B1与平面区AA位于同一平面，弯折子区B2和弯折延伸子区B3均不与平面区AA平齐，也即弯折子区B2与平面区AA位于不同平面，弯折延伸子区B3与平面区AA位于不同平面。

[0045] 具体而言，柔性屏体10包括柔性衬底，柔性衬底为由柔性材料制作而成的衬底，柔性材料优选为聚酰亚胺（PI），柔性衬底可以划分为第一区域和自第一区域延伸的第二区域。

[0046] 柔性衬底的第一区域上可以集成显示层，显示层可以包括多个用于显示图像的显示部件，从而使柔性衬底的第一区域与显示层共同形成柔性屏体10的平面区AA。显示层可以包括诸如薄膜晶体管、栅极线、数据线、电容、阳极、阴极和发光层等不同的显示部件，本申请实施例对柔性屏体10的平面区AA本身的结构并没有改进，采用本领域常用的结构即可，本申请实施例对其结构不作具体限定。

[0047] 柔性衬底的第二区域上设置有用于实现信号传输和驱动图像显示等功能的集成电路，从而使柔性衬底的第二区域与集成电路共同形成柔性屏体10的弯折区，本申请实施例对柔性屏体10的弯折区本身的结构并没有改进，采用本领域常用的结构即可，本申请实施例对其结构不作具体限定。

[0048] 为了实现显示装置的窄边框设计，通常将柔性屏体10的弯折区进行弯折，如图1所示，本申请实施例具体将柔性屏体10的弯折子区B2进行180°弯折，使得平面区AA与弯折过渡子区B1所组成的整体与弯折延伸子区B3相对且相互平行，此时，弯折子区B2呈半圆弧状，平面区AA、弯折过渡子区B1、弯折子区B2和弯折延伸子区B3形成一个容纳槽，支撑层20位于该容纳槽内。

[0049] 需要说明的是，一方面，由于柔性屏体10的弯折区包括设置在平面区AA和弯折子区B2之间的弯折过渡子区B1，因此使得柔性屏体10的初始弯折位置为弯折子区B2和弯折过渡子区B1衔接的位置，即柔性屏体10的初始弯折位置偏离平面区A

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A和弯折区衔接的位置，初始弯折位置的两侧均为弯折区域，有效缓解了柔性屏体10的初始弯折位置因其两侧区域的结构不同而导致的应力集中的现象，实现对柔性屏体10的弯折起始位置的保护；另一方面，由于弯折子区B2和平面区AA不直接相邻，两者之间设置有弯折过渡子区B1，因此减小了弯折子区B2弯折时作用于平面区AA上的应力，从而对平面区AA进行保护，例如防止平面区AA开裂。

[0050] 支撑层20的一侧支撑柔性屏体10的平面区AA和弯折过渡子区B1，支撑层20远离平面区AA的一侧支撑柔性屏体10的弯折延伸子区B3，即柔性屏体10的平面区AA和弯折过渡子区B1设置在支撑层20的同一侧，柔性屏体10的弯折延伸子区B3设置在支撑层20远离平面区AA的另一侧。

[0051] 需要说明的是，支撑层20主要用于固定并支撑柔性屏体10，防止柔性屏体10的弯折子区B2由于弯折程度过大而折断。支撑层20可以为兼具硬度和弹性的材料，从而既可以对柔性屏体10进行支撑，又可以对柔性屏体10进行减震。支撑层20可以为一层，也可以为多层结构，本申请实施例对此不作具体限定。

[0052] 保护层30设置在柔性屏体10远离支撑层20的一侧，保护层30至少覆盖部分弯折区，图1所示的保护层30完全覆盖柔性屏体10的弯折子区B2，并至少覆盖部分柔性屏体10的弯折过渡子区B1。其中，图1所示的保护层30完全覆盖柔性屏体10的弯折子区B2和弯折过渡子区B1，当然，在其他实施例中，保护层30还可以完全覆盖柔性屏体10的弯折子区B2且覆盖部分弯折过渡子区B1。

[0053] 需要说明的是，保护层30完全覆盖柔性屏体10的弯折子区B2，从而缓解弯折子区B2的弯折应力；保护层30至少覆盖部分柔性屏体10的弯折过渡子区B1，从而使保护层30能够从柔性屏体10的初始弯折位置靠近平面区AA的一侧开始更好地缓解柔性屏体10的初始弯折位置的弯折应力，需要说明的是，保护层30靠近平面区AA的侧边与柔性屏体10的初始弯折位置之间的距离还可以大于第一预设值，第一预设值为大于或等于0的值，第一预设值可以根据实际需求进行灵活调整，本申请实施例对此不作具体限定。

[0054] 柔性屏体10的平面区AA包括红色子像素单元、绿色子像素单元和蓝色子像素单元，其中，红色子像素单元用于发出红色的光，绿色子像素单元用于发出绿色

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的光，蓝色子像素单元用于发出蓝色的光。

[0055] 彩膜50设置在柔性屏体10远离支撑层20的一侧，彩膜50至少覆盖平面区AA，彩膜50用于替代偏光片，承担着防止显示装置的漏光以及降低显示装置的反射率的作用。

[0056] 具体而言，彩膜50包括多个彩色色阻以及设置在不同的彩色色阻之间的黑色矩阵，多个彩色色阻包括红色色阻、绿色色阻和蓝色色阻，其中，红色色阻对应红色子像素单元设置，红色色阻承担着红色子像素单元的出光；绿色色阻对应绿色子像素单元设置，绿色色阻承担着绿色子像素单元的出光；蓝色色阻对应蓝色子像素单元设置，蓝色色阻承担着蓝色子像素单元的出光；黑色矩阵主要承担着防止显示装置漏光以及降低显示装置的反射率的作用。

[0057] 盖板40设置在彩膜50远离柔性屏体10的一侧，盖板40至少覆盖平面区AA，图1所示的盖板40通过光学胶60与彩膜50连接，其中，光学胶60用于胶结光学元件，光学胶60可以为具有无色透明、光透过率在90%以上、胶结强度良好、可在室温或中温下固化且固化收缩小等特点的OCA光学胶，在本申请实施例中，光学胶60用于将盖板40与彩膜50进行胶结。盖板40用于保护柔性屏体10不受外界的冲击力而损伤。

[0058] 本申请实施例提供的显示装置，在保护层30与盖板40重叠的区域内，保护层30与盖板40之间的距离大于或等于预设值，需要说明的是，预设值为大于0的值，预设值可以根据实际需求（例如制程精度）进行灵活调整，本申请实施例对此不作具体限定。如此，盖板40不会挤压保护层30，消除了显示装置的开裂风险。

[0059] 基于上述实施例，请参阅图2，保护层30仅设置在柔性屏体10的表面，柔性屏体10的表面的保护层30的厚度小于或等于盖板40靠近柔性屏体10的一侧到柔性屏体10靠近盖板40的一侧之间的距离。

[0060] 基于上述实施例，请参阅图3，显示装置还包括设置在柔性屏体10与彩膜50之间的触控层70，以及设置在触控层70与彩膜50之间的绝缘层80，保护层30仅设置在绝缘层80的表面，绝缘层80的表面的保护层30的厚度小于或等于盖板40靠近绝缘层80的一侧到绝缘层80靠近盖板40的一侧之间的距离。

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[0061] 基于上述实施例，请参阅图1和图4，保护层30还设置在彩膜50的表面，彩膜50的表面的保护层30的厚度小于或等于盖板40靠近彩膜50的一侧到彩膜50靠近盖板40的一侧之间的距离。

[0062] 基于上述实施例，在本申请实施例中，光学胶60的厚度大于保护层30在柔性屏体10的弯折过渡子区B1的最大厚度，如此，即可保证覆盖柔性屏体10的弯折过渡子区B1的盖板40与覆盖柔性屏体10的弯折过渡子区B1的保护层30具有一定间隔，盖板40不会挤压保护层30，消除了显示装置的开裂风险。

[0063] 基于上述实施例，本申请实施例对显示装置进行进一步说明，保护层30还至少覆盖部分柔性屏体10的弯折延伸子区B3，以更好地缓解柔性屏体10的末端弯折位置的弯折应力。需要说明的是，保护层30靠近弯折延伸子区B3的侧边与柔性屏体10的末端弯折位置之间的距离还可以大于第二预设值，第二预设值为大于或等于0的值，第二预设值可以根据实际需求进行灵活调整，本申请实施例对此不作具体限定。其中，图1所示的保护层30覆盖部分柔性屏体10的弯折延伸子区B3，当然，在其他实施例中，保护层30还可以完全覆盖柔性屏体10的弯折延伸子区B3。

[0064] 基于上述实施例，在一些实施例中，保护层30为UV胶，当然，在其他实施例中，保护层30不限于UV胶，还可以是热固化胶或其他种类的光固化胶，本申请实施例对此不作具体限定。需要说明的是，在满足盖板40与保护层30之间的距离大于0的情况下，本领域技术人员可以根据柔性屏体10的大小、种类、弯折子区B2的弯折半径、保护层30的柔韧性以及缓解应力的能力为保护层30设置合适的厚度，本申请实施例对其不作具体限定。

[0065] 基于上述实施例，本申请实施例对显示装置进行进一步说明，支撑层20包括设置在柔性屏体10的平面区AA和弯折过渡子区B1远离盖板40的一侧的第一背板201，以及设置在柔性屏体10的弯折延伸子区B3远离保护层30的一侧的第二背板202。其中，弯折延伸子区B3可以通过胶粘或者物理方法固定于第二背板202上。

[0066] 需要说明的是，第一背板201用于支撑和保护柔性屏体10的平面区AA和弯折过渡子区B1，避免其受到外界的冲击力而损伤，第二背板202用于支撑和保护柔性屏体10的弯折延伸子区B3，避免其受到外界的冲击力而损伤。第一背板201和第

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二背板202的材料可以为聚对苯二甲酸乙二醇酯（Polyethylene terephthalate，PET）材料，由于PET材料具有弹性模量低和受热不易膨胀的优点，因此采用PET材料制作而成的第一背板201和第二背板202不会因为环境温度的变化而变形，降低了第一背板201与其连接的膜层剥离的可能性以及第二背板202与其连接的膜层剥离的可能性，从而提高了显示装置的良率和可靠性。

[0067] 进一步地，为了防止第一背板201和第二背板202影响柔性屏体10的弯折子区B2的弯折，必须确保第一背板201和第二背板202均避开弯折子区B2。优选地，为了更好的支撑柔性屏体10的平面区AA和弯折过渡子区B1，第一背板201的边缘与柔性屏体10的初始弯折位置重合，同理，为了更好的支撑柔性屏体10的弯折延伸子区B3，第二背板202的边缘与柔性屏体10的末端弯折位置重合。

[0068] 基于上述实施例，在一些实施例中，支撑层20还包括设置在第一背板201和第二背板202之间的垫高块，垫高块的高度还可以根据柔性屏体10的弯折子区B2的宽度进行调整，本申请实施例对其不作具体限定。垫高块可以为硅胶等材料，垫高块可以具有一定弹性和硬度，垫高块具有一定硬度以避免所述柔性屏体10被挤压变形，垫高块具有一定弹性以避免所述柔性屏体10由于受到局部应力而损坏。

[0069] 具体而言，垫高块避开柔性屏体10的弯折子区B2设置。当然，在其他实施例中，垫高块靠近柔性屏体10的弯折子区B2的一端的表面与弯折子区B2弯折后的形状匹配，以使得弯折子区B2靠近垫高块一侧的表面与垫高块的表面相贴合，进而对弯折子区B2具有一定的支撑作用，且不易变形损坏。可以理解的是，在其他实施例中，还可以通过增加第一背板201和第二背板202的厚度，或增加其他支撑结构，以确保柔性屏体10的平面区AA和弯折延伸子区B3之间的距离。

[0070] 基于上述实施例，在一些实施例中，第一背板201和第二背板202之间设置有泡棉203。需要说明的是，泡棉203是塑料粒子发泡过的材料，其既能起到缓冲作用，也能起到遮光作用。

[0071] 基于上述实施例，在一些实施例中，泡棉203和第二背板202之间设置有补强板204。需要说明的是，补强板204用于提高柔性屏体10的强度。其中，补强板204可以为聚酰亚胺层，也可以为石墨层，其中，石墨层的外表面还可用聚酰亚胺

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包覆，本申请实施例对此不作具体限定。

[0072] 基于上述实施例，在一些实施例中，泡棉203和补强板204之间设置有散热层205。其中，散热层205起到屏蔽和散热作用，散热层205的材料为散热材料，具体可以为金属材料或石墨等，其中，金属可以为铜箔、铝箔或不锈钢箔等，本申请实施例对此不作具体限定。

[0073] 基于上述实施例，在一些实施例中，显示装置还包括设置在所述弯折延伸子区B3的驱动单元。具体而言，驱动单元设置在柔性屏体10的弯折延伸子区B3远离支撑层20的表面。驱动单元包括驱动芯片和柔性电路板，其中，驱动芯片和柔性电路板均设置在柔性屏体10的弯折延伸子区B3远离支撑层20的表面，柔性电路板与驱动芯片之间的距离大于0。

[0074] 基于上述实施例，在一些实施例中，柔性屏体10的平面区AA包括柔性衬底、薄膜晶体管、显示器件和封装层，其中，柔性衬底设置在第一背板201上，薄膜晶体管设置在柔性衬底上，显示器件设置在薄膜晶体管上，封装层设置在显示器件上。

[0075] 柔性衬底为由柔性材料制作而成的衬底，柔性材料优选为聚酰亚胺（PI）。

[0076] 显示器件用于进行发光，显示器件通常包括设置在薄膜晶体管上的阳极（Anode）、设置在阳极上的空穴注入层（Hole Injection Layer，HIL）、设置在空穴注入层上的空穴传输层（Hole Tranport Layer，HTL）、设置在空穴传输层上的发光层（Emission layer，EML）、设置在发光层上的电子传输层（Electron Transport Layer，ETL)、设置在电子传输层上的电子注入层（Electron Injection Layer，EIL）以及设置在电子传输层上的阴极（Cathode）。可选地，显示器件中还可设置有空穴阻挡层（Hole Block Layer，HBL），电子阻挡层(Electron Block Layer，EBL）和封盖层（Capping Layer，CPL）。

[0077] 发光层包括红色子像素单元、绿色子像素单元和蓝色子像素单元，其中，红色子像素单元用于发出红色的光，绿色子像素单元用于发出绿色的光，蓝色子像素单元用于发出蓝色的光。

[0078] 彩膜50用于替代偏光片，承担着防止显示装置的漏光以及降低显示装置的反射

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率的作用。具体而言，彩膜50包括多个彩色色阻以及设置在不同的彩色色阻之间的黑色矩阵，多个彩色色阻包括红色色阻、绿色色阻和蓝色色阻，其中，红色色阻对应红色子像素单元设置，红色色阻承担着红色子像素单元的出光；绿色色阻对应绿色子像素单元设置，绿色色阻承担着绿色子像素单元的出光；蓝色色阻对应蓝色子像素单元设置，蓝色色阻承担着蓝色子像素单元的出光；黑色矩阵主要承担着防止显示装置漏光以及降低显示装置的反射率的作用。

[0079] 封装层用于为显示装置隔绝外界的水和氧气，保证显示装置的良率。封装层通常为有机层、无机层和有机层构成的三明治结构。

[0080] 基于上述实施例，本申请实施例对上述显示装置的制作方法进行说明。图5为本申请实施例提供的显示装置的制作方法流程图，如图5所示，制作方法包括：

[0081] S1，在玻璃基板上制作柔性屏体10。

[0082] 柔性屏体10指的是能够进行弯曲和折叠的柔韧性高的屏幕，柔性屏体10可以划分为平面区AA和自平面区AA延伸的弯折区，平面区AA指的是能够进行显示的区域，弯折区指的是不能够进行显示的区域。弯折区包括依次设置的弯折过渡子区B1、弯折子区B2和弯折延伸子区B3，其中，弯折过渡子区B1的相对两端分别与平面区AA和弯折子区B2连接，弯折子区B2的相对两端分别与弯折过渡子区B1和弯折延伸子区B3连接。其中，弯折过渡子区B1与平面区AA平齐，也即弯折过渡子区B1与平面区AA位于同一平面，弯折子区B2和弯折延伸子区B3均不与平面区AA平齐，也即弯折子区B2与平面区AA位于不同平面，弯折延伸子区B3与平面区AA位于不同平面。

[0083] S2，在柔性屏体10上制作彩膜50。

[0084] 具体而言，柔性屏体10的平面区AA包括红色子像素单元、绿色子像素单元和蓝色子像素单元，彩膜50包括多个彩色色阻以及设置在不同的彩色色阻之间的黑色矩阵，多个彩色色阻包括红色色阻、绿色色阻和蓝色色阻，红色色阻对应红色子像素单元设置，绿色色阻对应绿色子像素单元设置，蓝色色阻对应蓝色子像素单元设置。需要说明的是，在一些实施例中，还可以在彩膜50上制作平坦层以对彩膜50进行平坦化。

[0085] S3，对柔性屏体10的弯折区进行驱动芯片和柔性电路板的邦定，并对柔性屏体

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10的弯折区进行UV胶覆盖。

[0086] 具体而言，将驱动芯片和柔性电路板均设置在柔性屏体10的弯折延伸子区B3远离支撑层20的表面，并使柔性电路板与驱动芯片之间的距离大于0。对柔性屏体10的弯折区进行UV胶覆盖，使得UV胶完全覆盖弯折子区B2，并至少覆盖部分弯折过渡子区B1。

[0087] S4，将玻璃基板进行剥离，并将支撑层20与柔性屏体10进行贴合。

[0088] 具体而言，支撑层20的一侧支撑柔性屏体10的平面区AA和弯折过渡子区B1，支撑层20远离平面区AA的一侧支撑柔性屏体10的弯折延伸子区B3，即柔性屏体10的平面区AA和弯折过渡子区B1设置在支撑层20的同一侧，柔性屏体10的弯折延伸子区B3设置在支撑层20远离平面区AA的另一侧。需要说明的是，支撑层20主要用于固定并支撑柔性屏体10，防止柔性屏体10的弯折子区B2由于弯折程度过大而折断。支撑层20可以为兼具硬度和弹性的材料，从而既可以对柔性屏体10进行支撑，又可以对柔性屏体10进行减震。支撑层20可以为一层，也可以为多层结构，本申请实施例对此不作具体限定。

[0089] S5，将盖板40与彩膜50通过光学胶60进行贴合，其中，光学胶60的厚度大于UV胶的最大厚度。

[0090] 具体而言，使用光学胶60将盖板40与彩膜50进行贴合，使盖板40完全覆盖柔性屏体10的平面区AA，并至少覆盖部分柔性屏体10的弯折过渡子区B1。由于光学胶60的厚度大于UV胶的最大厚度，因此在盖板40与彩膜50的贴合过程中，盖板40不会对UV胶产生压力，降低了显示装置的模组制程风险。

[0091] 需要说明的是，上述步骤的标号并不严格代表步骤的执行顺序，在一些实施例中，可以严格按照上述步骤的标号顺序执行对应的步骤，当然，在另一些实施例中，某些步骤可以同时执行，或者调换顺序执行，本申请实施例对此不作具体限定。

[0092] 可以理解的是，对本领域普通技术人员来说，可以根据本申请的技术方案及其申请构思加以等同替换或改变，而所有这些改变或替换都应属于本申请所附的权利要求的保护范围。

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权利要求书

[权利要求 1] 一种显示装置，其中，所述显示装置包括：

柔性屏体，包括平面区以及与所述平面区连接的弯折区；

彩膜，设置在所述柔性屏体上且至少覆盖所述平面区；

保护层，设置在所述柔性屏体上且至少覆盖部分所述弯折区；

盖板，设置在所述彩膜上且至少覆盖所述平面区；

其中，在所述保护层与所述盖板重叠的区域内，所述保护层与所述盖板之间的距离大于或等于预设值。

[权利要求 2] 根据权利要求1所述的显示装置，其中，所述保护层仅设置在所述柔性屏体的表面，所述柔性屏体的表面的所述保护层的厚度小于或等于所述盖板靠近所述柔性屏体的一侧到所述柔性屏体靠近所述盖板的一侧之间的距离。

[权利要求 3] 根据权利要求1所述的显示装置，其中，所述显示装置还包括设置在所述柔性屏体与所述彩膜之间的触控层，以及设置在所述触控层与所述彩膜之间的绝缘层，所述保护层仅设置在所述绝缘层的表面，所述绝缘层的表面的所述保护层的厚度小于或等于所述盖板靠近所述绝缘层的一侧到所述绝缘层靠近所述盖板的一侧之间的距离。

[权利要求 4] 根据权利要求2所述的显示装置，其中，所述保护层还设置在所述彩膜的表面，所述彩膜的表面的所述保护层的厚度小于或等于所述盖板靠近所述彩膜的一侧到所述彩膜靠近所述盖板的一侧之间的距离。

[权利要求 5] 根据权利要求1所述的显示装置，其中，所述弯折区包括与所述平面区连接并依次设置的弯折过渡子区、弯折子区以及弯折延伸子区，所述弯折过渡子区与所述平面区平齐；

所述保护层完全覆盖所述弯折子区，并至少覆盖部分所述弯折过渡子区；

盖板，所述盖板通过光学胶与所述彩膜连接，所述盖板完全覆盖所述平面区，并至少覆盖部分所述弯折过渡子区。

[权利要求 6] 根据权利要求5所述的显示装置，其中，所述光学胶的厚度大于所述

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保护层在所述弯折过渡子区的最大厚度。

[权利要求 7] 根据权利要求5所述的显示装置，其中，所述保护层还至少覆盖部分所述弯折延伸子区。

[权利要求 8] 根据权利要求5所述的显示装置，其中，所述保护层为UV胶。

[权利要求 9] 根据权利要求5所述的显示装置，其中，所述显示装置还包括：

支撑层，所述支撑层的一侧支撑所述平面区和所述弯折过渡子区，所述支撑层远离所述平面区的一侧支撑所述弯折延伸子区。

[权利要求 10] 根据权利要求9所述的显示装置，其中，所述支撑层包括设置在所述平面区和所述弯折过渡子区远离所述盖板的一侧的第一背板以及设置在所述弯折过渡子区远离所述保护层的一侧的第二背板。

[权利要求 11] 根据权利要求10所述的显示装置，其中，所述第一背板和所述第二背板之间设置有泡棉。

[权利要求 12] 根据权利要求11所述的显示装置，其中，所述泡棉和所述第二背板之间设置有补强板。

[权利要求 13] 根据权利要求12所述的显示装置，其中，所述泡棉和所述补强板之间设置有散热层。

[权利要求 14] 根据权利要求1所述的显示装置，其中，所述预设值大于0。

[权利要求 15] 根据权利要求5所述的显示装置，其中，所述保护层靠近所述平面区的侧边与所述柔性屏体的初始弯折位置之间的距离大于第一预设值，所述第一预设值大于或等于0，其中，所述初始弯折位置为所述弯折子区和所述弯折过渡子区衔接的位置。

[权利要求 16] 根据权利要求5所述的显示装置，其中，所述保护层靠近所述弯折延伸子区的侧边与所述柔性屏体的末端弯折位置之间的距离大于第二预设值，所述第二预设值大于或等于0。

[权利要求 17] 根据权利要求1所述的显示装置，其中，所述平面区包括红色子像素单元、绿色子像素单元和蓝色子像素单元，所述彩膜包括多个彩色色阻以及设置在不同的所述彩色色阻之间的黑色矩阵，多个所述彩色色阻包括红色色阻、绿色色阻和蓝色色阻，所述红色色阻对应所述红色

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子像素单元设置，所述绿色色阻对应所述绿色子像素单元设置，所述蓝色色阻对应所述蓝色子像素单元设置。

[权利要求 18] 根据权利要求5所述的显示装置，其中，所述光学胶为OCA光学胶。

[权利要求 19] 根据权利要求13所述的显示装置，其中，所述散热层的材料为金属材料或石墨，其中，所述金属材料包括铜箔、铝箔和不锈钢箔中的任意一种或多种的组合。

[权利要求 20] 根据权利要求9所述的显示装置，其中，所述显示装置还包括驱动单元，所述驱动单元设置在所述弯折延伸子区远离所述支撑层的表面。

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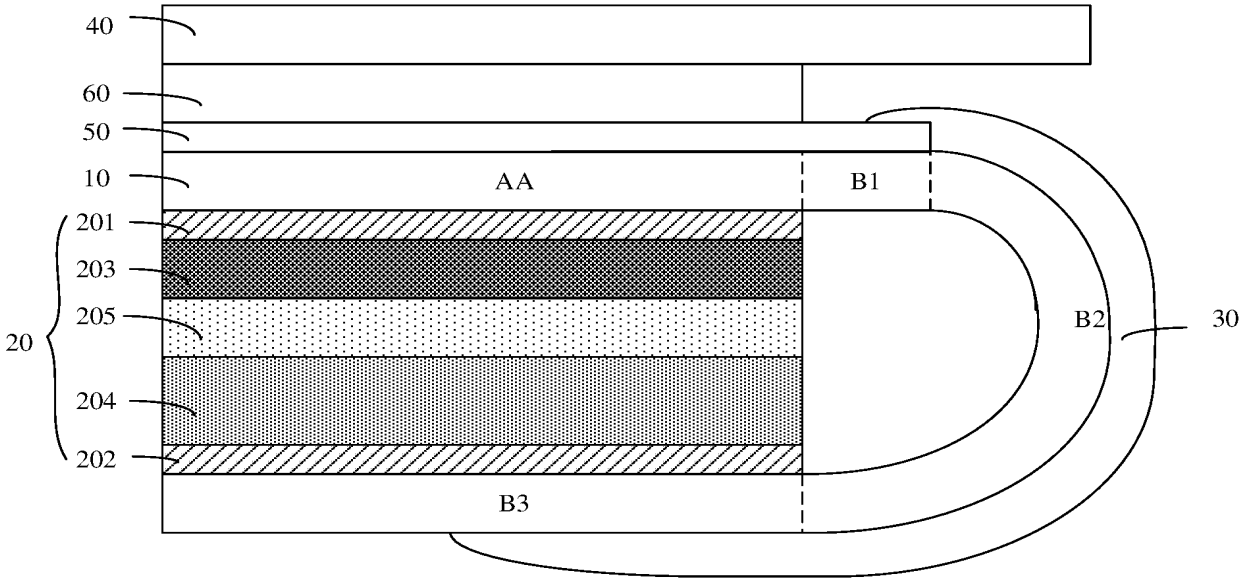


图 1

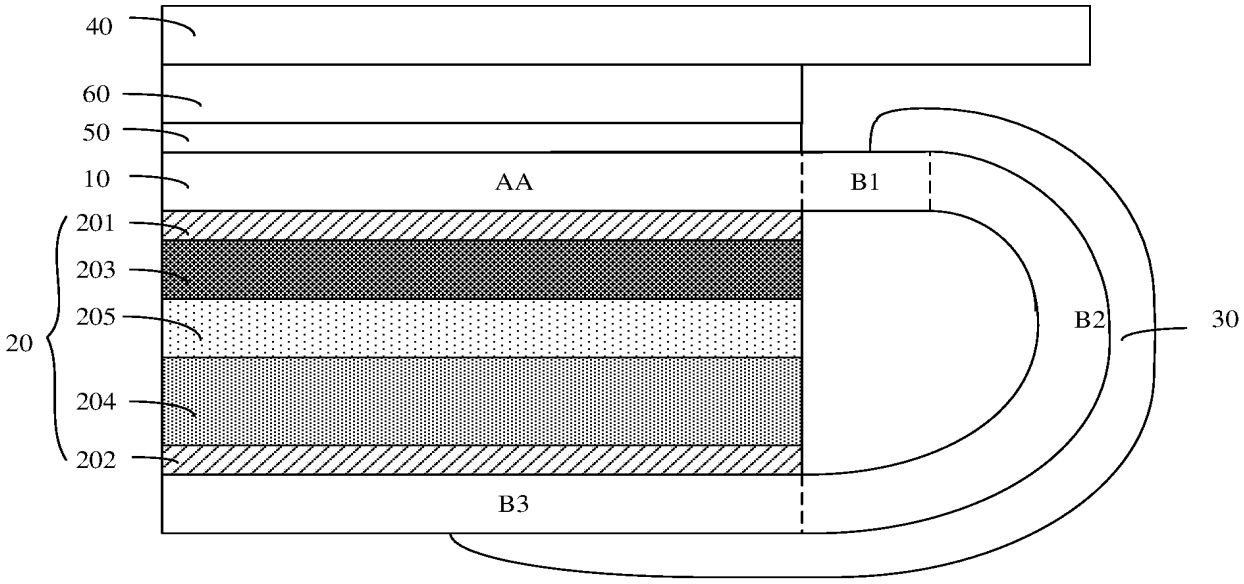


图 2

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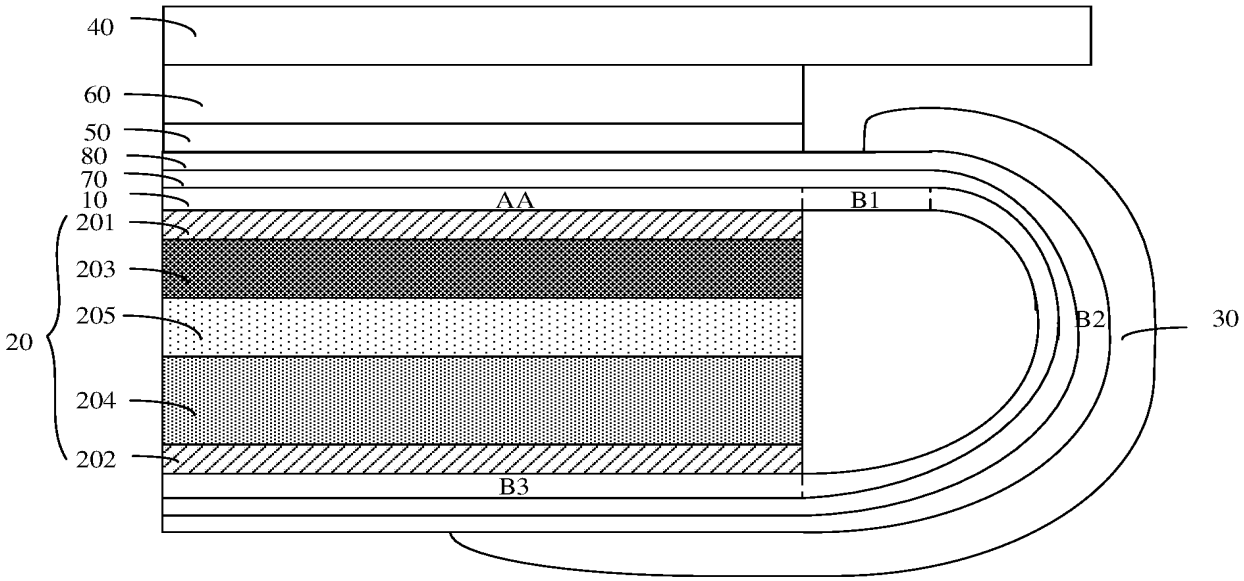


图 3

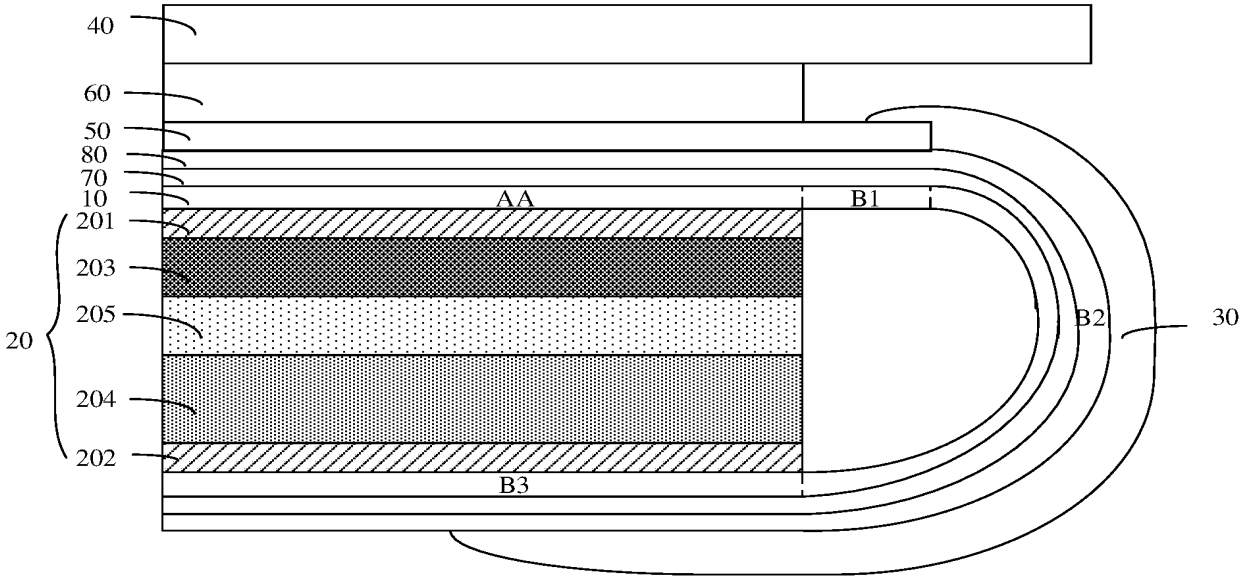


图 4

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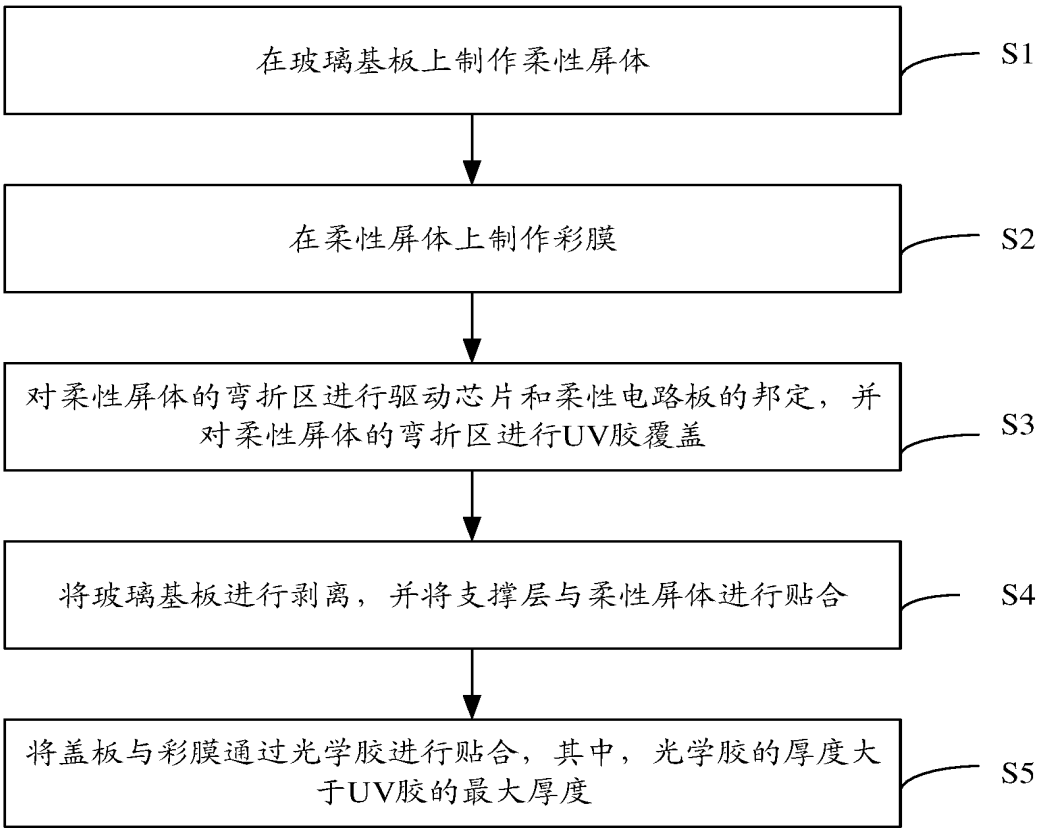


图 5

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2021/097527

A. CLASSIFICATION OF SUBJECT MATTER

G09F 9/30(2006.01)i; G09F 9/33(2006.01)i; H01L 27/32(2006.01)i; G06F 3/041(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G09F; H01L; G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNABS; CNTXT; CNKI; VEN; WOTXT; USTXT; EPTXT: 华星光电, 显示, 柔性, 弯折, 保护层, 胶层, 彩膜, 色阻, 触控, 触摸, 泡棉, 散热, 补强, 增强, 加强, 背板, 背膜, 支撑, 支承, display, bend+, bent, fold+, flexible, protect+, thermo-curable, photo-curable, glue, color film, reinforc+, enhanc+, heat dissipation, foam, support+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 108682307 A (KUNSHAN GOVISIONOX OPTOELECTRONICS CO., LTD.) 19 October 2018 (2018-10-19) description, paragraphs [0005]-[0062], and figure 1	1-20
Y	CN 109119453 A (WUHAN TIANMA MICRO-ELECTRONICS CO., LTD.) 01 January 2019 (2019-01-01) description, paragraphs [0006]-[0023] and [0045], and figure 1	1-20
Y	CN 109859642 A (SHANGHAI TIANMA MICROELECTRONICS CO., LTD.) 07 June 2019 (2019-06-07) description, paragraphs [0049]-[0051], and figure 6	11-13, 19
Y	CN 112786807 A (WUHAN CHINA STAR OPTOELECTRONICS SEMICONDUCTOR DISPLAY TECHNOLOGY CO., LTD.) 11 May 2021 (2021-05-11) description, paragraph [0003], and figure 1	1-20
Y	CN 112634764 A (WUHAN CHINA STAR OPTOELECTRONICS SEMICONDUCTOR DISPLAY TECHNOLOGY CO., LTD.) 09 April 2021 (2021-04-09) description, paragraphs [0029]-[0050], and figure 2	1-20

☑ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
05 November 2021	**29 November 2021**
Name and mailing address of the ISA/CN **China National Intellectual Property Administration (ISA/CN)** **No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088, China** Facsimile No. **(86-10)62019451**	Authorized officer Telephone No.

Petitioner Samsung Ex-1004, 0361

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 108877519 A (SHANGHAI TIANMA MICROELECTRONICS CO., LTD.) 23 November 2018 (2018-11-23) description, paragraphs [0057]-[0067], and figures 4 and 5	11-13, 19
A	CN 108962029 A (KUNSHAN GOVISIONOX OPTOELECTRONICS CO., LTD.) 07 December 2018 (2018-12-07) entire document	1-20
A	CN 110224081 A (BOE TECHNOLOGY GROUP CO., LTD. et al.) 10 September 2019 (2019-09-10) entire document	1-20
A	CN 112289185 A (WUHAN CHINA STAR OPTOELECTRONICS SEMICONDUCTOR DISPLAY TECHNOLOGY CO., LTD.) 29 January 2021 (2021-01-29) entire document	1-20
A	CN 111430426 A (WUHAN CHINA STAR OPTOELECTRONICS SEMICONDUCTOR DISPLAY TECHNOLOGY CO., LTD.) 17 July 2020 (2020-07-17) entire document	1-20
A	US 2019318689 A1 (SAMSUNG DISPLAY CO., LTD.) 17 October 2019 (2019-10-17) entire document	1-20

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2021/097527

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	108682307	A	19 October 2018	CN	208622354	U	19 March 2019
CN	109119453	A	01 January 2019	CN	109119453	B	16 April 2021
CN	109859642	A	07 June 2019	CN	109859642	B	09 February 2021
CN	112786807	A	11 May 2021		None		
CN	112634764	A	09 April 2021		None		
CN	108877519	A	23 November 2018	CN	108877519	B	23 October 2020
CN	108962029	A	07 December 2018	CN	108962029	B	22 September 2020
CN	110224081	A	10 September 2019		None		
CN	112289185	A	29 January 2021		None		
CN	111430426	A	17 July 2020		None		
US	2019318689	A1	17 October 2019	KR	20190119244	A	22 October 2019
				US	11017716	B2	25 May 2021

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国际检索报告

国际申请号
PCT/CN2021/097527

A. 主题的分类

G09F 9/30(2006.01)i; G09F 9/33(2006.01)i; H01L 27/32(2006.01)i; G06F 3/041(2006.01)i

按照国际专利分类(IPC)或者同时按照国家分类和IPC两种分类

B. 检索领域

检索的最低限度文献(标明分类系统和分类号)

G09F; H01L; G06F

包含在检索领域中的除最低限度文献以外的检索文献

在国际检索时查阅的电子数据库(数据库的名称，和使用的检索词（如使用））

CNABS;CNTXT;CNKI;VEN;WOTXT;USTXT;EPTXT:华星光电，显示，柔性，弯折，保护层，胶层，彩膜，色阻，触控，触摸，泡棉，散热，补强，增强，加强，背板，背膜，支撑，支承，display，bend+，bent，fold+，flexible，protect+，thermo-curable，photo-curable，glue，color film，reinforc+，enhanc+，heat dissipation，foam，support+

C. 相关文件

类 型*	引用文件，必要时，指明相关段落	相关的权利要求
Y	CN 108682307 A (昆山国显光电有限公司) 2018年 10月 19日 (2018-10-19) 说明书第[0005]-[0062]段，图1	1-20
Y	CN 109119453 A (武汉天马微电子有限公司) 2019年 1月 1日 (2019-01-01) 说明书第[0006]-[0023]、[0045]段，图1	1-20
Y	CN 109859642 A (上海天马微电子有限公司) 2019年 6月 7日 (2019-06-07) 说明书第[0049]-[0051]段，图6	11-13、19
Y	CN 112786807 A (武汉华星光电半导体显示技术有限公司) 2021年 5月 11日 (2021-05-11) 说明书第[0003]段，图1	1-20
Y	CN 112634764 A (武汉华星光电半导体显示技术有限公司) 2021年 4月 9日 (2021-04-09) 说明书第[0029]-[0050]段，图2	1-20
Y	CN 108877519 A (上海天马微电子有限公司) 2018年 11月 23日 (2018-11-23) 说明书第[0057]-[0067]段，图4、5	11-13、19

☑ 其余文件在C栏的续页中列出。

☑ 见同族专利附件。

* 引用文件的具体类型：

“A” 认为不特别相关的表示了现有技术一般状态的文件

“E” 在国际申请日的当天或之后公布的在先申请或专利

“L” 可能对优先权要求构成怀疑的文件，或为确定另一篇引用文件的公布日而引用的或者因其他特殊理由而引用的文件（如具体说明的）

“O” 涉及口头公开、使用、展览或其他方式公开的文件

“P” 公布日先于国际申请日但迟于所要求的优先权日的文件

“T” 在申请日或优先权日之后公布，与申请不相抵触，但为了理解发明之理论或原理的在后文件

“X” 特别相关的文件，单独考虑该文件，认定要求保护的发明不是新颖的或不具有创造性

“Y” 特别相关的文件，当该文件与另一篇或者多篇该类文件结合并且这种结合对于本领域技术人员为显而易见时，要求保护的发明不具有创造性

“&” 同族专利的文件

国际检索实际完成的日期	国际检索报告邮寄日期
2021年 11月 5日	2021年 11月 29日
ISA/CN的名称和邮寄地址 中国国家知识产权局(ISA/CN) 中国 北京市海淀区蓟门桥西土城路6号 100088 传真号 (86-10)62019451	受权官员 梁燕 电话号码 (86-512)88997338

Petitioner Samsung Ex-1004, 0364

C. 相关文件

类 型*	引用文件，必要时，指明相关段落	相关的权利要求
A	CN 108962029 A（昆山国显光电有限公司）2018年 12月 7日（2018 - 12 - 07） 全文	1-20
A	CN 110224081 A（京东方科技集团股份有限公司 等）2019年 9月 10日（2019 - 09 - 10） 全文	1-20
A	CN 112289185 A（武汉华星光电半导体显示技术有限公司）2021年 1月 29日（2021 - 01 - 29） 全文	1-20
A	CN 111430426 A（武汉华星光电半导体显示技术有限公司）2020年 7月 17日（2020 - 07 - 17） 全文	1-20
A	US 2019318689 A1（SAMSUNG DISPLAY CO LTD）2019年 10月 17日（2019 - 10 - 17） 全文	1-20

Petitioner Samsung Ex-1004, 0365

国际检索报告
关于同族专利的信息

国际申请号
PCT/CN2021/097527

检索报告引用的专利文件			公布日（年/月/日）	同族专利			公布日（年/月/日）
CN	108682307	A	2018年 10月 19日	CN	208622354	U	2019年 3月 19日
CN	109119453	A	2019年 1月 1日	CN	109119453	B	2021年 4月 16日
CN	109859642	A	2019年 6月 7日	CN	109859642	B	2021年 2月 9日
CN	112786807	A	2021年 5月 11日		无		
CN	112634764	A	2021年 4月 9日		无		
CN	108877519	A	2018年 11月 23日	CN	108877519	B	2020年 10月 23日
CN	108962029	A	2018年 12月 7日	CN	108962029	B	2020年 9月 22日
CN	110224081	A	2019年 9月 10日		无		
CN	112289185	A	2021年 1月 29日		无		
CN	111430426	A	2020年 7月 17日		无		
US	2019318689	A1	2019年 10月 17日	KR	20190119244	A	2019年 10月 22日
				US	11017716	B2	2021年 5月 25日

Petitioner Samsung Ex-1004, 0366

UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, VA 22313 - 1450
www.uspto.gov

ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
17/419,713	**06/29/2023 10:57:19 PM ET**	**TP204027-US**

Title of Invention

DISPLAY DEVICE

Application Information

APPLICATION TYPE	Utility - U.S. National Stage under 35 USC 371	PATENT #	-
CONFIRMATION #	9383	FILED BY	Wei Te Chung
PATENT CENTER #	62367678	FILING DATE	-
CUSTOMER #	168853	FIRST NAMED INVENTOR	Jing Zhou
INTL. APPLICATION #	-	INTL. FILING DATE	-
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	-

Documents

TOTAL DOCUMENTS: 2

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
TP204027refund.pdf	4	Refund Request	865 KB
WO2022241838-PAMPH-20221124-6556.pdf	25	Documents submitted with 371 (National Stage) Applications	1189 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
TP204027refund.pdf	6595512006C32626E69DF7E2D24156ADF0A911919E3FC0797E DFCE68AED8D82566AD2F1DF31F6BABD58B700664F6A06825

DCB1CF1ED20C14487599A368996DBD

WO2022241838-PAMPH-20221124-6556.pdf	29BA0BE642D248A6CD067EAE5EA8444CD5E5BCC3869CC3B83F3C49519398099E97129787EC3F9B2822B918D3E3ED9EBC9DF121E88184CFBFCB79C48A4AEFA615

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO-2326 (05-2022)
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

REQUEST FOR REFUND

Reference # *(Patent #, Application #, Trademark Serial #, Registration #, etc.)*	**Title of Invention or Mark Information**	
17/419,713	DISPLAY DEVICE	
Attorney Docket # *(if applicable)*	**Payment Date** *(mm/dd/yyyy)*	**Refund Request Amount**
TP204027-US	06/29/2021	$ 160.00

Refund Option *(Select one)*

- (●) If approved, issue the refund to the account associated with the original payment.
- ( ) If approved, and the original payment was a check, issue the refund to deposit account # _____.
- ( ) If approved, and the original payment was a check, issue the refund as a U.S. Treasury check.

Reason for Refund Request *Refund requests must generally be filed within 2 years of payment date (37 CFR 1.26 and 2.209)*

- [ ] Duplicate Payment
- [x] No Fee Due
- [ ] Office Error
- [ ] Small Entity Later Established* (*must be filed within 3 months of payment date, 37 CFR 1.28)
- [ ] Other _____

Rationale *(Supporting documentation may be submitted with this form)*

see ATTACHED STATEMENT OF REQUEST FOR REFUND

Requester's Information

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PV IP PC		
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5028 Wisconsin Ave NW #100,	Washington	DC
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	US	20016
Email Address *(You will receive an acknowledgment of receipt only if you provide a valid email address)*		**Phone Number**
wetchung@hotmail.com		4082539926
Requester's Name		**Registration Number** *(if applicable)*
Wei Te Chung		43325
Signature		**Date** *(mm/dd/yyyy)*
/Wei Te Chung/		06/29/2023

Submit online: USPTO's patent electronic filing system (Patent Center or EFS-Web), or
Fax to: 571-273-6500, or
Mail to: Mail Stop 16, Director of the U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Jing zhou Serial No: **17/419,713** Confirmation No.: 9383 Filed: 06/29/2021 (TBD) Attorney Docket No.: **TP204027-US** For: **DISPLAY DEVICE**	)	Examiner: N/A Group Art Unit: N/A Dated: June 29, 2023

Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

STATEMENT OF REQUEST FOR REFUND

Sir:

1. The instant application is a national phase application of the corresponding PCT application PCT/CN2021/097527. During the initial filing (national phase entry) on 06/29/2021, the full amount of $700 for the search fee was paid because no international search report was available. In fact, the international search report was done on 11/29/2021 and published on 11/24/2022.
2. Notably, USPTO generally and routinely proactively/automatically retrieves the WIPO Publication – Non-English version before mailing of the filing

Petitioner Samsung Ex-1004, 0370

receipt wherein such a WIPO Publication will be labeled with the mail room date same as the national phase entry date. Anyhow, for an unknown reason, in the instant application, no filing receipt has been mailed out and no WIPO Publication has been retrieved. Under such a situation, the applicant is proactively submitting the corresponding 25 pages WIPO Publication-Non English version within this submission.

3. Notably, the 25 pages WIPO Publication contains the international search report in both English version (pages 20-22) and Chinese version (pages 23-25). Based on this objective situation, it is believed the instant application is qualified to be refunded with $160, i.e., the difference of $700 (without report provided) vs. $540 (with report provided) for the search fee, *because the search report has been actually provided when the filing receipt is issued later*.
4. Understandably, USPTO may still proactively and automatically electronically retrieve the same 25 pages WIPO Publication-Non English version when issuance of the filing receipt. Anyhow disregarding whether USPTO will retrieve the 25 pages WIPO Publication-Non English version by itself, the applicant respectfully requests that USPTO grant this refund request based on provision of the same 25 pages WIPO Publication-Non English version either submitted concurrently by the applicant in this submission or retrieved by USPTO in a later time. Based upon the foregoing reason, a refund of $160 for the search fee, i.e., $700-$540, due to provision of the search report in essence, is respectfully requested ***when the filing receipt is about to be issued***.

Respectfully submitted,

Jing Zhou

Petitioner Samsung Ex-1004, 0371

By /Wei Te Chung/

Wei Te Chung

Reg. No.: 43,325

Tel. No.: (408) 253-9926

Email: wetchung@hotmail.com

Enclosure: 25 pages WIPO Publication-Non English version

Petitioner Samsung Ex-1004, 0372

United States Patent and Trademark Office

Office of the Chief Financial Officer

Document Code:WFEE

User :Patricia Booker

Sale Accounting Date:07/07/2023

Sale Item Reference Number	Effective Date
17419713	06/29/2021

Document Number	Fee Code	Fee Code Description	Amount Paid	Payment Method
I202377F57389523	1642	NATL STAGE SEARCH FEE - REPORT PROVIDED	$540.00	Deposit Account

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

U.S. APPLICATION NO.	FIRST NAMED INVENTOR	ATTY. DOCKET NO.
17/419,713	Jing Zhou	TP204027-US

168853
PVIP
Wei Te Chung
1079 Lancer Drive
San Jose, CA 95129

INTERNATIONAL APPLICATION NO.	
PCT/CN2021/097527	
I.A. FILING DATE	PRIORITY DATE
05/31/2021	05/20/2021

CONFIRMATION NO. 9383

371 ACCEPTANCE LETTER

OC000000062661660

Date Mailed: 10/03/2023

NOTICE OF ACCEPTANCE OF APPLICATION UNDER 35 U.S.C 371 AND 37 CFR 1.495

The applicant is hereby advised that the United States Patent and Trademark Office, in its capacity as a Designated / Elected Office (37 CFR 1.495), has ACCEPTED the above identified international application for national patentability examination in the United States Patent and Trademark Office.

The United States Application Number assigned to the application is shown above. A Filing Receipt will be issued for the present application in due course. **THE DATE APPEARING ON THE FILING RECEIPT AS THE "FILING DATE or 371(c) DATE" IS THE DATE ON WHICH THE LAST OF THE 35 U.S.C. 371 (c)(1) and (c)(2) REQUIREMENTS HAS BEEN RECEIVED IN THE OFFICE. THIS DATE IS SHOWN BELOW.** The filing date of the above identified application is the international filing date of the international application (Article 11(3) and 35 U.S.C. 363)

06/29/2021
DATE OF RECEIPT OF 35 U.S.C.
371(c)(1) and (c)(2) REQUIREMENTS

The following items have been received:

- Priority Documents filed on 06/29/2021
- Power of Attorney filed on 06/29/2021
- Assignee Statement for PGPUB filed on 06/29/2021
- Copy of the International Search Report filed on 06/29/2021
- Application Data Sheet (37 CFR 1.76) filed on 06/29/2021
- Authorization to Permit Access filed on 06/29/2021
- Authorize Access to Search Results filed on 06/29/2021
- Request for Immediate Examination filed on 06/29/2021
- Inventor's Oath or Declaration filed on 06/29/2021
- Drawings filed on 06/29/2021
- Assignment filed on 06/29/2021
- Preliminary Amendments filed on 06/29/2021
- Copy of the International Application filed on 06/29/2021
- English Translation of the IA filed on 06/29/2021
- Information Disclosure Statements filed on 04/08/2022
- U.S. Basic National Fees filed on 06/29/2021

Applicant is reminded that any communications to the United States Patent and Trademark Office must be mailed to the address given in the heading and include the U.S. application no. shown above (37 CFR 1.5)

CHARITTA S FLETCHER

Telephone: (571) 272-3926

Petitioner Samsung Ex-1004, 0375

MULTIPLE DEPENDENT CLAIM FEE CALCULATION SHEET

Substitute for Form PTO-1360
(For use with Form PTO/SB/06)

Application Number	Filing Date
17/419,713	

Applicant(s) Jing Zhou

* May be used for additional claims or amendments

CLAIMS	AS FILED		AFTER FIRST AMENDMENT		AFTER SECOND AMENDMENT	
	Indep	Depend	Indep	Depend	Indep	Depend
1	1		1			
2		1		1		
3		1		1		
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Total Indep	1		1			
Total Depend	19	↵	18	↵		↵
Total Claims	20		19		0	

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	Indep	Depend	Indep	Depend	Indep	Depend
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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 17/419,713

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	320
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	540
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	800
TOTAL CLAIMS (37 CFR 1.16(i))	19 minus 20 =	* 0			OR	x =	0
INDEPENDENT CLAIMS (37 CFR 1.16(h))	1 minus 3 =	*				x =	0
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	1660

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE($)	ADDITIONAL FEE($)	OR	RATE($)	ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

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United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
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www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
17/419,713	06/29/2021		1660	TP204027-US	19	1

CONFIRMATION NO. 9383

FILING RECEIPT

168853
PVIP
Wei Te Chung
1079 Lancer Drive
San Jose, CA 95129

Date Mailed: 10/03/2023

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

Inventor(s)

Jing Zhou, Wuhan, CHINA;

Applicant(s)

WUHAN CHINA STAR OPTOELECTRONICS SEMICONDUCTOR DISPLAY TECHNOLOGY CO., LTD., Wuhan, CHINA;

Assignment For Published Patent Application

WUHAN CHINA STAR OPTOELECTRONICS SEMICONDUCTOR DISPLAY TECHNOLOGY CO., LTD., Wuhan, CHINA

Power of Attorney: The patent practitioners associated with Customer Number 168853

Domestic Priority data as claimed by applicant

This application is a 371 of PCT/CN2021/097527 05/31/2021

Foreign Applications (You may be eligible to benefit from the Patent Prosecution Highway program at the USPTO. Please see http://www.uspto.gov for more information.)
CHINA 202110548905.2 05/20/2021 Access Code Provided

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Petitioner Samsung Ex-1004, 0378

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 09/29/2023
The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 17/419,713**
Projected Publication Date: 01/11/2024
Non-Publication Request: No
Early Publication Request: No
Title

DISPLAY DEVICE

Preliminary Class

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

Petitioner Samsung Ex-1004, 0379

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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United States Patent and Trademark Office

Under Secretary of Commerce for Intellectual Property and
Director of the United States Patent and Trademark Office

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Kathi Vidal

Kathi Vidal
Under Secretary of Commerce for Intellectual Property and
Director of the United States Patent and Trademark Office

Derrick Brent
Deputy Under Secretary of Commerce for Intellectual Property and
Deputy Director of the United States Patent and Trademark Office

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Filing date: 20 May 2021 (20.05.2021)

Application number: 2021105489052

Date of availability of document: 28 May 2021 (28.05.2021)

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国家知识产权局

NATIONAL INTELLECTUAL PROPERTY ADMINISTRATION, PRC

证　　明

本证明之附件是向本局提交的下列专利申请文件副本。

申　　请　　号：202110548905.2

申　请　类　型：发明专利

发明 创造 名称：显示装置

申　　请　　日：2021 年 05 月 20 日

申　　请　　人：武汉华星光电半导体显示技术有限公司

发明人或设计人：周菁

局长

申长雨

2021 年 06 月 03 日

Petitioner Samsung Ex-1004, 0383

2021105489052

权　利　要　求　书

1、一种显示装置，其特征在于，所述显示装置包括:

柔性屏体，包括平面区以及与所述平面区连接的弯折区;

彩膜，设置在所述柔性屏体上且至少覆盖所述平面区;

保护层，设置在所述柔性屏体上且至少覆盖部分所述弯折区;

盖板，设置在所述彩膜上且至少覆盖所述平面区;

其中，在所述保护层与所述盖板重叠的区域内，所述保护层与所述盖板之间的距离大于或等于预设值。

2、根据权利要求1所述的显示装置，其特征在于，所述保护层仅设置在所述柔性屏体的表面，所述柔性屏体的表面的所述保护层的厚度小于或等于所述盖板靠近所述柔性屏体的一侧到所述柔性屏体靠近所述盖板的一侧之间的距离。

3、根据权利要求1所述的显示装置，其特征在于，所述显示装置还包括设置在所述柔性屏体与所述彩膜之间的触控层，以及设置在所述触控层与所述彩膜之间的绝缘层，所述保护层仅设置在所述绝缘层的表面，所述绝缘层的表面的所述保护层的厚度小于或等于所述盖板靠近所述绝缘层的一侧到所述绝缘层靠近所述盖板的一侧之间的距离。

4、根据权利要求2或3所述的显示装置，其特征在于，所述保护层还设置在所述彩膜的表面，所述彩膜的表面的所述保护层的厚度小于或等于所述盖板靠近所述彩膜的一侧到所述彩膜靠近所述盖板的一侧之间的距离。

5、根据权利要求1所述的显示装置，其特征在于，所述弯折区包括与所述平面区连接并依次设置的弯折过渡子区、弯折子区以及弯折延伸子区，所述弯折过渡子区与所述平面区平齐;

所述保护层完全覆盖所述弯折子区，并至少覆盖部分所述弯折过渡子区;

盖板，所述盖板通过光学胶与所述彩膜连接，所述盖板完全覆盖所述平面区，并至少覆盖部分所述弯折过渡子区。

6、根据权利要求5所述的显示装置，其特征在于，所述光学胶的厚度大于所述保护层在所述弯折过渡子区的最大厚度。

7、根据权利要求5所述的显示装置，其特征在于，所述保护层还至少覆盖

Petitioner Samsung Ex-1004, 0384

部分所述弯折延伸子区。

8、根据权利要求5所述的显示装置，其特征在于，所述保护层为UV胶。

9、根据权利要求5所述的显示装置，其特征在于，所述显示装置还包括：

支撑层，所述支撑层的一侧支撑所述平面区和所述弯折过渡子区，所述支撑层远离所述平面区的一侧支撑所述弯折延伸子区。

10、根据权利要求9所述的显示装置，其特征在于，所述支撑层包括设置在所述平面区和所述弯折过渡子区远离所述盖板的一侧的第一背板以及设置在所述弯折过渡子区远离所述保护层的一侧的第二背板；所述第一背板和所述第二背板之间设置有泡棉；所述泡棉和所述第二背板之间设置有补强板；所述泡棉和所述补强板之间设置有散热层。

Petitioner Samsung Ex-1004, 0385

2021105489052

说　　明　　书

显示装置

技术领域

本发明实施例涉及显示技术领域，尤其涉及一种显示装置。

背景技术

对于有机发光二极管（Organic Light-Emitting Diode，OLED）显示面板而言，偏光片能够有效降低强光下OLED显示面板的反射率，却导致OLED显示面板损失了将近58%的出光，这极大地增加了OLED显示面板的使用寿命负担，并且，偏光片的厚度约为100μm，其厚度较大且材质脆，不利于动态弯折产品的开发。

为了开发基于OLED显示面板的动态弯折产品，通常采用无偏光片（POL-less）技术制作OLED显示面板，POL-less技术指的是采用彩膜（Color Filter，CF）替代偏光片的技术。其中，彩膜由红色色阻、绿色色阻、蓝色色阻和黑色矩阵（Black Matrix，BM）组成，在OLED显示面板中，红色色阻、绿色色阻和蓝色色阻分别承担着红色子像素单元、绿色子像素单元和蓝色子像素单元的出光，黑色矩阵主要承担着防止OLED显示面板漏光以及降低OLED显示面板的反射率的作用。彩膜不仅能够在一定程度上降低强光下OLED显示面板的反射率，还能够将OLED显示面板的出光率从42%提高到60%，并且，彩膜的厚度约为5μm，其远小于偏光片的厚度且柔韧性高，能够降低OLED显示面板的整体厚度，有利于动态弯折产品的开发。

进一步地，为了实现OLED显示面板的窄边框设计，通常将OLED显示面板的弯折区弯折到OLED显示面板的背面，从而减小边框的宽度。然而，OLED显示面板的弯折区的弯折容易导致OLED显示面板内的线路断裂，为了防止弯折导致的线路断裂，通常将UV胶覆盖于OLED显示面板的弯折区，缓解OLED显示面板的弯折区的弯折应力。

然而，UV胶的厚度约为95μm，当盖板与彩膜通过光学胶粘接时，由于彩膜与光学胶的厚度均较薄，因此盖板会挤压UV胶，导致OLED显示面板存在开

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裂风险。

发明内容

因此，有必要提供一种显示装置，用以解决现有的OLED显示面板存在开裂风险的问题。

本发明实施例提供一种显示装置，所述显示装置包括:

柔性屏体，包括平面区以及与所述平面区连接的弯折区;

彩膜，设置在所述柔性屏体上且至少覆盖所述平面区;

保护层，设置在所述柔性屏体上且至少覆盖部分所述弯折区;

盖板，设置在所述彩膜上且至少覆盖所述平面区;

其中，在所述保护层与所述盖板重叠的区域内，所述保护层与所述盖板之间的距离大于或等于预设值。

在一些实施例中，所述保护层仅设置在所述柔性屏体的表面，所述柔性屏体的表面的所述保护层的厚度小于或等于所述盖板靠近所述柔性屏体的一侧到所述柔性屏体靠近所述盖板的一侧之间的距离。

在一些实施例中，所述显示装置还包括设置在所述柔性屏体与所述彩膜之间的触控层，以及设置在所述触控层与所述彩膜之间的绝缘层，所述保护层仅设置在所述绝缘层的表面，所述绝缘层的表面的所述保护层的厚度小于或等于所述盖板靠近所述绝缘层的一侧到所述绝缘层靠近所述盖板的一侧之间的距离。

在一些实施例中，所述保护层还设置在所述彩膜的表面，所述彩膜的表面的所述保护层的厚度小于或等于所述盖板靠近所述彩膜的一侧到所述彩膜靠近所述盖板的一侧之间的距离。

在一些实施例中，所述弯折区包括与所述平面区连接并依次设置的弯折过渡子区、弯折子区以及弯折延伸子区，所述弯折过渡子区与所述平面区平齐;

所述保护层完全覆盖所述弯折子区，并至少覆盖部分所述弯折过渡子区;

盖板，所述盖板通过光学胶与所述彩膜连接，所述盖板完全覆盖所述平面区，并至少覆盖部分所述弯折过渡子区。

在一些实施例中，所述光学胶的厚度大于所述保护层在所述弯折过渡子区

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的最大厚度。

在一些实施例中，所述保护层还至少覆盖部分所述弯折延伸子区。

在一些实施例中，所述保护层为 UV 胶。

在一些实施例中，所述显示装置还包括:

支撑层，所述支撑层的一侧支撑所述平面区和所述弯折过渡子区，所述支撑层远离所述平面区的一侧支撑所述弯折延伸子区。

在一些实施例中，所述支撑层包括设置在所述平面区和所述弯折过渡子区远离所述盖板的一侧的第一背板以及设置在所述弯折过渡子区远离所述保护层的一侧的第二背板；所述第一背板和所述第二背板之间设置有泡棉；所述泡棉和所述第二背板之间设置有补强板;所述泡棉和所述补强板之间设置有散热层。

本发明实施例提供的显示装置，通过在保护层与盖板重叠的区域内，使保护层与盖板之间的距离大于或等于预设值，如此，盖板不会挤压保护层，消除了显示装置的开裂风险。

附图说明

为了更清楚地说明本发明实施例中的技术方案，下面将对实施例描述中所需要使用的附图作简单地介绍，显而易见地，下面描述中的附图仅仅是本发明的一些实施例，对于本领域技术人员来讲，在不付出创造性劳动的前提下，还可以根据这些附图获得其他的附图。

图 1 为本发明实施例提供的显示装置的结构示意图;

图 2 为本发明另一实施例提供的显示装置的结构示意图;

图 3 为本发明再一实施例提供的显示装置的结构示意图;

图 4 为本发明又一实施例提供的显示装置的结构示意图;

图 5 为本发明实施例提供的显示装置的制作方法流程图。

具体实施方式

下面将结合本发明实施例中的附图，对本发明实施例中的技术方案进行清楚、完整地描述。显然，所描述的实施例是本发明一部分实施例，而不是全部的实施例。基于本发明中的实施例，本领域普通技术人员在没有做出创造性劳

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动前提下所获得的所有其他实施例，都属于本发明保护的范围。

本发明实施例提供一种显示装置，显示装置可以为可穿戴设备，例如智能手环、智能手表或虚拟现实（Virtual Reality，VR）等设备，也可以为移动电话机、电子书、电子报纸、电视机或个人便携电脑，还可以为可弯曲和可折叠的柔性OLED显示或照明设备，本发明实施例对显示装置的具体形式不作具体限定。

图1为本发明实施例提供的显示装置的结构示意图，如图1所示，显示装置包括柔性屏体10、彩膜50、保护层30和盖板40，可选地，显示装置还可以包括支撑层20和光学胶60，以下分别对柔性屏体10、支撑层20、保护层30、盖板40、彩膜50和光学胶60进行具体说明。

柔性屏体10指的是能够进行弯曲和折叠的柔韧性高的屏幕，柔性屏体10可以划分为平面区AA和自平面区AA延伸的弯折区，平面区AA指的是能够进行显示的区域，弯折区指的是不能够进行显示的区域。弯折区可以包括依次设置的弯折过渡子区B1、弯折子区B2和弯折延伸子区B3，其中，弯折过渡子区B1的相对两端分别与平面区AA和弯折子区B2连接，弯折子区B2的相对两端分别与弯折过渡子区B1和弯折延伸子区B3连接。其中，弯折过渡子区B1与平面区AA平齐，也即弯折过渡子区B1与平面区AA位于同一平面，弯折子区B2和弯折延伸子区B3均不与平面区AA平齐，也即弯折子区B2与平面区AA位于不同平面，弯折延伸子区B3与平面区AA位于不同平面。

具体而言，柔性屏体10包括柔性衬底，柔性衬底为由柔性材料制作而成的衬底，柔性材料优选为聚酰亚胺（PI），柔性衬底可以划分为第一区域和自第一区域延伸的第二区域。

柔性衬底的第一区域上可以集成显示层，显示层可以包括多个用于显示图像的显示部件，从而使柔性衬底的第一区域与显示层共同形成柔性屏体10的平面区AA。显示层可以包括诸如薄膜晶体管、栅极线、数据线、电容、阳极、阴极和发光层等不同的显示部件，本发明实施例对柔性屏体10的平面区AA本身的结构并没有改进，采用本领域常用的结构即可，本发明实施例对其结构不作具体限定。

柔性衬底的第二区域上设置有用于实现信号传输和驱动图像显示等功能的

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集成电路，从而使柔性衬底的第二区域与集成电路共同形成柔性屏体10的弯折区，本发明实施例对柔性屏体10的弯折区本身的结构并没有改进，采用本领域常用的结构即可，本发明实施例对其结构不作具体限定。

为了实现显示装置的窄边框设计，通常将柔性屏体10的弯折区进行弯折，如图1所示，本发明实施例具体将柔性屏体10的弯折子区B2进行180°弯折，使得平面区AA与弯折过渡子区B1所组成的整体与弯折延伸子区B3相对且相互平行，此时，弯折子区B2呈半圆弧状，平面区AA、弯折过渡子区B1、弯折子区B2和弯折延伸子区B3形成一个容纳槽，支撑层20位于该容纳槽内。

需要说明的是，一方面，由于柔性屏体10的弯折区包括设置在平面区AA和弯折子区B2之间的弯折过渡子区B1，因此使得柔性屏体10的初始弯折位置为弯折子区B2和弯折过渡子区B1衔接的位置，即柔性屏体10的初始弯折位置偏离平面区AA和弯折区衔接的位置，初始弯折位置的两侧均为弯折区域，有效缓解了柔性屏体10的初始弯折位置因其两侧区域的结构不同而导致的应力集中的现象，实现对柔性屏体10的弯折起始位置的保护；另一方面，由于弯折子区B2和平面区AA不直接相邻，两者之间设置有弯折过渡子区B1，因此减小了弯折子区B2弯折时作用于平面区AA上的应力，从而对平面区AA进行保护，例如防止平面区AA开裂。

支撑层20的一侧支撑柔性屏体10的平面区AA和弯折过渡子区B1，支撑层20远离平面区AA的一侧支撑柔性屏体10的弯折延伸子区B3，即柔性屏体10的平面区AA和弯折过渡子区B1设置在支撑层20的同一侧，柔性屏体10的弯折延伸子区B3设置在支撑层20远离平面区AA的另一侧。

需要说明的是，支撑层20主要用于固定并支撑柔性屏体10，防止柔性屏体10的弯折子区B2由于弯折程度过大而折断。支撑层20可以为兼具硬度和弹性的材料，从而既可以对柔性屏体10进行支撑，又可以对柔性屏体10进行减震。支撑层20可以为一层，也可以为多层结构，本发明实施例对此不作具体限定。

保护层30设置在柔性屏体10远离支撑层20的一侧，保护层30至少覆盖部分弯折区，图1所示的保护层30完全覆盖柔性屏体10的弯折子区B2，并至少覆盖部分柔性屏体10的弯折过渡子区B1。其中，图1所示的保护层30完全

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覆盖柔性屏体 10 的弯折子区 B2 和弯折过渡子区 B1，当然，在其他实施例中，保护层 30 还可以完全覆盖柔性屏体 10 的弯折子区 B2 且覆盖部分弯折过渡子区 B1。

需要说明的是，保护层 30 完全覆盖柔性屏体 10 的弯折子区 B2，从而缓解弯折子区 B2 的弯折应力；保护层 30 至少覆盖部分柔性屏体 10 的弯折过渡子区 B1，从而使保护层 30 能够从柔性屏体 10 的初始弯折位置靠近平面区 AA 的一侧开始更好地缓解柔性屏体 10 的初始弯折位置的弯折应力，需要说明的是，保护层 30 靠近平面区 AA 的侧边与柔性屏体 10 的初始弯折位置之间的距离还可以大于第一预设值，第一预设值为大于或等于 0 的值，第一预设值可以根据实际需求进行灵活调整，本发明实施例对此不作具体限定。

柔性屏体 10 的平面区 AA 包括红色子像素单元、绿色子像素单元和蓝色子像素单元，其中，红色子像素单元用于发出红色的光，绿色子像素单元用于发出绿色的光，蓝色子像素单元用于发出蓝色的光。

彩膜 50 设置在柔性屏体 10 远离支撑层 20 的一侧，彩膜 50 至少覆盖平面区 AA，彩膜 50 用于替代偏光片，承担着防止显示装置的漏光以及降低显示装置的反射率的作用。

具体而言，彩膜 50 包括多个彩色色阻以及设置在不同的彩色色阻之间的黑色矩阵，多个彩色色阻包括红色色阻、绿色色阻和蓝色色阻，其中，红色色阻对应红色子像素单元设置，红色色阻承担着红色子像素单元的出光；绿色色阻对应绿色子像素单元设置，绿色色阻承担着绿色子像素单元的出光；蓝色色阻对应蓝色子像素单元设置，蓝色色阻承担着蓝色子像素单元的出光；黑色矩阵主要承担着防止显示装置漏光以及降低显示装置的反射率的作用。

盖板 40 设置在彩膜 50 远离柔性屏体 10 的一侧，盖板 40 至少覆盖平面区 AA，图 1 所示的盖板 40 通过光学胶 60 与彩膜 50 连接，其中，光学胶 60 用于胶结光学元件，光学胶 60 可以为具有无色透明、光透过率在 90%以上、胶结强度良好、可在室温或中温下固化且固化收缩小等特点的 OCA 光学胶，在本发明实施例中，光学胶 60 用于将盖板 40 与彩膜 50 进行胶结。盖板 40 用于保护柔性屏体 10 不受外界的冲击力而损伤。

本发明实施例提供的显示装置，在保护层 30 与盖板 40 重叠的区域内，保

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护层 30 与盖板 40 之间的距离大于或等于预设值，需要说明的是，预设值为大于 0 的值，预设值可以根据实际需求（例如制程精度）进行灵活调整，本发明实施例对此不作具体限定。如此，盖板 40 不会挤压保护层 30，消除了显示装置的开裂风险。

基于上述实施例，请参阅图 2，保护层 30 仅设置在柔性屏体 10 的表面，柔性屏体 10 的表面的保护层 30 的厚度小于或等于盖板 40 靠近柔性屏体 10 的一侧到柔性屏体 10 靠近盖板 40 的一侧之间的距离。

基于上述实施例，请参阅图 3，显示装置还包括设置在柔性屏体 10 与彩膜 50 之间的触控层 70，以及设置在触控层 70 与彩膜 50 之间的绝缘层 80，保护层 30 仅设置在绝缘层 80 的表面，绝缘层 80 的表面的保护层 30 的厚度小于或等于盖板 40 靠近绝缘层 80 的一侧到绝缘层 80 靠近盖板 40 的一侧之间的距离。

基于上述实施例，请参阅图 1 和图 4，保护层 30 还设置在彩膜 50 的表面，彩膜 50 的表面的保护层 30 的厚度小于或等于盖板 40 靠近彩膜 50 的一侧到彩膜 50 靠近盖板 40 的一侧之间的距离。

基于上述实施例，在本发明实施例中，光学胶60的厚度大于保护层30在柔性屏体10的弯折过渡子区B1的最大厚度，如此，即可保证覆盖柔性屏体10的弯折过渡子区B1的盖板40与覆盖柔性屏体10的弯折过渡子区B1的保护层30具有一定间隔，盖板40不会挤压保护层30，消除了显示装置的开裂风险。

基于上述实施例，本发明实施例对显示装置进行进一步说明，保护层 30 还至少覆盖部分柔性屏体 10 的弯折延伸子区 B3，以更好地缓解柔性屏体 10 的末端弯折位置的弯折应力。需要说明的是，保护层 30 靠近弯折延伸子区 B3 的侧边与柔性屏体 10 的末端弯折位置之间的距离还可以大于第二预设值，第二预设值为大于或等于 0 的值，第二预设值可以根据实际需求进行灵活调整，本发明实施例对此不作具体限定。其中，图 1 所示的保护层 30 覆盖部分柔性屏体 10 的弯折延伸子区 B3，当然，在其他实施例中，保护层 30 还可以完全覆盖柔性屏体 10 的弯折延伸子区 B3。

基于上述实施例，在一些实施例中，保护层 30 为 UV 胶，当然，在其他实施例中，保护层 30 不限于 UV 胶，还可以是热固化胶或其他种类的光固化胶，本发明实施例对此不作具体限定。需要说明的是，在满足盖板 40 与保护层 30

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之间的距离大于 0 的情况下，本领域技术人员可以根据柔性屏体 10 的大小、种类、弯折子区 B2 的弯折半径、保护层 30 的柔韧性以及缓解应力的能力为保护层 30 设置合适的厚度，本发明实施例对其不作具体限定。

基于上述实施例，本发明实施例对显示装置进行进一步说明，支撑层 20 包括设置在柔性屏体 10 的平面区 AA 和弯折过渡子区 B1 远离盖板 40 的一侧的第一背板 201，以及设置在柔性屏体 10 的弯折延伸子区 B3 远离保护层 30 的一侧的第二背板 202。其中，弯折延伸子区 B3 可以通过胶粘或者物理方法固定于第二背板 202 上。

需要说明的是，第一背板 201 用于支撑和保护柔性屏体 10 的平面区 AA 和弯折过渡子区 B1，避免其受到外界的冲击力而损伤，第二背板 202 用于支撑和保护柔性屏体 10 的弯折延伸子区 B3，避免其受到外界的冲击力而损伤。第一背板 201 和第二背板 202 的材料可以为聚对苯二甲酸乙二醇酯（Polyethylene terephthalate，PET）材料，由于 PET 材料具有弹性模量低和受热不易膨胀的优点，因此采用 PET 材料制作而成的第一背板 201 和第二背板 202 不会因为环境温度的变化而变形，降低了第一背板 201 与其连接的膜层剥离的可能性以及第二背板 202 与其连接的膜层剥离的可能性，从而提高了显示装置的良率和可靠性。

进一步地，为了防止第一背板201和第二背板202影响柔性屏体10的弯折子区B2的弯折，必须确保第一背板201和第二背板202均避开弯折子区B2。优选地，为了更好的支撑柔性屏体10的平面区AA和弯折过渡子区B1，第一背板201的边缘与柔性屏体10的初始弯折位置重合，同理，为了更好的支撑柔性屏体10的弯折延伸子区B3，第二背板202的边缘与柔性屏体10的末端弯折位置重合。

基于上述实施例，在一些实施例中，支撑层 20 还包括设置在第一背板 201 和第二背板 202 之间的垫高块，垫高块的高度还可以根据柔性屏体 10 的弯折子区 B2 的宽度进行调整，本发明实施例对其不作具体限定。垫高块可以为硅胶等材料，垫高块可以具有一定弹性和硬度，垫高块具有一定硬度以避免所述柔性屏体 10 被挤压变形，垫高块具有一定弹性以避免所述柔性屏体 10 由于受到局部应力而损坏。

具体而言，垫高块避开柔性屏体 10 的弯折子区 B2 设置。当然，在其他实

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施例中，垫高块靠近柔性屏体 10 的弯折子区 B2 的一端的表面与弯折子区 B2 弯折后的形状匹配，以使得弯折子区 B2 靠近垫高块一侧的表面与垫高块的表面相贴合，进而对弯折子区 B2 具有一定的支撑作用，且不易变形损坏。可以理解的是，在其他实施例中，还可以通过增加第一背板 201 和第二背板 202 的厚度，或增加其他支撑结构，以确保柔性屏体 10 的平面区 AA 和弯折延伸子区 B3 之间的距离。

基于上述实施例，在一些实施例中，第一背板 201 和第二背板 202 之间设置有泡棉 203。需要说明的是，泡棉 203 是塑料粒子发泡过的材料，其既能起到缓冲作用，也能起到遮光作用。

基于上述实施例，在一些实施例中，泡棉 203 和第二背板 202 之间设置有补强板 204。需要说明的是，补强板 204 用于提高柔性屏体 10 的强度。其中，补强板 204 可以为聚酰亚胺层，也可以为石墨层，其中，石墨层的外表面还可用聚酰亚胺包覆，本发明实施例对此不作具体限定。

基于上述实施例，在一些实施例中，泡棉 203 和补强板 204 之间设置有散热层 205。其中，散热层 205 起到屏蔽和散热作用，散热层 205 的材料为散热材料，具体可以为金属材料或石墨等，其中，金属可以为铜箔、铝箔或不锈钢箔等，本发明实施例对此不作具体限定。

基于上述实施例，在一些实施例中，显示装置还包括设置在所述弯折延伸子区 B3 的驱动单元。具体而言，驱动单元设置在柔性屏体 10 的弯折延伸子区 B3 远离支撑层 20 的表面。驱动单元包括驱动芯片和柔性电路板，其中，驱动芯片和柔性电路板均设置在柔性屏体 10 的弯折延伸子区 B3 远离支撑层 20 的表面，柔性电路板与驱动芯片之间的距离大于 0。

基于上述实施例，在一些实施例中，柔性屏体 10 的平面区 AA 包括柔性衬底、薄膜晶体管、显示器件和封装层，其中，柔性衬底设置在第一背板 201 上，薄膜晶体管设置在柔性衬底上，显示器件设置在薄膜晶体管上，封装层设置在显示器件上。

柔性衬底为由柔性材料制作而成的衬底，柔性材料优选为聚酰亚胺（PI）。

显示器件用于进行发光，显示器件通常包括设置在薄膜晶体管上的阳极（Anode）、设置在阳极上的空穴注入层（Hole Injection Layer，HIL）、设置

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在空穴注入层上的空穴传输层（Hole Tranport Layer，HTL）、设置在空穴传输层上的发光层（Emission layer，EML）、设置在发光层上的电子传输层（Electron Transport Layer，ETL)、设置在电子传输层上的电子注入层（Electron Injection Layer，EIL）以及设置在电子传输层上的阴极（Cathode）。可选地，显示器件中还可设置有空穴阻挡层（Hole Block Layer，HBL），电子阻挡层(Electron Block Layer，EBL）和封盖层（Capping Layer，CPL）。

发光层包括红色子像素单元、绿色子像素单元和蓝色子像素单元，其中，红色子像素单元用于发出红色的光，绿色子像素单元用于发出绿色的光，蓝色子像素单元用于发出蓝色的光。

彩膜 50 用于替代偏光片，承担着防止显示装置的漏光以及降低显示装置的反射率的作用。具体而言，彩膜 50 包括多个彩色色阻以及设置在不同的彩色色阻之间的黑色矩阵，多个彩色色阻包括红色色阻、绿色色阻和蓝色色阻，其中，红色色阻对应红色子像素单元设置，红色色阻承担着红色子像素单元的出光；绿色色阻对应绿色子像素单元设置，绿色色阻承担着绿色子像素单元的出光；蓝色色阻对应蓝色子像素单元设置，蓝色色阻承担着蓝色子像素单元的出光；黑色矩阵主要承担着防止显示装置漏光以及降低显示装置的反射率的作用。

封装层用于为显示装置隔绝外界的水和氧气，保证显示装置的良率。封装层通常为有机层、无机层和有机层构成的三明治结构。

基于上述实施例，本发明实施例对上述显示装置的制作方法进行说明。图 5 为本发明实施例提供的显示装置的制作方法流程图，如图 5 所示，制作方法包括：

S1，在玻璃基板上制作柔性屏体 10。

柔性屏体 10 指的是能够进行弯曲和折叠的柔韧性高的屏幕，柔性屏体 10 可以划分为平面区 AA 和自平面区 AA 延伸的弯折区，平面区 AA 指的是能够进行显示的区域，弯折区指的是不能够进行显示的区域。弯折区包括依次设置的弯折过渡子区 B1、弯折子区 B2 和弯折延伸子区 B3，其中，弯折过渡子区 B1 的相对两端分别与平面区 AA 和弯折子区 B2 连接，弯折子区 B2 的相对两端分别与弯折过渡子区 B1 和弯折延伸子区 B3 连接。其中，弯折过渡子区 B1 与平面区 AA 平齐，也即弯折过渡子区 B1 与平面区 AA 位于同一平面，弯折子

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区 B2 和弯折延伸子区 B3 均不与平面区 AA 平齐，也即弯折子区 B2 与平面区 AA 位于不同平面，弯折延伸子区 B3 与平面区 AA 位于不同平面。

S2，在柔性屏体 10 上制作彩膜 50。

具体而言，柔性屏体 10 的平面区 AA 包括红色子像素单元、绿色子像素单元和蓝色子像素单元，彩膜 50 包括多个彩色色阻以及设置在不同的彩色色阻之间的黑色矩阵，多个彩色色阻包括红色色阻、绿色色阻和蓝色色阻，红色色阻对应红色子像素单元设置，绿色色阻对应绿色子像素单元设置，蓝色色阻对应蓝色子像素单元设置。需要说明的是，在一些实施例中，还可以在彩膜 50 上制作平坦层以对彩膜 50 进行平坦化。

S3，对柔性屏体 10 的弯折区进行驱动芯片和柔性电路板的邦定，并对柔性屏体 10 的弯折区进行 UV 胶覆盖。

具体而言，将驱动芯片和柔性电路板均设置在柔性屏体 10 的弯折延伸子区 B3 远离支撑层 20 的表面，并使柔性电路板与驱动芯片之间的距离大于 0。对柔性屏体 10 的弯折区进行 UV 胶覆盖，使得 UV 胶完全覆盖弯折子区 B2，并至少覆盖部分弯折过渡子区 B1。

S4，将玻璃基板进行剥离，并将支撑层 20 与柔性屏体 10 进行贴合。

具体而言，支撑层 20 的一侧支撑柔性屏体 10 的平面区 AA 和弯折过渡子区 B1，支撑层 20 远离平面区 AA 的一侧支撑柔性屏体 10 的弯折延伸子区 B3，即柔性屏体 10 的平面区 AA 和弯折过渡子区 B1 设置在支撑层 20 的同一侧，柔性屏体 10 的弯折延伸子区 B3 设置在支撑层 20 远离平面区 AA 的另一侧。需要说明的是，支撑层 20 主要用于固定并支撑柔性屏体 10，防止柔性屏体 10 的弯折子区 B2 由于弯折程度过大而折断。支撑层 20 可以为兼具硬度和弹性的材料，从而既可以对柔性屏体 10 进行支撑，又可以对柔性屏体 10 进行减震。支撑层 20 可以为一层，也可以为多层结构，本发明实施例对此不作具体限定。

S5，将盖板 40 与彩膜 50 通过光学胶 60 进行贴合，其中，光学胶 60 的厚度大于 UV 胶的最大厚度。

具体而言，使用光学胶 60 将盖板 40 与彩膜 50 进行贴合，使盖板 40 完全覆盖柔性屏体 10 的平面区 AA，并至少覆盖部分柔性屏体 10 的弯折过渡子区 B1。由于光学胶 60 的厚度大于 UV 胶的最大厚度，因此在盖板 40 与彩膜 50

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的贴合过程中，盖板 40 不会对 UV 胶产生压力，降低了显示装置的模组制程风险。

需要说明的是，上述步骤的标号并不严格代表步骤的执行顺序，在一些实施例中，可以严格按照上述步骤的标号顺序执行对应的步骤，当然，在另一些实施例中，某些步骤可以同时执行，或者调换顺序执行，本发明实施例对此不作具体限定。

最后应说明的是：以上实施例仅用以说明本发明的技术方案，而非对其限制；尽管参照前述实施例对本发明进行了详细的说明，本领域的普通技术人员应当理解：其依然可以对前述各实施例所记载的技术方案进行修改，或者对其中部分技术特征进行等同替换；而这些修改或者替换，并不使相应技术方案的本质脱离本发明各实施例技术方案的精神和范围。

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2021105489052

说 明 书 附 图

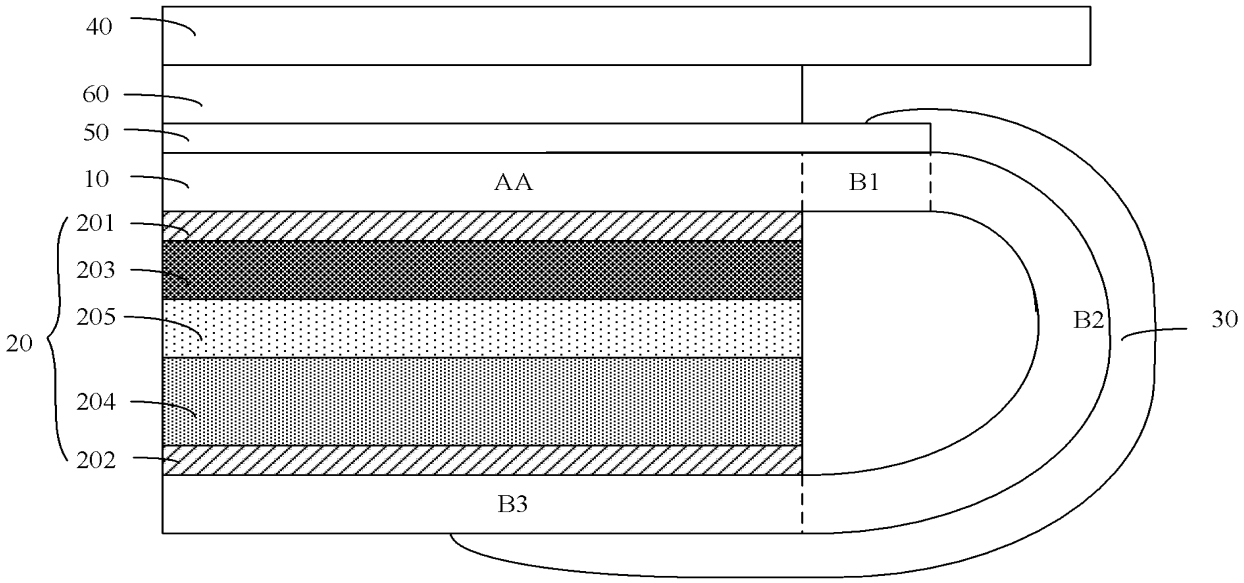


图 1

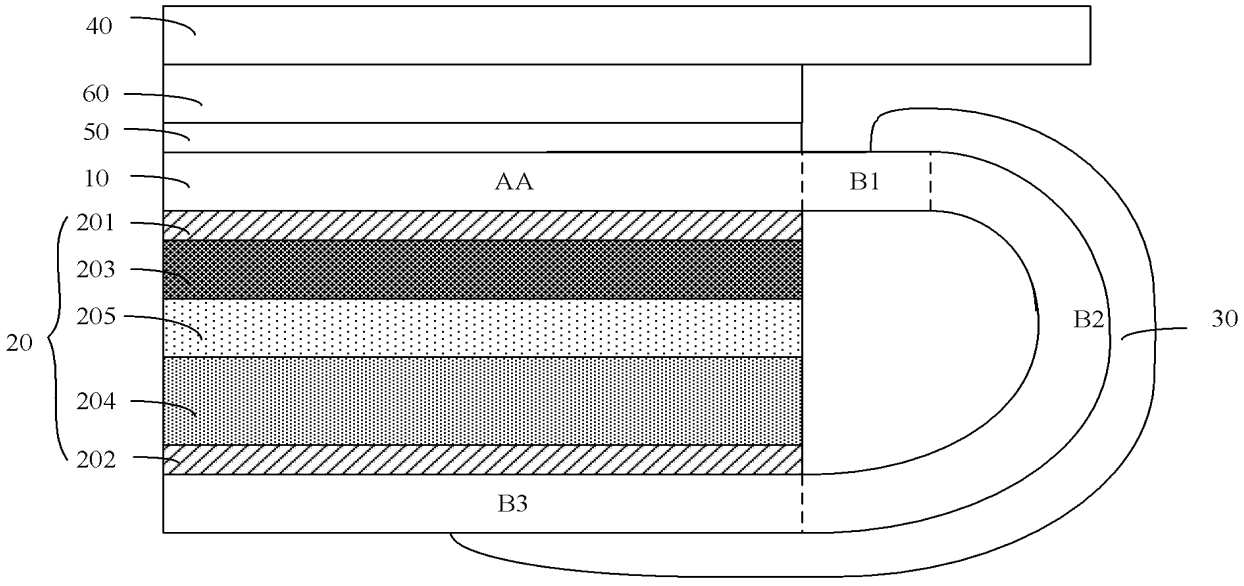


图 2

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2021105489052

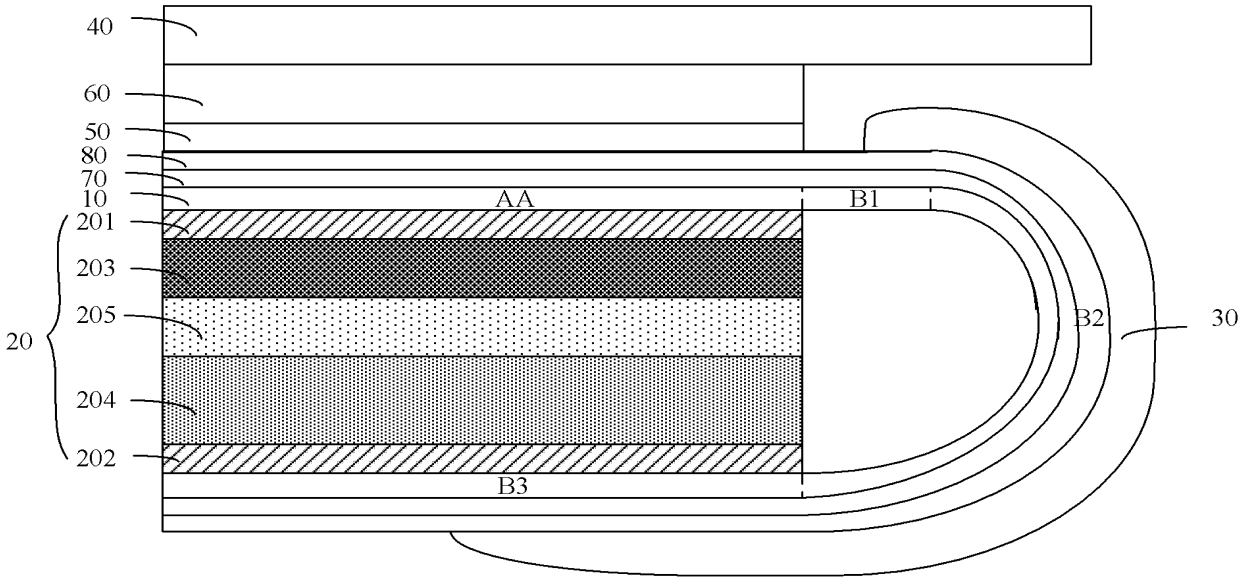


图 3

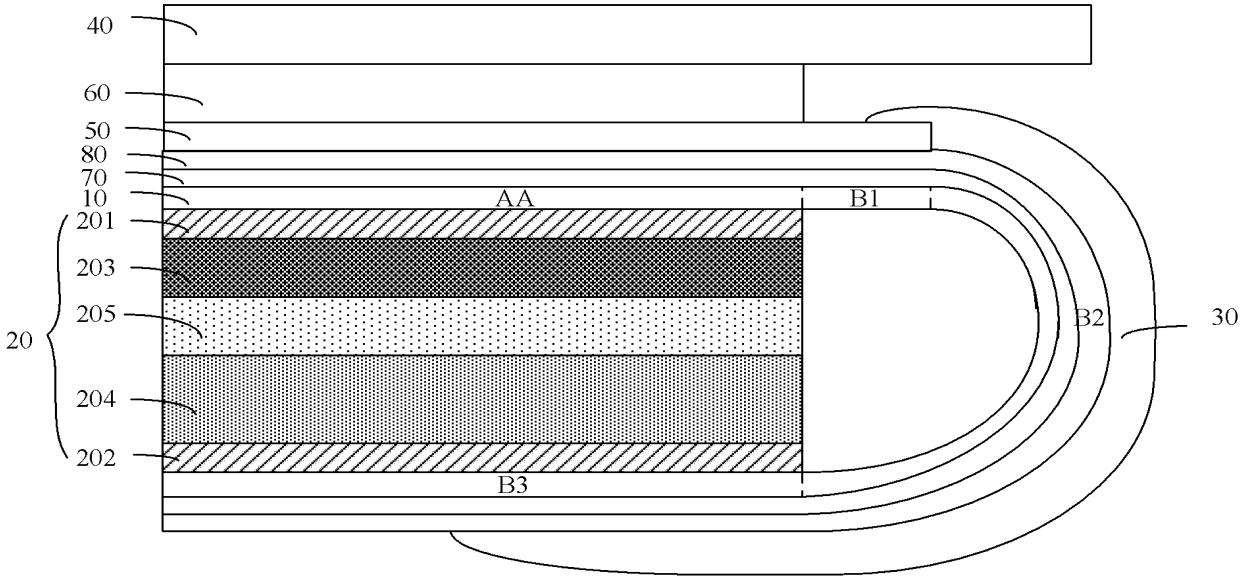


图 4

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2021105489052

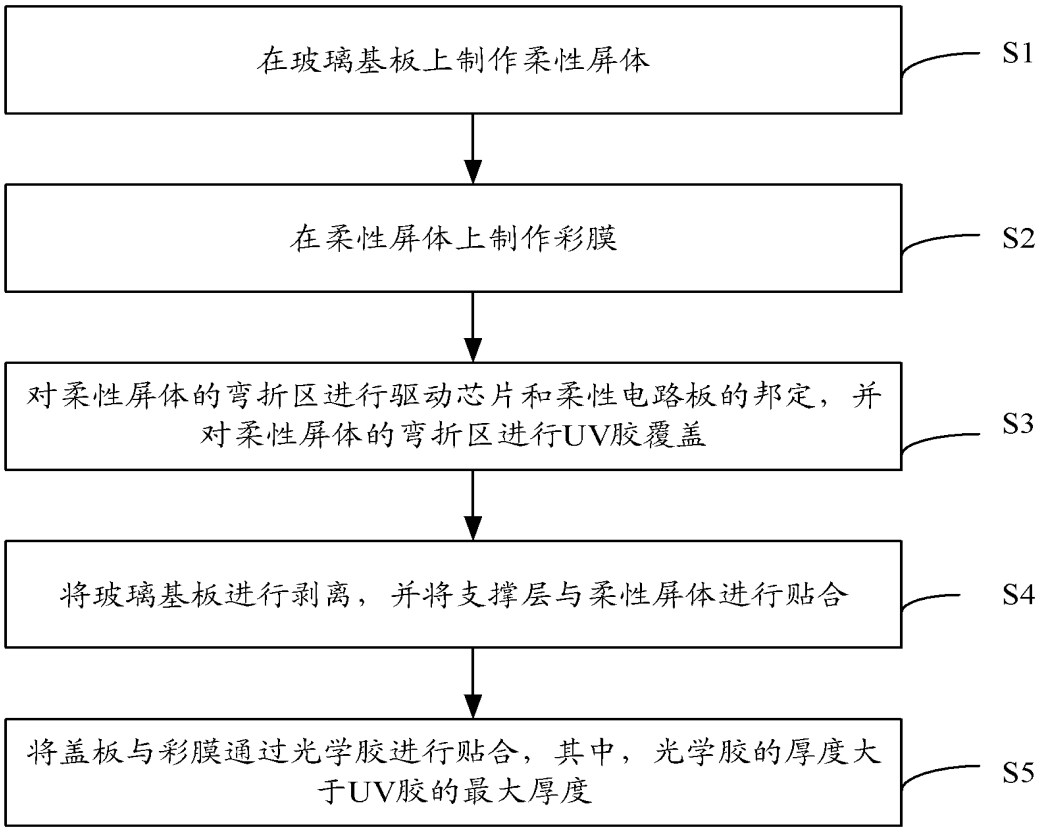


图 5

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UNITED STATES PATENT AND TRADEMARK OFFICE

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United States Patent and Trademark Office
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NOTICE OF ALLOWANCE AND FEE(S) DUE

168853 7590 12/07/2023

PVIP
Wei Te Chung
1079 Lancer Drive
San Jose, CA 95129

EXAMINER
HO, ANTHONY

ART UNIT	PAPER NUMBER
2817	

DATE MAILED: 12/07/2023

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/419,713	06/29/2021	Jing Zhou	TP204027-US	9383

TITLE OF INVENTION: DISPLAY DEVICE

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	03/07/2024

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 40% the amount of undiscounted fees, and micro entity fees are 20% the amount of undiscounted fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

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PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via the USPTO patent electronic filing system.

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Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications. **Because electronic patent issuance may occur shortly after issue fee payment, any desired continuing application should preferably be filed prior to payment of this issue fee in order not to jeopardize copendency.**

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

168853 7590 12/07/2023

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San Jose, CA 95129

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via the USPTO patent electronic filing system or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/419,713	06/29/2021	Jing Zhou	TP204027-US	9383

TITLE OF INVENTION: DISPLAY DEVICE

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nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	03/07/2024

EXAMINER	ART UNIT	CLASS-SUBCLASS
HO, ANTHONY	2817	257-089000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/AIA/122 or PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. Fees submitted: ❑ Issue Fee ❑ Publication Fee (if required)

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via the USPTO patent electronic filing system ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

❑ Applicant asserting small entity status. See 37 CFR 1.27

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

❑ Applicant changing to regular undiscounted fee status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

Petitioner Samsung Ex-1004, 0402

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/419,713	06/29/2021	Jing Zhou	TP204027-US	9383

168853 7590 12/07/2023

PVIP
Wei Te Chung
1079 Lancer Drive
San Jose, CA 95129

EXAMINER	
HO, ANTHONY	
ART UNIT	PAPER NUMBER
2817	

DATE MAILED: 12/07/2023

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Petitioner Samsung Ex-1004, 0403

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. The United States Patent and Trademark Office (USPTO) collects the information in this record under authority of 35 U.S.C. 2. The USPTO's system of records is used to manage all applicant and owner information including name, citizenship, residence, post office address, and other information with respect to inventors and their legal representatives pertaining to the applicant's/owner's activities in connection with the invention for which a patent is sought or has been granted. The applicable Privacy Act System of Records Notice for the information collected in this form is COMMERCE/PAT-TM-7 Patent Application Files, available in the Federal Register at 78 FR 19243 (March 29, 2013).
https://www.govinfo.gov/content/pkg/FR-2013-03-29/pdf/2013-07341.pdf

Routine uses of the information in this record may include disclosure to:

1) law enforcement, in the event that the system of records indicates a violation or potential violation of law;
2) a federal, state, local, or international agency, in response to its request;
3) a contractor of the USPTO having need for the information in order to perform a contract;
4) the Department of Justice for determination of whether the Freedom of Information Act (FOIA) requires disclosure of the record;
5) a Member of Congress submitting a request involving an individual to whom the record pertains, when the individual has requested the Member's assistance with respect to the subject matter of the record;
6) a court, magistrate, or administrative tribunal, in the course of presenting evidence, including disclosures to opposing counsel in the course of settlement negotiations;
7) the Administrator, General Services Administration (GSA), or their designee, during an inspection of records conducted by GSA under authority of 44 U.S.C. 2904 and 2906, in accordance with the GSA regulations and any other relevant (i.e., GSA or Commerce) directive, where such disclosure shall not be used to make determinations about individuals;
8) another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c));
9) the Office of Personnel Management (OPM) for personnel research purposes; and
10) the Office of Management and Budget (OMB) for legislative coordination and clearance.

If you do not furnish the information requested on this form, the USPTO may not be able to process and/or examine your submission, which may result in termination of proceedings, abandonment of the application, and/or expiration of the patent.

Notice of Allowability	Application No. 17/419,713	Applicant(s) Zhou, Jing	
	Examiner ANTHONY HO	Art Unit 2817	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to filing of June 29, 2021.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 1-13 and 15-20 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information , please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☑ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☑ All b) ☐ Some* c) ☐ None of the:

   1. ☑ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☑ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 4/8/2022.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☐ Examiner's Amendment/Comment
6. ☑ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/ANTHONY HO/
Primary Examiner, Art Unit 2817

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Priority

2. Receipt is acknowledged of certified copies of papers required by 37 CFR 1.55.

Information Disclosure Statement

3. The information disclosure statement (IDS) submitted on April 8, 2022 is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Allowable Subject Matter

4. Claims 1-13 and 15-20 are allowed.

5. The following is an examiner's statement of reasons for allowance: The prior arts of record do not disclose or suggest at least the limitation of "a display device comprising a color filter disposed on the flexible screen body and at least covering the planar area wherein in an overlapping area of the protective layer and the coverplate, a distance between the protective layer and the coverplate is greater than or equal to a default value, wherein the default value is greater than 0" as recited in claim 1.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to ANTHONY HO whose telephone number is (571)270-1432. The examiner can normally be reached 9AM - 5PM, Monday-Friday.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eva Montalvo can be reached on 571-270-3829. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of published or unpublished applications may be obtained from Patent Center. Unpublished application information in Patent Center is available to registered users. To file and manage patent submissions in Patent Center, visit: https://patentcenter.uspto.gov. Visit https://www.uspto.gov/patents/apply/patent-center for more information about Patent Center and https://www.uspto.gov/patents/docx for information about filing in DOCX format. For additional questions, contact the Electronic

Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO

Customer Service Representative, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/ANTHONY HO/
Primary Examiner, Art Unit 2817

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/419,713	Zhou, Jing
	Examiner	Art Unit
	ANTHONY HO	2817

CPC - Searched*		
Symbol	Date	Examiner
H10K 59/873, H10K 59/38, H10K 59/871	12/02/2023	ah

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
conduct SEARCH	12/02/2023	ah
cursory review of CPC search	12/02/2023	ah
consult IP.com	12/02/2023	ah
consult related PCT case	12/02/2023	ah

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
H10K	59/873, 59/38, 59/871	12/02/2023	ah

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/419,713	Zhou, Jing
	Examiner	**Art Unit**
	ANTHONY HO	2817

CPC						
Symbol					**Type**	**Version**
H10K	/	59	/	873	F	2023-02-01
H10K	/	59	/	871	I	2023-02-01
H10K	/	59	/	38	A	2023-02-01
H10K	/	2102	/	311	A	2023-02-01

CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
	/		/					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	19	
/ANTHONY HO/ Primary Examiner, Art Unit 2817	03 December 2023	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

U.S. Patent and Trademark Office — Part of Paper No.: 20231203

Petitioner Samsung Ex-1004, 0410

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/419,713	Zhou, Jing
	Examiner	**Art Unit**
	ANTHONY HO	2817

INTERNATIONAL CLASSIFICATION					
CLAIMED					
H01L	/	23	/	00	

NON-CLAIMED					
	/		/		

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**

CROSS REFERENCES(S)						
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	19	
/ANTHONY HO/ Primary Examiner, Art Unit 2817	03 December 2023	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/419,713	Zhou, Jing
	Examiner	**Art Unit**
	ANTHONY HO	2817

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	10	10	18	19										
2	2	11	11	19	20										
3	3	12	12												
4	4	13	13												
5	5		14												
6	6	14	15												
7	7	15	16												
8	8	16	17												
9	9	17	18												

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	19	
/ANTHONY HO/ Primary Examiner, Art Unit 2817	03 December 2023	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Petitioner Samsung Ex-1004, 0412

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (03-15)
Approved for use through 07/31/2016. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	17419713
Filing Date	2021-06-29
First Named Inventor	ZHOU, Jing
Art Unit	N/A
Examiner Name	N/A
Attorney Docket Number	TP204027-US

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20190318689	A1	2019-10-17	KIM SUNG HOON	ALL

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	108682307	CN	A	2018-10-19	KUNSHAN GOVISIONOX OPTOELECTRONICS CO LTD	ALL	☓
	2	108877519	CN	A	2018-11-23	SHANGHAI TIANMA MICROELECTRONICS CO LTD	ALL	☒
	3	108962029	CN	A	2018-12-07	KUNSHAN GOVISIONOX OPTOELECTRONICS CO LTD	ALL	☒

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.H/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	17419713
	Filing Date	2021-06-29
	First Named Inventor	ZHOU, Jing
	Art Unit	N/A
	Examiner Name	N/A
	Attorney Docket Number	TP204027-US

	4	109119453	CN	A	2019-01-01	WUHAN TIANMA MICRO ELECTRONICS CO LTD	ALL	☒
	5	109859642	CN	A	2019-06-07	SHANGHAI TIANMA MICROELECTRONICS CO LTD	ALL	☒
	6	110224081	CN	A	2019-09-10	BOE TECHNOLOGY GROUP CO LTD, ETC.	ALL	☒
	7	111430426	CN	A	2020-07-17	WUHAN CHINA STAR OPTOELECTRONICS SEMICONDUCTOR	ALL	☒
	8	112289185	CN	A	2021-01-29	WUHAN CHINA STAR OPTOELECTRONICS SEMICONDUCTOR	ALL	☒
	9	112634764	CN	A	2021-04-09	WUHAN CHINA STAR OPTOELECTRONICS SEMICONDUCTOR	ALL	☒
	10	112786807	CN	A	2021-05-11	WUHAN CHINA STAR OPTOELECTRONICS SEMICONDUCTOR	ALL	☒

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	International Search Report in International application number: PCT/CN2021/097527, mailed on 11/29/2021	☓
	2	Written Opinion of the International Searching Authority in International application number: PCT/CN2021/097527, mailed on 11/29/2021	☒

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.H/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	17419713
	Filing Date	2021-06-29
	First Named Inventor	ZHOU, Jing
	Art Unit	N/A
	Examiner Name	N/A
	Attorney Docket Number	TP204027-US

	3	Chinese Office Action in corresponding Chinese Patent Application No. 202110548905.2 dated January 07, 2022, pages 1-9	☒

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/ANTHONY HO/	Date Considered	12/03/2023

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

Petitioner Samsung Ex-1004, 0415

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.H/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	17419713
Filing Date	2021-06-29
First Named Inventor	ZHOU, Jing
Art Unit	N/A
Examiner Name	N/A
Attorney Docket Number	TP204027-US

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Wei Te Chung/	Date (YYYY-MM-DD)	2022-04-07
Name/Print	Wei Te Chung	Registration Number	43325

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.H/

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.H/

PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
L1	891	H10K59/873.cpc.	(US-PGPUB; USPAT)	OR	ON	ON	2023/12/02 11:21 PM
L2	8965	H10K59/38.cpc.	(US-PGPUB; USPAT)	OR	ON	ON	2023/12/02 11:22 PM
L3	107	H10K59/871.cpc.	(US-PGPUB; USPAT)	OR	ON	ON	2023/12/02 11:22 PM
L4	370	(jing SAME zhou).in.	(US-PGPUB; USPAT)	OR	ON	ON	2023/12/02 11:22 PM
L5	1970	(wuhan SAME china SAME star SAME optoelectronics SAME semiconductor SAME display SAME technology).as.	(US-PGPUB; USPAT)	OR	ON	ON	2023/12/02 11:22 PM
L6	1	("20190318689").PN.	(US-PGPUB; USPAT)	OR	ON	ON	2023/12/02 11:23 PM
L7	104	1 AND 2	(US-PGPUB; USPAT)	OR	ON	ON	2023/12/02 11:28 PM
L8	18	1 AND 3	(US-PGPUB; USPAT)	OR	ON	ON	2023/12/02 11:28 PM
L9	4	2 AND 3	(US-PGPUB; USPAT)	OR	ON	ON	2023/12/02 11:28 PM
L10	915	H10K59/873.cpc.	(US-PGPUB; USPAT)	OR	ON	ON	2023/12/03 07:54 AM
L11	8971	H10K59/38.cpc.	(US-PGPUB; USPAT)	OR	ON	ON	2023/12/03 07:54 AM
L12	118	H10K59/871.cpc.	(US-PGPUB; USPAT)	OR	ON	ON	2023/12/03 07:54 AM
L13	370	(jing SAME zhou).in.	(US-PGPUB; USPAT)	OR	ON	ON	2023/12/03 07:54 AM
L14	1970	(wuhan SAME china SAME star SAME optoelectronics SAME semiconductor SAME display SAME technology).as.	(US-PGPUB; USPAT)	OR	ON	ON	2023/12/03 07:54 AM
L15	1	("20190318689").PN.	(US-PGPUB; USPAT)	OR	ON	ON	2023/12/03 07:54 AM
L16	104	1 AND 2	(US-PGPUB; USPAT)	OR	ON	ON	2023/12/03 07:54 AM
L17	29	1 AND 3	(US-PGPUB; USPAT)	OR	ON	ON	2023/12/03 07:54 AM
L18	4	2 AND 3	(US-PGPUB; USPAT)	OR	ON	ON	2023/12/03 07:54 AM

PE2E SEARCH - Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
N1	891	H10K59/873.cpc.	(US-PGPUB; USPAT)	OR	ON	ON	2023/12/02 11:28 PM
N2	8965	H10K59/38.cpc.	(US-PGPUB; USPAT)	OR	ON	ON	2023/12/02 11:28 PM
N3	107	H10K59/871.cpc.	(US-PGPUB; USPAT)	OR	ON	ON	2023/12/02 11:28 PM
N4	915	H10K59/873.cpc.	(US-PGPUB; USPAT)	OR	ON	ON	2023/12/03 07:54 AM
N5	8971	H10K59/38.cpc.	(US-PGPUB; USPAT)	OR	ON	ON	2023/12/03 07:54 AM
N6	118	H10K59/871.cpc.	(US-PGPUB; USPAT)	OR	ON	ON	2023/12/03 07:54 AM
N7	0	(display SAME device SAME color SAME filter SAME (layer OR film) SAME coverplate SAME distance SAME flexible SAME body SAME area).clm.	(US-PGPUB; USPAT)	OR	ON	ON	2023/12/03 09:30 AM

Bibliographic Data

Application No: 17/419,713

Foreign Priority claimed: (•) Yes ( ) No

35 USC 119 (a-d) conditions met: [✓] Yes [ ] No [ ] Met After Allowance

Verified and Acknowledged: /ANTHONY HO/ [ ]

Examiner's Signature | Initials

Title: DISPLAY DEVICE

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
06/29/2021	257	2817	TP204027-US
RULE			

APPLICANTS

WUHAN CHINA STAR OPTOELECTRONICS SEMICONDUCTOR DISPLAY TECHNOLOGY CO., LTD., Wuhan, CHINA

INVENTORS

Jing Zhou, Wuhan, CHINA

CONTINUING DATA

This application is a 371 of PCT/CN2021/097527 05/31/2021

FOREIGN APPLICATIONS

CHINA CN202110548905.2 05/20/2021

IF REQUIRED, FOREIGN LICENSE GRANTED**

09/29/2023

STATE OR COUNTRY

CHINA

ADDRESS

PVIP
Wei Te Chung
1079 Lancer Drive
San Jose, CA 95129
UNITED STATES

FILING FEE RECEIVED

$1,120

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
17/419,713	06/29/2021	Jing Zhou	TP204027-US

CONFIRMATION NO. 9383

168853
PVIP
Wei Te Chung
1079 Lancer Drive
San Jose, CA 95129

PUBLICATION NOTICE

OC000000066872748

Date Mailed: 01/12/2024

Title:DISPLAY DEVICE

Publication No.US-2024-0016037-A1
Publication Date:01/11/2024

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently https://portal.uspto.gov/pair/PublicPair. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Petitioner Samsung Ex-1004, 0421

UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, VA 22313 - 1450
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ELECTRONIC PAYMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
17/419,713	**03/07/2024 03:18:01 AM Z ET**	**TP204027-US**

Title of Invention

DISPLAY DEVICE

Application Information

APPLICATION TYPE	Utility - U.S. National Stage under 35 USC 371	PATENT #	-
CONFIRMATION #	9383	FILED BY	Wei Te Chung
PATENT CENTER #	64583203	AUTHORIZED BY	-
CUSTOMER #	168853	FILING DATE	06/29/2021
INTL. APPLICATION #	-	INTL. FILING DATE	-
CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	Jing Zhou

Payment Information

PAYMENT METHOD	PAYMENT TRANSACTION ID	PAYMENT AUTHORIZED BY
DA / 603449	**E202437418189505**	**Wei Te Chung**

FEE CODE	DESCRIPTION	ITEM PRICE($)	QUANTITY	ITEM TOTAL($)
1501	UTILITY ISSUE FEE	1200.00	1	1200.00
			TOTAL AMOUNT:	**$1,200.00**

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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P.O. Box 1450
Alexandria, VA 22313 - 1450
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ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
17/419,713	**03/07/2024 03:18:01 AM Z ET**	**TP204027-US**

Title of Invention

DISPLAY DEVICE

Application Information

APPLICATION TYPE	Utility - U.S. National Stage under 35 USC 371	PATENT #	-
CONFIRMATION #	9383	FILED BY	Wei Te Chung
PATENT CENTER #	64583203	FILING DATE	06/29/2021
CUSTOMER #	168853	FIRST NAMED INVENTOR	Jing Zhou
INTL. APPLICATION #	-	INTL. FILING DATE	-
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	-

Documents

TOTAL DOCUMENTS: 1

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
1-TP204027-US.pdf	2	Issue Fee Payment (PTO-85B)	362 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
1-TP204027-US.pdf	28E69DEC0D77BA13CF452C648737EFACE0D03C794484C9D5 83A4673140E13278B0D7486D7E324DA891D7B5738FD4F7F3B A06580BDB97767613C162FAB6B928BA

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National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PART B – FEE(S) TRANSMITTAL

Complete and send this form, together with the applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

By fax, send to: (571) 273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

168853 7590 12/07/2023

Wei Te Chung
1079 Lancer Drive
San Jose, CA 95129

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO	CONFIRMATION NO
17/419,713	06/29/2021	Jing Zhou	TP204027-US	9383

TITLE OF INVENTION:

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	Undiscounted	$1200	$0	$0	$1200	03/07/2024

EXAMINER	ART UNIT	CLASS-SUBCLASS

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363)

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1. PV IP PC
2. Chung, Wei Te
3. Ma, Zhigang

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: WUHAN CHINA STAR OPTOELECTRONICS SEMICONDUCTOR DISPLAY TECHNOLOGY CO., LTD.

(B) RESIDENCE: (CITY and STATE or COUNTRY): Wuhan , CHINA

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☑ Corporation or other private group entity ☐ Government

4a. Fees Submitted: ☑ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

4b. Method of Payment (*Please first reapply any previously paid fee shown above*):

☑ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 603449

5. Change of Entity Status (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29. NOTE: Absent a valid Certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

☐ Applicant asserting small entity status. See 37 CFR 1.27. NOTE: If the application was previously under micro entity status, checking this box will be taken as a notification of loss of entitlement to micro entity status.

☐ Applicant changing to regular undiscounted fee status. NOTE: Checking this box will be taken as a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Wei Te Chung/ Date 03/07/2024

Typed or printed name Wei Te Chung Registration No. 43,325

Petitioner Samsung Ex-1004, 0426

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/419,713	04/09/2024	11957031	TP204027-US	9383

168853 7590 03/20/2024

PVIP
Wei Te Chung
1079 Lancer Drive
San Jose, CA 95129

ISSUE NOTIFICATION

The projected patent number and issue date are specified above. The patent will issue electronically. The electronically issued patent is the official patent grant pursuant to 35 U.S.C. § 153. The patent may be accessed on or after the issue date through Patent Center at https://patentcenter.uspto.gov/. The patent will be available in both the public and the private sides of Patent Center. Further assistance in electronically accessing the patent, or about Patent Center, is available by calling the Patent Electronic Business Center at 1-888-217-9197.

The USPTO is implementing electronic patent issuance with a transition period, during which period the USPTO will mail a ceremonial paper copy of the electronic patent grant to the correspondence address of record. Additional copies of the patent (i.e., certified and presentation copies) may be ordered for a fee from the USPTO's Certified Copy Center at https://certifiedcopycenter.uspto.gov/index.html. The Certified Copy Center may be reached at (800)972-6382.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Center (https://patentcenter.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Patents Stakeholder Experience (OPSE), Stakeholder Support Division (SSD) at (571)-272-4200.

INVENTOR(s) (Please see PATENT CENTER site https://patentcenter.uspto.gov for additional inventors):

Jing Zhou, Wuhan, CHINA;

APPLICANT(s) (Please see PATENT CENTER site https://patentcenter.uspto.gov for additional applicants):

WUHAN CHINA STAR OPTOELECTRONICS SEMICONDUCTOR DISPLAY TECHNOLOGY CO., LTD., Wuhan, CHINA;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

Petitioner Samsung Ex-1004, 0429

United States of America

To Promote the Progress of Science and Useful Arts

The Director

of the United States Patent and Trademark Office has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.

Therefore, this United States

Patent

grants to the person(s) having title to this patent the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States of America or importing the invention into the United States of America, and if the invention is a process, of the right to exclude others from using, offering for sale or selling throughout the United States of America, products made by that process, for the term set forth in 35 U.S.C. 154(a)(2) or (c)(1), subject to the payment of maintenance fees as provided by 35 U.S.C. 41(b). See the Maintenance Fee Notice on the inside of the cover.

Katherine Kelly Vidal

Director of the United States Patent and Trademark Office

Petitioner Samsung Ex-1004, 0430

Maintenance Fee Notice

If the application for this patent was filed on or after December 12, 1980, maintenance fees are due three years and six months, seven years and six months, and eleven years and six months after the date of this grant, or within a grace period of six months thereafter upon payment of a surcharge as provided by law. The amount, number and timing of the maintenance fees required may be changed by law or regulation. Unless payment of the applicable maintenance fee is received in the United States Patent and Trademark Office on or before the date the fee is due or within a grace period of six months thereafter, the patent will expire as of the end of such grace period.

Patent Term Notice

If the application for this patent was filed on or after June 8, 1995, the term of this patent begins on the date on which this patent issues and ends twenty years from the filing date of the application or, if the application contains a specific reference to an earlier filed application or applications under 35 U.S.C. 120, 121, 365(c), or 386(c), twenty years from the filing date of the earliest such application ("the twenty-year term"), subject to the payment of maintenance fees as provided by 35 U.S.C. 41(b), and any extension as provided by 35 U.S.C. 154(b) or 156 or any disclaimer under 35 U.S.C. 253.

If this application was filed prior to June 8, 1995, the term of this patent begins on the date on which this patent issues and ends on the later of seventeen years from the date of the grant of this patent or the twenty-year term set forth above for patents resulting from applications filed on or after June 8, 1995, subject to the payment of maintenance fees as provided by 35 U.S.C. 41(b) and any extension as provided by 35 U.S.C. 156 or any disclaimer under 35 U.S.C. 253.

Petitioner Samsung Ex-1004, 0431

US011957031B2

(12) **United States Patent**
Zhou

(10) **Patent No.: US 11,957,031 B2**
(45) **Date of Patent: Apr. 9, 2024**

(54) **DISPLAY DEVICE**

(71) Applicant: **WUHAN CHINA STAR OPTOELECTRONICS SEMICONDUCTOR DISPLAY TECHNOLOGY CO., LTD.**, Wuhan (CN)

(72) Inventor: **Jing Zhou**, Wuhan (CN)

(73) Assignee: **WUHAN CHINA STAR OPTOELECTRONICS SEMICONDUCTOR DISPLAY TECHNOLOGY CO., LTD.**, Wuhan (CN)

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

(21) Appl. No.: **17/419,713**

(22) PCT Filed: **May 31, 2021**

(86) PCT No.: **PCT/CN2021/097527**
§ 371 (c)(1),
(2) Date: **Jun. 29, 2021**

(87) PCT Pub. No.: **WO2022/241838**
PCT Pub. Date: **Nov. 24, 2022**

(65) **Prior Publication Data**

US 2024/0016037 A1 Jan. 11, 2024

(30) **Foreign Application Priority Data**

May 20, 2021 (CN) 202110548905.2

(51) **Int. Cl.**
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H10K 59/80 (2023.01)
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H10K 102/00 (2023.01)

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(58) **Field of Classification Search**
CPC H10K 59/873; H10K 59/38; H10K 59/871
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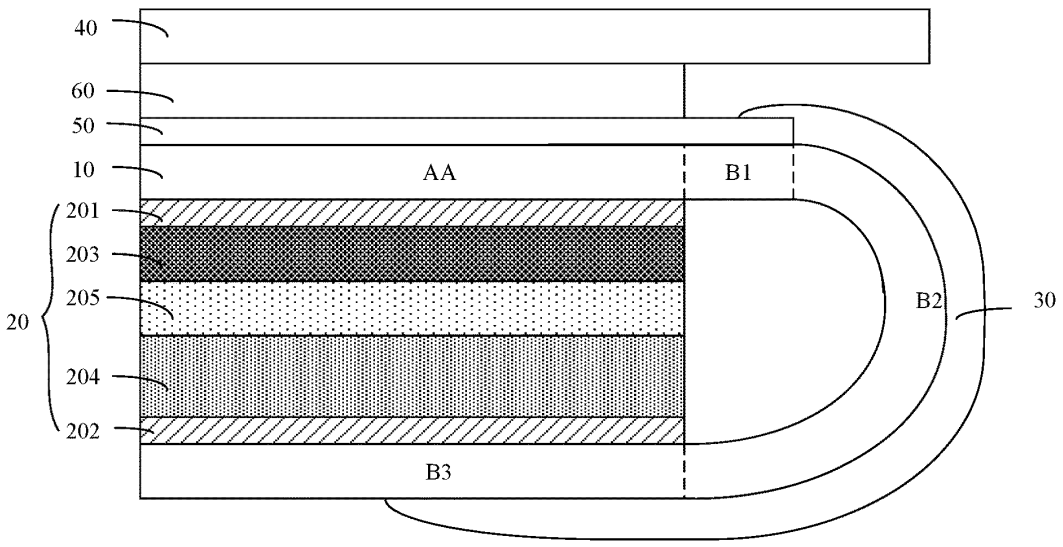
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(57) **ABSTRACT**

A display device is provided. The present disclosure allows a distance between a protective layer and a coverplate to be greater than or equal to a default value in an overlapping area of the protective layer and the coverplate, so the coverplate will not squeeze the protective layer, thereby preventing a risk of cracking the display device.

19 Claims, 3 Drawing Sheets



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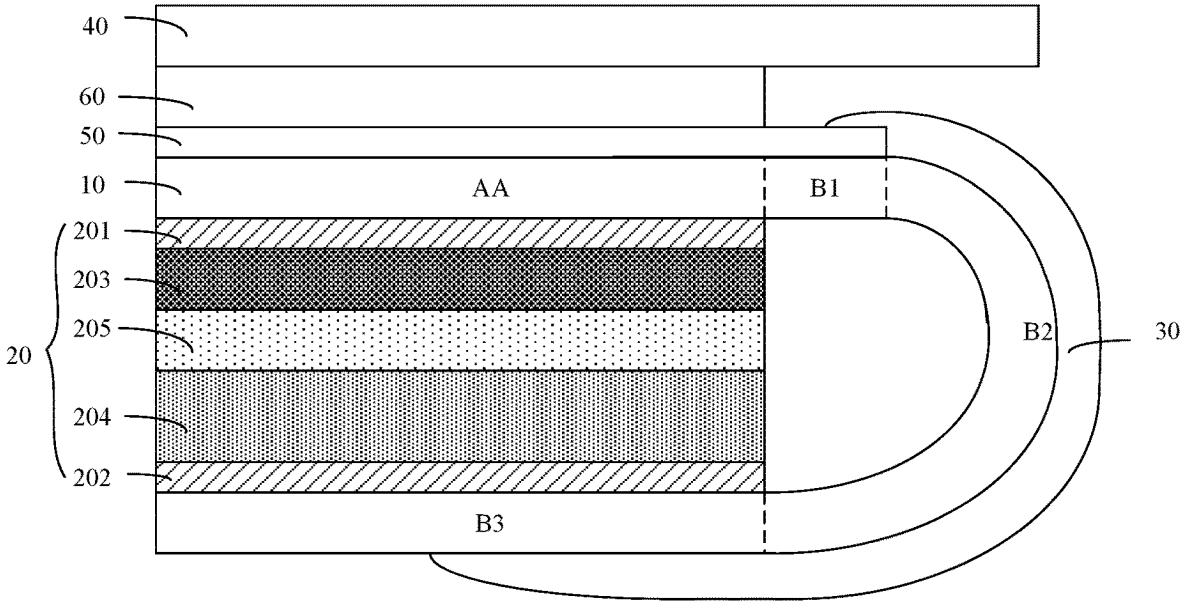

40
60
50
10
AA
B1
201
203
205
20
B2
30
204
202
B3

FIG. 1

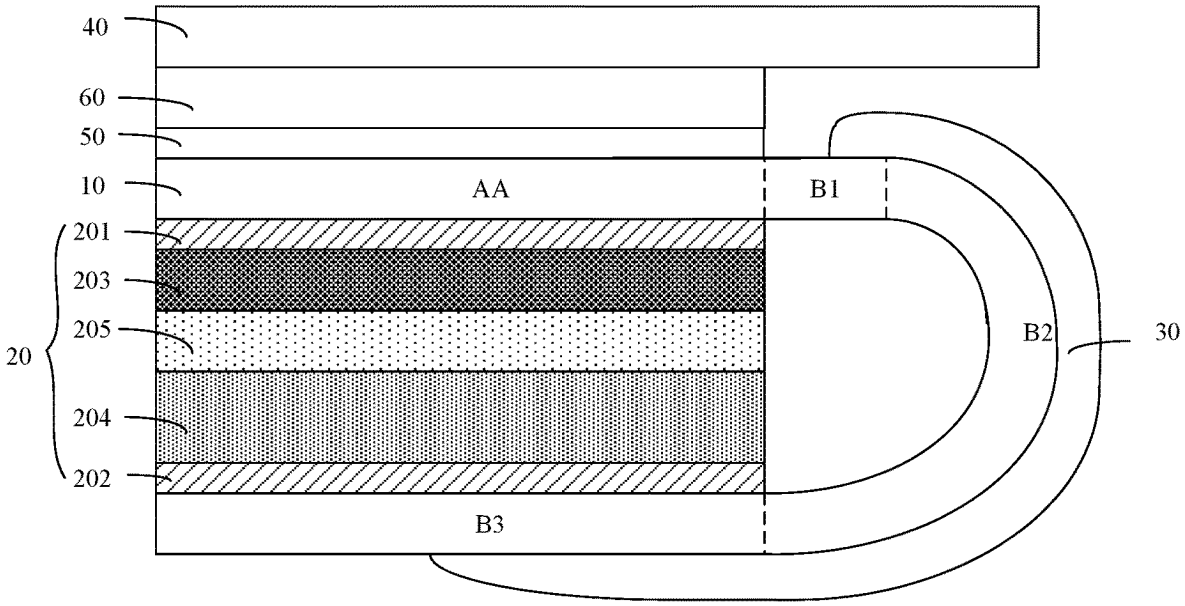

40
60
50
10
AA
B1
201
203
205
20
B2
30
204
202
B3

FIG. 2

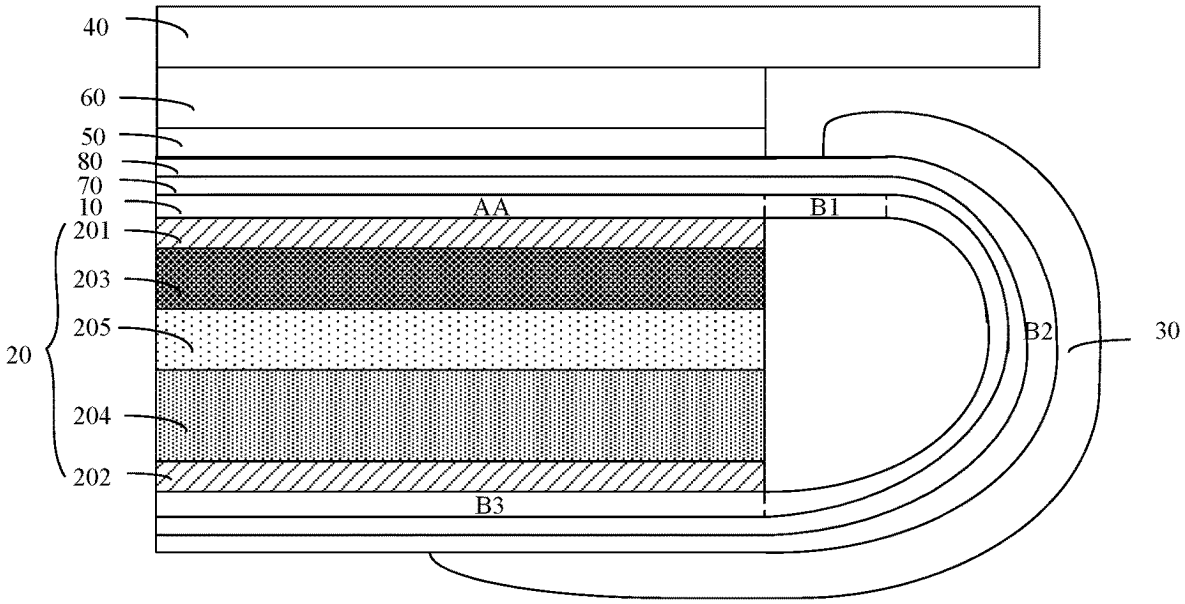

40
60
50
80
70
10
201
203
205
204
202
20
AA
B1
B2
B3
30

FIG. 3

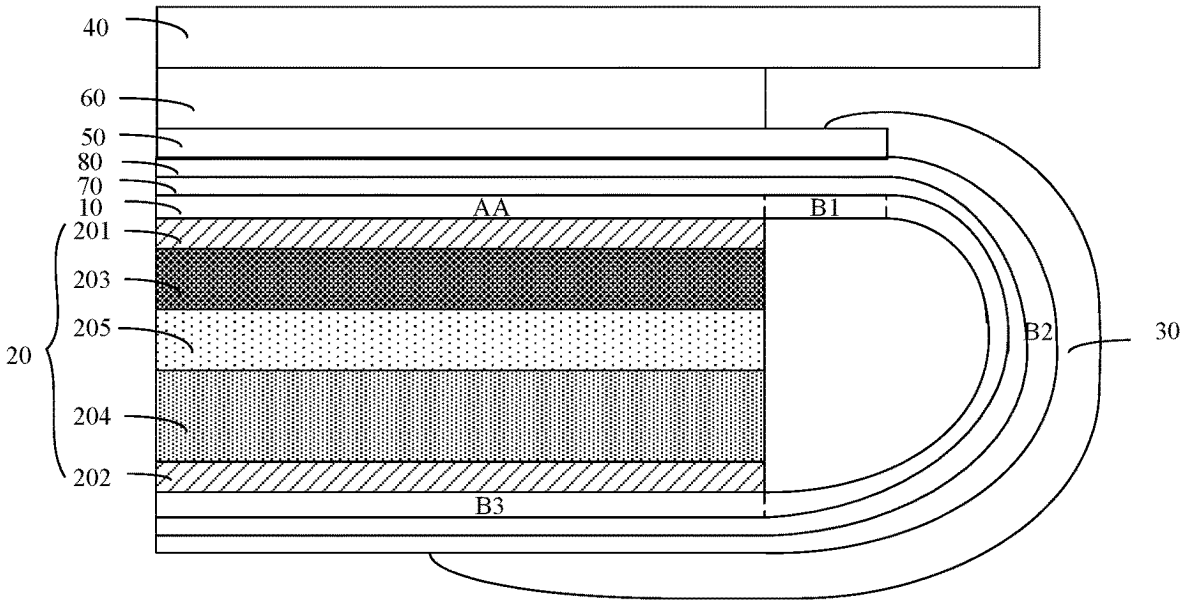

40
60
50
80
70
10
201
203
205
204
202
20
AA
B1
B2
B3
30

FIG. 4

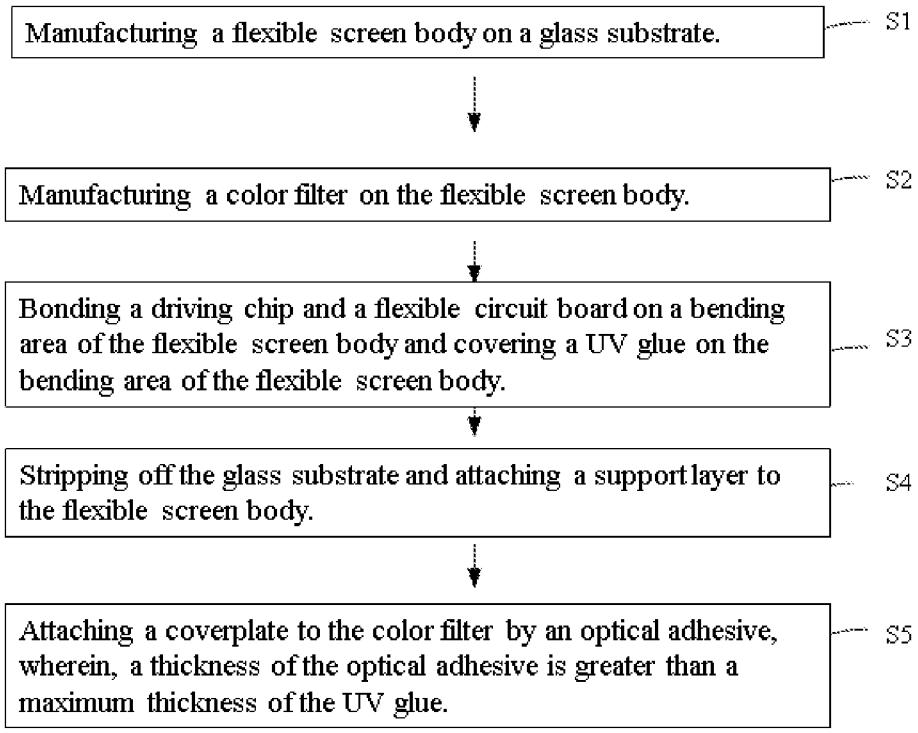

Manufacturing a flexible screen body on a glass substrate.
S1
Manufacturing a color filter on the flexible screen body.
S2
Bonding a driving chip and a flexible circuit board on a bending area of the flexible screen body and covering a UV glue on the bending area of the flexible screen body.
S3
Stripping off the glass substrate and attaching a support layer to the flexible screen body.
S4
Attaching a coverplate to the color filter by an optical adhesive, wherein, a thickness of the optical adhesive is greater than a maximum thickness of the UV glue.
S5

FIG. 5

DISPLAY DEVICE

RELATED APPLICATIONS

This application is a Notional Phase of PCT Patent Application No. PCT/CN2021/097527 having international filing date of May 31, 2021, which claims the benefit of priority of Chinese Patent Application No. 202110548905.2 filed on May 20, 2021. The contents of the above applications are all incorporated by reference as if fully set forth herein in their entirety.

FIELD OF INVENTION

The present disclosure relates to the field of display technologies, and more particularly, to a display device.

BACKGROUND OF INVENTION

For organic light-emitting diode (OLED) display panels, although polarizers can effectively reduce reflectivity of the OLED display panels under strong light, they cause the OLED display panels to lose nearly 58% of light extraction efficiency, which greatly increases a burden of service life for the OLED display panels. In addition, a thickness of the polarizers is about 100 μm, which is a greater thickness, and material of the polarizers is brittle, thereby being unbeneficial for development of dynamic bending products.

In order to develop the dynamic bending products based on the OLED display panels, a POL-less technique is usually used to manufacture the OLED display panels. The POL-less technique means a technique using color filters (CFs) to replace the polarizers.

Wherein, the color filters consist of red color resists, green color resists, blue color resists, and a black matrix (BM). In the OLED display panels, the red color resists, the green color resists, and the blue color resists are responsible for light extraction of red sub-pixel units, green sub-pixel units, and blue sub-pixel units, respectively, and the black matrix is mainly responsible for preventing light leakage of the OLED display panels and reducing reflectivity of the OLED display panels. The color filters can not only reduce the reflectivity of the OLED display panels to a certain degree under the strong light, but can also increase the light extraction efficiency of the OLED display panels from 42% to 60%. In addition, a thickness of the color filters is about 5 μm, which is much less than the thickness of the polarizers, and the color filters have high flexibility, thereby reducing a whole thickness of the OLED display panels and being beneficial for the development of the dynamic bending products.

Further, in order to realize a narrow bezel design of the OLED display panels, bending areas of the OLED display panels are usually bent to a back surface of the OLED display panels, thereby reducing a width of bezels. However, bending of the bending areas of the OLED display panels is prone to cause circuit lines in the OLED display panels to break. In order to prevent breakage of the circuit lines caused by bending, the bending areas of the OLED display panels are usually covered by UV glues, so bending stresses in the bending areas of the OLED display panels can be relieved.

However, a thickness of the UV glues is about 95 μm, and since thicknesses of the color filters and optical adhesives are both thin, when coverplates are attached to the color filters by the optical adhesives, the coverplates will squeeze the UV glues, thereby causing the OLED display panels to have a risk of cracking.

Technical problem: the present disclosure provides a display device to solve a problem of current OLED display panels having the risk of cracking.

SUMMARY OF INVENTION

The present disclosure provides a display device, which includes:

- a flexible screen body including a planar area and a bending area connected to the planar area;
- a color filter disposed on the flexible screen body and at least covering the planar area;
- a protective layer disposed on the flexible screen body and at least covering a part of the bending area; and
- a coverplate disposed on the color filter and at least covering the planar area;
- wherein, in an overlapping area of the protective layer and the coverplate, a distance between the protective layer and the coverplate is greater than or equal to a default value.

In some embodiments, the protective layer is disposed on a surface of the flexible screen body, and a thickness of the protective layer on the surface of the flexible screen body is less than or equal to a distance between one side of the coverplate adjacent to the flexible screen body and one side of the flexible screen body adjacent to the coverplate.

In some embodiments, the display device further includes a touch control layer disposed between the flexible screen body and the color filter and an insulating layer disposed between the touch control layer and the color filter; wherein, the protective layer is disposed on a surface of the insulating layer, and a thickness of the protective layer on the surface of the insulating layer is less than or equal to a distance between one side of the coverplate adjacent to the insulating layer and one side of the insulating layer adjacent to the coverplate.

In some embodiments, the protective layer is further disposed on a surface of the color filter, and the thickness of the protective layer on the surface of the color filter is less than or equal to a distance between one side of the coverplate adjacent to the color filter and one side of the color filter adjacent to the coverplate.

In some embodiments, the bending area includes a transitional bending sub-area, a bending sub-area, and an extending bending sub-area connected to the planar area and defined in sequence, and the transitional bending sub-area is flush with the planar area;

- the protective layer completely covers the bending sub-area and covers at least a part of the transitional bending sub-area; and
- the coverplate is connected to the color filter by an optical adhesive, and the coverplate completely covers the planar area and covers at least the part of the transitional bending sub-area.

In some embodiments, wherein a thickness of the optical adhesive is greater than a maximum thickness of the protective layer on the transitional bending sub-area.

In some embodiments, the protective layer further covers at least a part of the extending bending sub-area.

In some embodiments, the protective layer is a UV glue.

In some embodiments, the display device further includes a support layer, wherein, one side of the support layer supports the planar area and the transitional bending sub-

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area, and another side of the support layer away from the planar area supports the extending bending sub-area.

In some embodiments, the support layer includes a first backplate disposed on one side of the planar area and the transitional bending sub-area away from the coverplate and a second backplate disposed on one side of the transitional bending sub-area away from the protective layer.

In some embodiments, foam is disposed between the first backplate and the second backplate.

In some embodiments, a stiffener plate is disposed between the foam and the second backplate.

In some embodiments, a heat dissipation layer is disposed between the foam and the stiffener plate.

In some embodiments, the default value is greater than 0.

In some embodiments, a distance between one side end of the protective layer adjacent to the planar area and an initial bending position of the flexible screen body is greater than a first default value, wherein, the first default value is greater than or equal to 0, and the initial bending position is a jointed position of the bending sub-area and the transitional bending sub-area.

In some embodiments, a distance between one side end of the protective layer adjacent to the extending bending sub-area and a terminal bending position of the flexible screen body is greater than a second default value, wherein, the second default value is greater than or equal to 0.

In some embodiments, the planar area includes a plurality of red sub-pixel units, green sub-pixel units, and blue sub-pixel units, the color filter includes a plurality of color resists and a black matrix disposed among the color resists, and the color resists include red color resists, green color resists, and blue color resists; and wherein, the red color resists are disposed corresponding to the red sub-pixel units, the green color resists are disposed corresponding to the green sub-pixel units, and the blue color resists are disposed corresponding to the blue sub-pixel units.

In some embodiments, the optical adhesive is an optically clear adhesive (OCA).

In some embodiments, a material of the heat dissipation layer is a metal material or graphite, and the metal material includes one or more combinations of copper foil, aluminum foil, or stainless steel foil.

In some embodiments, the display device further includes a driving unit disposed on one surface of the extending bending sub-area away from the support layer.

Beneficial effect: the display device provided by the present disclosure allows the distance between the protective layer and the coverplate to be greater than or equal to the default value in the overlapping area of the protective layer and the coverplate, so the coverplate will not squeeze the protective layer, thereby preventing a risk of cracking the display device.

DESCRIPTION OF DRAWINGS

FIG. **1** is a schematic structural diagram of a display device according to an embodiment of the present disclosure.

FIG. **2** is a schematic structural diagram of the display device according to another embodiment of the present disclosure.

FIG. **3** is a schematic structural diagram of the display device according to yet another embodiment of the present disclosure.

FIG. **4** is a schematic structural diagram of the display device according to still another embodiment of the present disclosure.

FIG. **5** is a flowchart of a manufacturing method of the display device according to an embodiment of the present disclosure.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

In order to make the purpose, technical solutions, and effects of the present disclosure clearer and more definite, the following further describes the present disclosure in detail with reference to the drawings and embodiments. It should be understood that the specific embodiments described herein are only used to explain the disclosure, and are not used to limit the disclosure.

An embodiment of the present disclosure provides a display device, which may be wearable devices, such as smart bracelets, smart watches, or virtual reality (VR) devices, may be mobile phones, e-books, e-newspapers, TVs, or personal laptops, and may also be bendable and foldable flexible OLED displays or lighting devices. The embodiment of the present disclosure does not specifically limit a specific form of the display device.

FIG. **1** is a schematic structural diagram of the display device according to an embodiment of the present disclosure. As shown in FIG. **1**, the display device includes a flexible screen body **10**, a color filter **50**, a protective layer **30**, and a coverplate **40**. Optionally, the display device can also include a support layer **20** and an optical adhesive **60**. The following describes the flexible screen body **10**, the support layer **20**, the protective layer **30**, the coverplate **40**, the color filter **50**, and the optical adhesive **60** in detail, respectively.

The flexible screen body **10** means a highly flexible screen that can be bent and folded. The flexible screen body **10** can be divided into a planar area AA and a bending area extending from the planar area AA, the planar area AA means an area for displaying, and the bending area means an area that cannot display. The bending area may include a transitional bending sub-area B**1**, a bending sub-area B**2**, and an extending bending sub-area B**3**. Wherein, two opposite ends of the transitional bending sub-area B**1** are connected to the planar area AA and the bending sub-area B**2**, respectively, and two opposite ends of the bending sub-area B**2** are connected to the transitional bending sub-area B**1** and the extending bending sub-area B**3**, respectively. Wherein, the transitional bending sub-area B**1** is flush with the planar area AA, that is, the transitional bending sub-area B**1** and the planar area AA are positioned on a same plane. Both the bending sub-area B**2** and the extending bending sub-area B**3** are not flush with the planar area AA, that is, the bending sub-area B**2** and the planar area AA are positioned on different planes, and the extending bending sub-area B**3** and the planar area AA are positioned on different planes.

Specifically, the flexible screen body **10** includes a flexible substrate. The flexible substrate is a substrate made of a flexible material, which is preferably polyimide (PI). The flexible substrate can be divided into a first area and a second area extending from the first area.

A display layer can be integrated in the first area of the flexible substrate and can include a plurality of display components for displaying pictures, so the first area of the flexible substrate and the display layer can together form the planar area AA of the flexible screen body **10**. The display layer may include different display components, such as thin film transistors, gate electrode lines, data lines, capacitors, anodes, cathodes, and light-emitting layers. A structure of the planar area AA itself of the flexible screen body **10** in this

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embodiment has not been improved, and a commonly used structure of the planar area AA in this field may be used, which is not specifically limited in the embodiment.

The second area of the flexible substrate is provided with an integrated circuit configured to achieve signal transmissions and drive picture displays, thereby allowing the second area of the flexible substrate and the integrated circuit to together form the bending area of the flexible screen body **10**. A structure of the bending area itself of the flexible screen body **10** in this embodiment has not been improved, and a commonly used structure of the bending area in this field may be used, which is not specifically limited in the embodiment.

In order to realize a narrow bezel design of the display device, the bending area of the flexible screen body **10** is usually bent. As shown in FIG. **1**, specifically, the bending sub-area B**2** of the flexible screen body **10** is bent by 180°, thereby allowing an entire body consisting of the planar area AA and the transitional bending sub-area B**1** to be opposite to and in parallel to the extending bending sub-area B**3**. At this time, the bending sub-area B**2** is semi-circular arc shaped, the planar area AA, the transitional bending sub-area B**1**, the bending sub-area B**2**, and the extending bending sub-area B**3** form a receiving groove, and the support layer **20** is disposed in the receiving groove.

It should be noted that in one aspect, since the bending area of the flexible screen body **10** includes the transitional bending sub-area B**1** defined between the planar area AA and the bending sub-area B**2**, an initial bending position of the flexible screen body **10** is a jointed position of the bending sub-area B**2** and the transitional bending sub-area B**1**. That is, the initial bending position of the flexible screen body **10** departs from a jointed position of the planar area AA and the bending area, and both sides of the initial bending position are in the bending area, thereby effectively relieving stress concentration caused by different structures on both sides of the initial bending position of the flexible screen body **10** and realizing protection of the initial bending position of the flexible screen body **10**. In another aspect, since the bending sub-area B**2** is not directly adjacent to the planar area AA and the transitional bending sub-area B**1** is defined between them, stresses acting on the planar area AA is reduced when the bending sub-area B**2** is bent, thereby protecting the planar area AA, for example, preventing the planar area AA from cracking.

One side of the support layer **20** supports the planar area AA and the transitional bending sub-area B**1** of the flexible screen body **10**, and another side of the support layer **20** away from the planar area AA supports the extending bending sub-area B**3** of the flexible screen body **10**. That is, the planar area AA and the transitional bending sub-area B**1** of the flexible screen body **10** are disposed on a same side of the support layer **20**, and the extending bending sub-area B**3** of the flexible screen body **10** is disposed on another side of the support layer **20** away from the planar area AA.

It should be noted that the support layer **20** is mainly configured to fix and support the flexible screen body **10**, thereby preventing the bending sub-area B**2** of the flexible screen body **10** from breaking due to an overly large degree of bending. The support layer **20** may be a material having both hardness and elasticity, so it can not only support the flexible screen body **10**, but can also damp the flexible screen body **10**. The support layer **20** may be one layer or a multi-layered structure, and is not specifically limited in the embodiment.

The protective layer **30** is disposed on one side of the flexible screen body **10** away from the support layer **20** and covers at least a part of the bending area. The protective layer **30** shown in FIG. **1** completely covers the bending sub-area B**2** of the flexible screen body **10** and covers at least a part of the transitional bending sub-area B**1** of the flexible screen body **10**. Wherein, the protective layer **30** shown in FIG. **1** completely covers the bending sub-area B**2** and the transitional bending sub-area B**1** of the flexible screen body **10**. Of course, in other embodiments, the protective layer **30** may also completely cover the bending sub-area B**2** of the flexible screen body **10** and covers the part of the transitional bending sub-area B**1**.

It should be noted that the protective layer **30** completely covers the bending sub-area B**2** of the flexible screen body **10**, thereby relieving bending stresses of the bending sub-area B**2**. The protective layer **30** covers at least the part of the transitional bending sub-area B**1** of the flexible screen body **10**, thereby allowing the protective layer **30** to better relieve bending stresses of the initial bending position of the flexible screen body **10** from one side of the initial bending position of the flexible screen body **10** adjacent to the planar area AA. It should be noted that a distance between one side end of the protective layer **30** adjacent to the planar area AA and the initial bending position of the flexible screen body **10** may be greater than a first default value. Wherein, the first default value is a value greater than or equal to 0 and may be flexibly adjusted according to actual needs, and is not specifically limited in the embodiment.

The planar area AA of the flexible screen body **10** includes red sub-pixel units, green sub-pixel units, and blue sub-pixel units. Wherein, the red sub-pixel units are configured to emit red light, the green sub-pixel units are configured to emit green light, and the blue sub-pixel units are configured to emit blue light.

The color filter **50** is disposed on the side of the flexible screen body **10** away from the support layer **20** and at least covers the planar area AA. The color filter **50** is configured to replace polarizers and is responsible for preventing light leakage of the display device and reducing reflectivity of the display device.

Specifically, the color filter **50** includes a plurality of color resists and a black matrix disposed among the color resists, and the color resists include red color resists, green color resists, and blue color resists. Wherein, the red color resists are disposed corresponding to the red sub-pixel units and are responsible for light extraction of the red sub-pixel units; the green color resists are disposed corresponding to the green sub-pixel units and are responsible for light extraction of the green sub-pixel units; the blue color resists are disposed corresponding to the blue sub-pixel units and are responsible for light extraction of the blue sub-pixel units; and the black matrix is mainly responsible for preventing the light leakage of the display device and reducing the reflectivity of the display device.

The coverplate **40** is disposed on one side of the color filter **50** away from the flexible screen body **10** and at least covers the planar area AA. The coverplate **40** shown in FIG. **1** is connected to the color filter **50** by the optical adhesive **60**. The optical adhesive **60** is configured to bond optical elements and may be an optically clear adhesive (OCA) that has characteristics of transparency, light transmittance above 90%, good bonding strength, ability to be cured at room temperature or a moderate temperature, and small curing shrinkage. In this embodiment, the optical adhesive **60** is configured to bond the coverplate **40** and the color filter **50**. The coverplate **40** is configured to protect the flexible screen body **10**, thereby preventing it from being damaged by external impact.

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In an overlapping area of the protective layer **30** and the coverplate of the display device provided by the embodiment of the present disclosure, a distance between the protective layer **30** and the coverplate **40** is greater than or equal to a default value. It should be noted that the default value is a value greater than 0 and may be flexibly adjusted according to actual needs, and is not specifically limited in the embodiment. Therefore, the coverplate **40** will not squeeze the protective layer **30**, thereby preventing a risk of cracking the display device.

Based on the above embodiments, referring to FIG. **2**, the protective layer **30** is disposed only on a surface of the flexible screen body **10**, and a thickness of the protective layer **30** on the surface of the flexible screen body is less than or equal to a distance between one side of the coverplate **40** adjacent to the flexible screen body **10** and one side of the flexible screen body adjacent to the coverplate **40**.

Based on the above embodiments, referring to FIG. **3**, the display device further includes a touch control layer **70** disposed between the flexible screen body **10** and the color filter **50** and an insulating layer **80** disposed between the touch control layer **70** and the color filter **50**. The protective layer is disposed only on a surface of the insulating layer **80**, and the thickness of the protective layer **30** on the surface of the insulating layer **80** is less than or equal to a distance between one side of the coverplate **40** adjacent to the insulating layer **80** and one side of the insulating layer **80** adjacent to the coverplate **40**.

Based on the above embodiments, referring to FIGS. **1** and **4**, the protective layer **30** is further disposed on a surface of the color filter **50**, and the thickness of the protective layer **30** on the surface of the color filter **50** is less than or equal to a distance between one side of the coverplate **40** adjacent to the color filter **50** and one side of the color filter **50** adjacent to the coverplate **40**.

Based on the above embodiments, in this embodiment, a thickness of the optical adhesive **60** is greater than a maximum thickness of the protective layer **30** on the transitional bending sub-area B**1** of the flexible screen body **10**. Therefore, it can ensure that a predetermined spacing is between the coverplate **40** covering the transitional bending sub-area B**1** of the flexible screen body **10** and the protective layer **30** covering the transitional bending sub-area B**1** of the flexible screen body **10**. Therefore, the coverplate **40** will not squeeze the protective layer **30**, thereby preventing the risk of cracking the display device.

Based on the above embodiments, the display device of the embodiment will be further described. The protective layer **30** further covers at least a part of the extending bending sub-area B**3** of the flexible screen body **10**, thereby better relieving bending stresses of a terminal bending position of the flexible screen body **10**. It should be noted that a distance between one side end of the protective layer **30** adjacent to the extending bending sub-area B**3** and the terminal bending position of the flexible screen body **10** may also be greater than a second default value. Wherein, the second default value is a value greater than or equal to 0 and may be flexibly adjusted according to actual needs, and is not specifically limited in the embodiment. Wherein, the protective layer **30** shown in FIG. **1** covers the part of the extending bending sub-area B**3** of the flexible screen body **10**. Of course, in other embodiments, the protective layer **30** may also completely cover the extending bending sub-area B**3** of the flexible screen body **10**.

Based on the above embodiments, in some embodiments, the protective layer **30** is a UV glue. Of course, in other embodiments, the protective layer **30** is not limited to the UV glue and may also be thermal curing adhesives or other kinds of photo curing adhesives, and is not specifically limited in the embodiment. It should be noted that in a case that the distance between the coverplate **40** and the protective layer **30** is greater than 0, a skilled person in the art can set a suitable thickness for the protective layer **30** according to a size and type of the flexible screen body **10**, a bending radius of the bending sub-area B**2**, flexibility and an ability to relieve stresses of the protective layer **30**, and is not specifically limited in the embodiment.

Based on the above embodiments, the display device of the embodiment will be further described. The support layer **20** includes a first backplate **201** disposed on one side of the planar area AA and the transitional bending sub-area B**1** of the flexible screen body **10** that are away from the cover plate **40**, and a second backplate **202** disposed on one side of the extending bending sub-area B**3** of the flexible screen body **10** that is away from the protective layer **30**. Wherein, the extending bending sub-area B**3** may be fixed onto the second backplate **202** by gluing or physical methods.

The first backplate **201** is configured to support and protect the planar area AA and the transitional bending sub-area B**1** of the flexible screen body **10**, thereby preventing them from being damaged by the external impact. The second backplate **202** is configured to support and protect the extending bending sub-area B**3** of the flexible screen body **10**, thereby preventing it from being damaged by the external impact. Materials of the first backplate **201** and the second backplate **202** may be polyethylene terephthalate (PET) material. Since the PET material has advantages of low elastic modulus and not easily expanding when heated, the first backplate **201** and the second backplate **202** manufactured using the PET material will not deform with changes of an environment temperature, which reduces a probability of peeling between the first backplate **201** and film layers that are connected thereto and reduces a probability of peeling between the second backplate **202** and film layers that are connected thereto, thereby improving yields and reliability of the display device.

Further, in order to prevent the first backplate **201** and the second backplate **202** from affecting bending of the bending sub-area B**2** of the flexible screen body **10**, it must be ensured that the first backplate **201** and the second backplate **202** both avoid the bending sub-area B**2**. Preferably, in order to better support the planar area AA and the transitional bending sub-area B**1** of the flexible screen body **10**, an edge of the first backplate **201** coincides with the initial bending position of the flexible screen body **10**. Similarly, in order to better support the extending bending sub-area B**3** of the flexible screen body an edge of the second backplate **202** coincides with the terminal bending position of the flexible screen body **10**.

Based on the above embodiments, in some embodiments, the support layer **20** further includes a height-increased block disposed between the first backplate **201** and the second backplate **202**. A height of the height-increased block may be adjusted according to a width of the bending sub-area B**2** of the flexible screen body **10**, and is not specifically limited in the embodiment. The height-increased block may be a material, such as silica gel, and may have certain elasticity and hardness. The height-increased block has certain hardness to prevent the flexible screen body **10** from being squeezed and deformed, and has certain elasticity to prevent the flexible screen body **10** from being damaged by local stresses.

Specifically, the height-increased block is disposed avoiding the bending sub-area B**2** of the flexible screen body **10**.

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Of course, in other embodiments, one surface of one end of the height-increased block adjacent to the bending sub-area B**2** of the flexible screen body **10** matches a shape of the bending sub-area B**2** after bending, which allows one side surface of the bending sub-area B**2** adjacent to the height-increased block to fit with the surface of the height-increased block, thereby having a certain supporting effect on the bending sub-area B**2** and being uneasy to deform and to be damaged. It can be understood that in other embodiments, a distance between the planar area AA and the extending bending sub-area B**3** of the flexible screen body **10** can be ensured by increasing thicknesses of the first backplate **201** and the second backplate **202** or adding other supporting structures.

Based on the above embodiments, in some embodiments, a foam **203** is disposed between the first backplate **201** and the second backplate **202**. It should be noted that the foam **203** is a foamed material of plastic particles, and it can play a role of buffering and shielding light.

Based on the above embodiments, in some embodiments, a stiffener plate **204** is disposed between the foam **203** and the second backplate **202**. It should be noted that the stiffener plate **204** is configured to improve strength of the flexible screen body **10**. Wherein, the stiffener plate **204** may be a polyimide layer or a graphite layer. Wherein, an outer surface of the graphite layer may also be covered using polyimide, and is not specifically limited in the embodiment.

Based on the above embodiments, in some embodiments, a heat dissipation layer **205** is disposed between the foam **203** and the stiffener plate **204**. Wherein, the heat dissipation layer **205** plays a role of shielding and heat dissipating, and a material of the heat dissipation layer **205** is a heat dissipating material and specifically may be a metal material or graphite. Wherein, the metal material may be copper foil, aluminum foil, or stainless steel foil, and it is not specifically limited in the embodiment.

Based on the above embodiments, in some embodiments, the display device further includes a driving unit disposed on the extending bending sub-area B**3**. Specifically, the driving unit is disposed on a surface of the extending bending sub-area B**3** of the flexible screen body **10** away from the support layer **20**. The driving unit includes a driving chip and a flexible circuit board. Wherein, the driving chip and the flexible circuit board are both disposed on the surface of the extending bending sub-area B**3** of the flexible screen body **10** away from the support layer **20**, and a distance between the flexible circuit board and the driving chip is greater than 0.

Based on the above embodiments, in some embodiments, the planar area AA of the flexible screen body **10** includes the flexible substrate, the thin film transistors, display components, and an encapsulation layer. Wherein, the flexible substrate is disposed on the first backplate **201**, the thin film transistors are disposed on the flexible substrate, the display components are disposed on the thin film transistors, and the encapsulation layer is disposed on the display components.

The flexible substrate is the substrate made of the flexible material, which is preferably polyimide (PI).

The display components are configured to emit light and usually include the anodes disposed on the thin film transistors, hole injection layers (HILs) disposed on the anodes, hole transport layers (HTLs) disposed on the hole injection layers, light-emitting layers (emission layers, EMLs) disposed on the hole transport layers, electron transport layers (ETLs) disposed on the light-emitting layers, electron injection layers (EILs) disposed on the electron transport layers, and the cathodes disposed on the electron injection layers. Optionally, hole blocking layers (HBLs), electron blocking layers (EBLs), and capping layers (CPLs) may also be disposed in the display components.

The light-emitting layers include the red sub-pixel units, the green sub-pixel units, and the blue sub-pixel units. Wherein, the red sub-pixel units are configured to emit the red light, the green sub-pixel units are configured to emit the green light, and the blue sub-pixel units are configured to emit the blue light.

The color filter **50** is configured to replace the polarizers and is responsible for preventing the light leakage of the display device and reducing the reflectivity of the display device. Specifically, the color filter **50** includes the plurality of color resists and the black matrix disposed among the color resists, and the color resists include the red color resists, the green color resists, and the blue color resists. Wherein, the red color resists are disposed corresponding to the red sub-pixel units and are responsible for the light extraction of the red sub-pixel units; the green color resists are disposed corresponding to the green sub-pixel units and are responsible for the light extraction of the green sub-pixel units; the blue color resists are disposed corresponding to the blue sub-pixel units and are responsible for the light extraction of the blue sub-pixel units; and the black matrix is mainly responsible for preventing the light leakage of the display device and reducing the reflectivity of the display device.

The encapsulation layer is configured to isolate external water and oxygen for the display device, thereby ensuring the yields of the display devices. The encapsulation layer is usually a sandwich structure composed of an organic layer, an inorganic layer, and another organic layer.

Based on the above embodiments, a manufacturing method of the display device mentioned above in the embodiments is described in this embodiment. FIG. **5** is a flowchart of the manufacturing method of the display device according to an embodiment of the present disclosure. As shown in FIG. **5**, the manufacturing method includes following steps.

S**1**: manufacturing the flexible screen body **10** on a glass substrate.

The flexible screen body **10** means the highly flexible screen that can be bent and folded. The flexible screen body **10** can be divided into the planar area AA and the bending area extending from the planar area AA, the planar area AA means the area for displaying, and the bending area means the area that cannot display. The bending area includes the transitional bending sub-area B**1**, the bending sub-area B**2**, and the extending bending sub-area B**3**. Wherein, the two opposite ends of the transitional bending sub-area B**1** are connected to the planar area AA and the bending sub-area B**2**, respectively, and the two opposite ends of the bending sub-area B**2** are connected to the transitional bending sub-area B**1** and the extending bending sub-area B**3**, respectively. Wherein, the transitional bending sub-area B**1** is flush with the planar area AA, that is, the transitional bending sub-area B**1** and the planar area AA are positioned on the same plane. Both the bending sub-area B**2** and the extending bending sub-area B**3** are not flush with the planar area AA, that is, the bending sub-area B**2** and the planar area AA are positioned on different planes, and the extending bending sub-area B**3** and the planar area AA are positioned on different planes.

S**2**: manufacturing the color filter **50** on the flexible screen body **10**.

Specifically, the planar area AA of the flexible screen body **10** includes the red sub-pixel units, the green sub-pixel

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units, and the blue sub-pixel units. The color filter **50** includes the plurality of color resists and the black matrix disposed among the color resists, and the color resists include the red color resists, the green color resists, and the blue color resists. The red color resists are disposed corresponding to the red sub-pixel units, the green color resists are disposed corresponding to the green sub-pixel units, and the blue color resists are disposed corresponding to the blue sub-pixel units. It should be noted that in some embodiments, a planarization layer may be manufactured on the color filter **50** to planarize the color filter **50**.

S**3**: bonding the driving chip and the flexible circuit board on the bending area of the flexible screen body **10** and covering the UV glue on the bending area of the flexible screen body **10**.

Specifically, the driving chip and the flexible circuit board are both disposed on the surface of the extending bending sub-area B**3** of the flexible screen body **10** away from the support layer **20**, and the distance between the flexible circuit board and the driving chip is greater than 0. The bending area of the flexible screen body **10** is covered by the UV glue to allow the UV glue to completely cover the bending sub-area B**2** and to cover at least the part of the transitional bending sub-area B**1**.

S**4**: stripping off the glass substrate and attaching the support layer **20** to the flexible screen body **10**.

Specifically, the side of the support layer **20** supports the planar area AA and the transitional bending sub-area B**1** of the flexible screen body **10**, and the another side of the support layer **20** away from the planar area AA supports the extending bending sub-area B**3** of the flexible screen body **10**. That is, the planar area AA and the transitional bending sub-area B**1** of the flexible screen body **10** are disposed on the same side of the support layer **20**, and the extending bending sub-area B**3** of the flexible screen body **10** is disposed on the another side of the support layer **20** away from the planar area AA. It should be noted that the support layer **20** is mainly configured to fix and support the flexible screen body **10**, thereby preventing the bending sub-area B**2** of the flexible screen body **10** from breaking due to the overly large degree of bending. The support layer **20** may be the material having both hardness and elasticity, so it can not only support the flexible screen body **10**, but can also damp the flexible screen body **10**. The support layer **20** may be one layer or the multi-layered structure, and is not specifically limited in the embodiment.

S**5**: attaching the coverplate **40** to the color filter **50** by the optical adhesive **60**, wherein, the thickness of the optical adhesive **60** is greater than the maximum thickness of the UV glue.

Specifically, the coverplate **40** is attached to the color filter **50** using the optical adhesive **60** to allow the coverplate **40** to completely cover the planar area AA of the flexible screen body **10** and to cover at least the part of the transitional bending sub-area B**1** of the flexible screen body **10**. Since the thickness of the optical adhesive **60** is greater than the maximum thickness of the UV glue, the coverplate **40** will not generate pressures on the UV glue during a bonding process of the coverplate **40** and the color filter **50**, thereby reducing a module processing risk of the display device.

It should be noted that the numbers of the above steps do not strictly represent the order of executing the steps. In some embodiments, the corresponding steps can be executed strictly according to the order of the numbers of the above steps. Of course, in other embodiments, some steps may be executed at a same time or executed in a reverse order, which is not specifically limited in the embodiment of the present disclosure.

It can be understood that for a person of ordinary skill in the art, equivalent replacements or changes can be made according to the technical solution of the present disclosure and its inventive concept, and all these changes or replacements should fall within the protection scope of the claims attached to the present disclosure.

What is claimed is:

1. A display device, comprising:

a flexible screen body comprising a planar area and a bending area connected to the planar area;

a color filter disposed on the flexible screen body and at least covering the planar area;

a protective layer disposed on the flexible screen body and at least covering a part of the bending area; and

a coverplate disposed on the color filter and at least covering the planar area;

wherein in an overlapping area of the protective layer and the coverplate, a distance between the protective layer and the coverplate is greater than or equal to a default value, wherein the default value is greater than 0.

2. The display device according to claim **1**, wherein the protective layer is disposed on a surface of the flexible screen body, and a thickness of the protective layer on the surface of the flexible screen body is less than or cqual to a distance between one side of the coverplate adjacent to the flexible screen body and one side of the flexible screen body adjacent to the coverplate.

3. The display device according to claim **1**, further comprising a touch control layer disposed between the flexible screen body and the color filter and an insulating layer disposed between the touch control layer and the color filter; wherein the protective layer is disposed on a surface of the insulating layer, and a thickness of the protective layer on the surface of the insulating layer is less than or equal to a distance between one side of the coverplate adjacent to the insulating layer and one side of the insulating layer adjacent to the coverplate.

4. The display device according to claim **2**, wherein the protective layer is further disposed on a surface of the color filter, and a thickness of the protective layer on the surface of the color filter is less than or equal to a distance between one side of the coverplate adjacent to the color filter and one side of the color filter adjacent to the coverplate.

5. The display device according to claim **1**, wherein the bending area comprises a transitional bending sub-area, a bending sub-area, and an extending bending sub-area defined in sequence, and the transitional bending sub-area is connected to and flush with the planar area;

the protective layer completely covers the bending sub-area and covers at least a part of the transitional bending sub-area; and

the coverplate is connected to the color filter by an optical adhesive, and the coverplate completely covers the planar area and covers at least the part of the transitional bending sub-area.

6. The display device according to claim **5**, wherein a thickness of the optical adhesive is greater than a maximum thickness of the protective layer on the transitional bending sub-area.

7. The display device according to claim **5**, wherein the protective layer further covers at least a part of the extending bending sub-area.

8. The display device according to claim **5**, wherein the protective layer is a UV glue.

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9. The display device according to claim **5**, further comprising:

a support layer, wherein one side of the support layer supports the planar area and the transitional bending sub-area, and another side of the support layer away from the planar area supports the extending bending sub-area.

10. The display device according to claim **9**, wherein the support layer comprises a first backplate disposed on one side of the planar area and the transitional bending sub-area away from the coverplate and a second backplate disposed on one side of the extending bending sub-area away from the protective layer.

11. The display device according to claim **10**, wherein a foam is disposed between the first backplate and the second backplate.

12. The display device according to claim **11**, wherein a stiffener plate is disposed between the foam and the second backplate.

13. The display device according to claim **12**, wherein a heat dissipation layer is disposed between the foam and the stiffener plate.

14. The display device according to claim **5**, wherein a distance between one side end of the protective layer adjacent to the planar area and an initial bending position of the flexible screen body is greater than a first default value, wherein the first default value is greater than or equal to 0, and the initial bending position is a jointed position of the bending sub-area and the transitional bending sub-area.

15. The display device according to claim **14**, wherein a distance between one side end of the protective layer adjacent to the extending bending sub-area and a terminal bending position of the flexible screen body is greater than a second default value, wherein the second default value is greater than or equal to 0.

16. The display device according to claim **1**, wherein the planar area comprises a plurality of red sub-pixel units, green sub-pixel units, and blue sub-pixel units, the color filter comprises a plurality of color resists and a black matrix disposed among the color resists, and the color resists comprise red color resists, green color resists, and blue color resists; and wherein the red color resists are disposed corresponding to the red sub-pixel units, the green color resists are disposed corresponding to the green sub-pixel units, and the blue color resists are disposed corresponding to the blue sub-pixel units.

17. The display device according to claim **5**, wherein the optical adhesive is an optically clear adhesive (OCA).

18. The display device according to claim **13**, wherein a material of the heat dissipation layer is a metal material or graphite, and the metal material comprises one or more combinations of copper foil, aluminum foil, or stainless steel foil.

19. The display device according to claim **9**, further comprising a driving unit disposed on one surface of the extending bending sub-area away from the support layer.

* * * * *

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/419,713	06/29/2021	Jing Zhou	TP204027-US	9383

168853 7590 04/09/2024

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Wei Te Chung
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EXAMINER
HO, ANTHONY

ART UNIT	PAPER NUMBER
2817	

NOTIFICATION DATE	DELIVERY MODE
04/09/2024	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

admin.pvip@pvipus.com
wetchung@hotmail.com

APPLICATION NO.	ISSUE DATE	PATENT NO.
17/419,713	09-Apr-2024	11957031

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San Jose, CA 95129

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ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
17/419,713	**12/29/2025 01:34:36 AM Z ET**	**TP204027-US**

Title of Invention

DISPLAY DEVICE

Application Information

APPLICATION TYPE	Utility - U.S. National Stage under 35 USC 371	PATENT #	11957031
CONFIRMATION #	9383	FILED BY	Wei Te Chung
PATENT CENTER #	73763054	FILING DATE	06/29/2021
CUSTOMER #	168853	FIRST NAMED INVENTOR	Jing Zhou
INTL. APPLICATION #	-	INTL. FILING DATE	-
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	-

Documents

TOTAL DOCUMENTS: 2

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
sb0044.pdf	2	Request for Certificate of Correction	804 KB
statement.pdf	2	Transmittal Letter	173 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
sb0044.pdf	DAF9B002E6B351DA9CD7F1615AACDDDD657C8D1740634D0 CB9939AF7375A55769BA52E4B721F64A79F614C56DC5D0A62 AB2F73DBEF45389D704FDEEBE55482E3

statement.pdf

DF85C643451FF90613E78062B94C8417CCD54ADEFBA3D3221
C07CA42324F64F1943DD7E935D1FB19CC0BC88323135E87B9
73EBDD0DCB040E23AF363409C6D414

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If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

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PTO/SB/44 (09-07)
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CERTIFICATE OF CORRECTION

PATENT NO. : 11,957,031

APPLICATION NO.: 17/419,713

ISSUE DATE : 04/09/2024

INVENTOR(S) : Jing Zhou

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 12, line 27, -cqual-
should read -equal-

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1079 Lancer Drive

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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Jing Zhou	)	Examiner: ANTHONY HO
	)	Group Art Unit: 2817
Patent No.: 11,957,031	)	
	)	Dated: 12/29/2025
Issued: 04/09/2024	)	
	)	
Application No: 17/419,713	)	
	)	
Filed: 06/29/2021	)	
	)	
Confirmation No.: 9383	)	

Commissioner for Patents
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Alexandria, VA 22313-1450

REQUEST FOR CERTIFICATE OF CORRECTION UNDER 37 CFR 1.322

Dear Sir/Madam:

In connection with the above-identified patent, the owner of the patent hereby requests for a Certificate of correction of Office mistake under 37 CFR 1.322.

In claim **2**, line **4**, "**cqual**" should be "**equal**" due to the typo, of which a screenshot is shown next page.

Petitioner Samsung Ex-1004, 0450

2. The display device according to claim 1, wherein the protective layer is disposed on a surface of the flexible screen body, and a thickness of the protective layer on the surface of the flexible screen body is less than or equal to a distance between one side of the coverplate adjacent to the flexible screen body and one side of the flexible screen body adjacent to the coverplate.

Clearly, this typo is a clerical error made by the Office.

A certificate of correction is hereby requested to correct such a typo ***in an expedited manner*** according to MPEP 1480.01 Expedited Issuance of Certificates of Correction – Error Attributable to Office.

Form PTO/SB/44 is also enclosed to specifically indicate the text of the correction.

It is believed that no fee is required for this correction due to Office's mistake. Anyhow, if there are any fee deficiencies thereof, please charge to DA 603449.

Respectfully submitted,
Jing Zhou

By /Wei Te Chung/
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Email: wetchung@hotmail.com

Petitioner Samsung Ex-1004, 0451

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Jing Zhou	)	Examiner: ANTHONY HO
	)	Group Art Unit: 2817
Patent No.: 11,957,031	)	
	)	Dated: 01/14/2026
Issued: 04/09/2024	)	
Application No: 17/419,713	)	
Filed: 06/29/2021	)	
Confirmation No.: 9383	)	

Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

REQUEST FOR CERTIFICATE OF CORRECTION UNDER 37 CFR 1.322

Dear Sir/Madam:

The previous Form PTO/SB/44 filed **12/29/2025** did not use the double hyphens(-- --) to enclose the added subject matter. The concurrently submitted updated PTO/SB/44 is now using the double hyphens (-- --) to enclose the added subject matter, i.e., equal, in a proper format.

It is believed that no fee is required for this correction due to Office's mistake. Anyhow, if there are any fee deficiencies thereof, please charge to DA 603449.

Petitioner Samsung Ex-1004, 0452

Respectfully submitted,
Jing Zhou

By /Wei Te Chung/
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Email: wetchung@hotmail.com

Petitioner Samsung Ex-1004, 0453

PTO/SB/44 (09-07)
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CERTIFICATE OF CORRECTION

PATENT NO. : 11,957,031

APPLICATION NO.: 17/419,713

ISSUE DATE : 04/09/2024

INVENTOR(S) : Jing Zhou

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 12, line 27, -cqual-
should read --equal--

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ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
17/419,713	**01/14/2026 09:39:28 PM Z ET**	**TP204027-US**

Title of Invention

DISPLAY DEVICE

Application Information

APPLICATION TYPE	Utility - U.S. National Stage under 35 USC 371	PATENT #	11957031
CONFIRMATION #	9383	FILED BY	Wei Te Chung
PATENT CENTER #	73987612	FILING DATE	06/29/2021
CUSTOMER #	168853	FIRST NAMED INVENTOR	Jing Zhou
INTL. APPLICATION #	-	INTL. FILING DATE	-
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	-

Documents

TOTAL DOCUMENTS: 1

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
correctionupdated.pdf	4	Request for Certificate of Correction	425 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
correctionupdated.pdf	FDBDD1DA4385BD50E1A623532194423267B1C3B70D20A6A6CC9F1D9C3957BCA26B6CAB4A2C27308D1D6A08C49B9F92C79A1680AA09EDBFDF2F50A2C798974222

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as

described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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CERTIFICATE OF CORRECTION

PATENT NO. : 11,957,031 B2
APPLICATION NO. : 17/419713
DATED : April 9, 2024
INVENTOR(S) : Jing Zhou

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Claims

Column 12, Line 27, -cqual- should read -equal-

Signed and Sealed this
Twenty-seventh Day of January, 2026

John A. Squires
Director of the United States Patent and Trademark Office

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

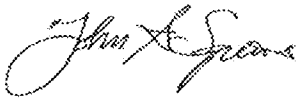
PATENT NO. : 11,957,031 B2
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John A. Squires
Director of the United States Patent and Trademark Office

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/419,713	06/29/2021	Jing Zhou	TP204027-US	9383

168853 7590 01/27/2026

PVIP
Wei Te Chung
1079 Lancer Drive
San Jose, CA 95129

EXAMINER
HO, ANTHONY

ART UNIT	PAPER NUMBER
2817	

NOTIFICATION DATE	DELIVERY MODE
01/27/2026	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

admin.pvip@pvipus.com
wetchung@hotmail.com

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APPLICATION NO.	ISSUE DATE	PATENT NO.
17/419,713	27-Jan-2026	11957031

PVIP
Wei Te Chung
San Jose, CA 95129

ELECTRONIC CERTIFICATE OF CORRECTION NOTIFICATION

Your electronic certificate of correction is now available, and can be accessed via Patent Center at https://patentcenter.uspto.gov.

The electronic certificate of correction is the official certificate of correction under 35 U.S.C. 254 or 255. For more information, please visit https://www.uspto.gov/electronicgrants.

Petitioner Samsung Ex-1004, 0461

AO 120 (Rev. 08/10)

TO:	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court for the Eastern District of Texas on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
2:26-cv-228	3/19/2026	for the Eastern District of Texas

PLAINTIFF	DEFENDANT
WUHAN CHINA STAR OPTOELECTRONICS SEMICONDUCTOR DISPLAY TECHNOLOGY CO., LTD.	SAMSUNG DISPLAY CO., LTD., WALMART INC., and BEST BUY CO. LTD.

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	12,133,429	3/1/2022	WUHAN CHINA STAR OPTOELECTRONICS SEMICONDUCTO
2	11,957,031	9/8/2021	WUHAN CHINA STAR OPTOELECTRONICS SEMICONDUCTO
3	11,257,891	12/16/2018	WUHAN CHINA STAR OPTOELECTRONICS SEMICONDUCTO
4			
5			

In the above---entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE

Copy 1—Upon initiation of action, mail this copy to Director **Copy 3—Upon termination of action, mail this copy to Director**
Copy 2—Upon filing document adding patent(s), mail this copy to Director **Copy 4—Case file copy**