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CHUNG et al.(10) **Pub. No.: US 2013/0033662 A1**(43) **Pub. Date: Feb. 7, 2013**(54) **DISPLAY PANEL AND DISPLAY APPARATUS**
COMPRISING THE SAME(52) **U.S. CL.** **349/96**(75) Inventors: **Seong-eun CHUNG**, Seoul (KR);
Il-yong JUNG, Yongin-si (KR)(57) **ABSTRACT**(73) Assignee: **SAMSUNG ELECTRONICS CO.,**
LTD., Suwon-si (KR)(21) Appl. No.: **13/566,441**(22) Filed: **Aug. 3, 2012**(30) **Foreign Application Priority Data**

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A display panel and a display apparatus including the same which employs a wire grid polarizing plate are provided. The display panel includes: first and second substrates; a liquid crystal layer which is interposed between the first and second substrates; first and second electrodes, which are interposed respectively between the first substrate and the liquid crystal layer and between the liquid crystal layer and the second substrate, and which apply power to the liquid crystal layer; first and second wire grid polarizing plates which are formed on a surface of each of the first and second substrates and allow polarized light to be transmitted therethrough; and a phase difference compensation film which is interposed between the first and second wire grid polarizing plates and compensates for a phase difference of incident light.

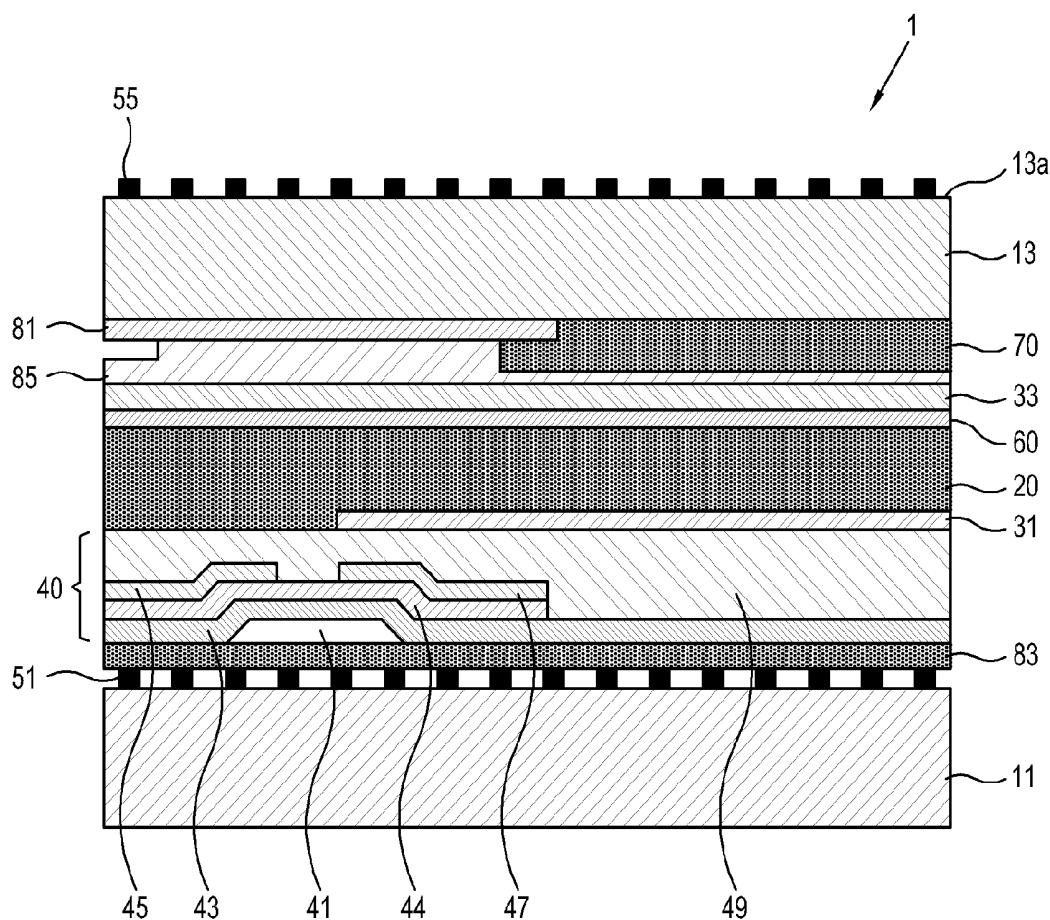


FIG. 1

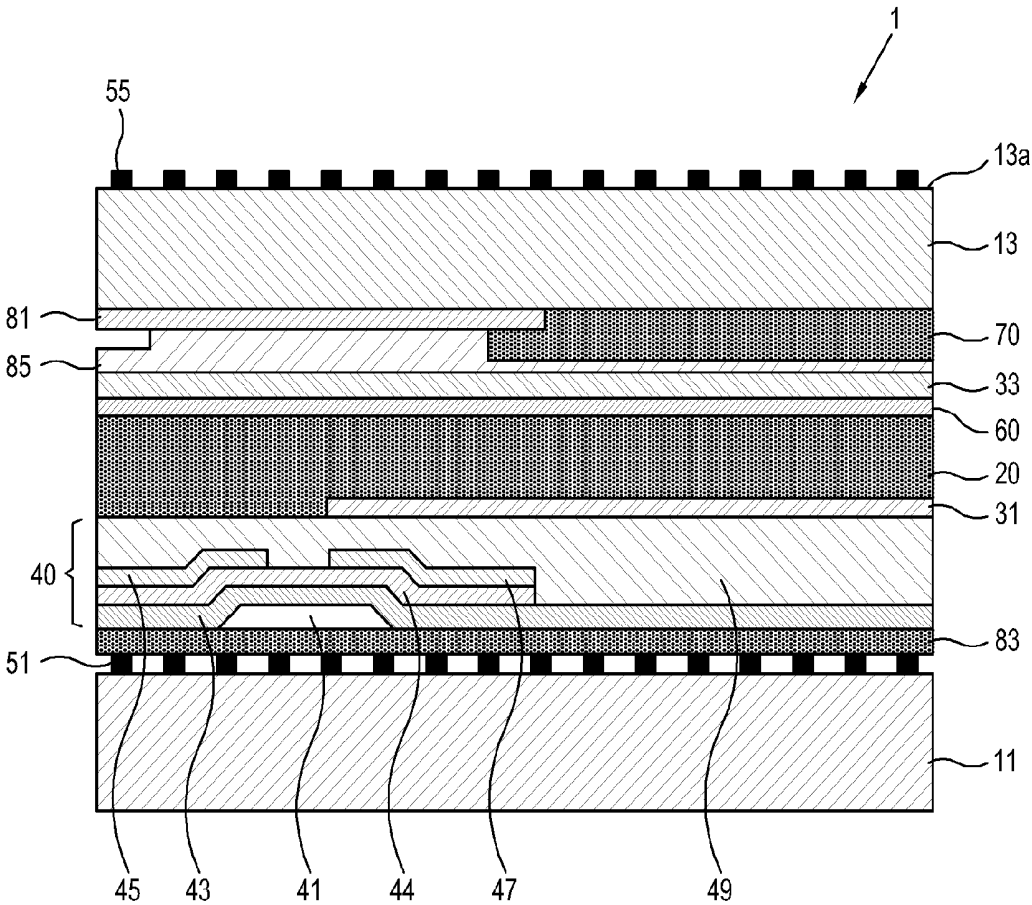


FIG. 2

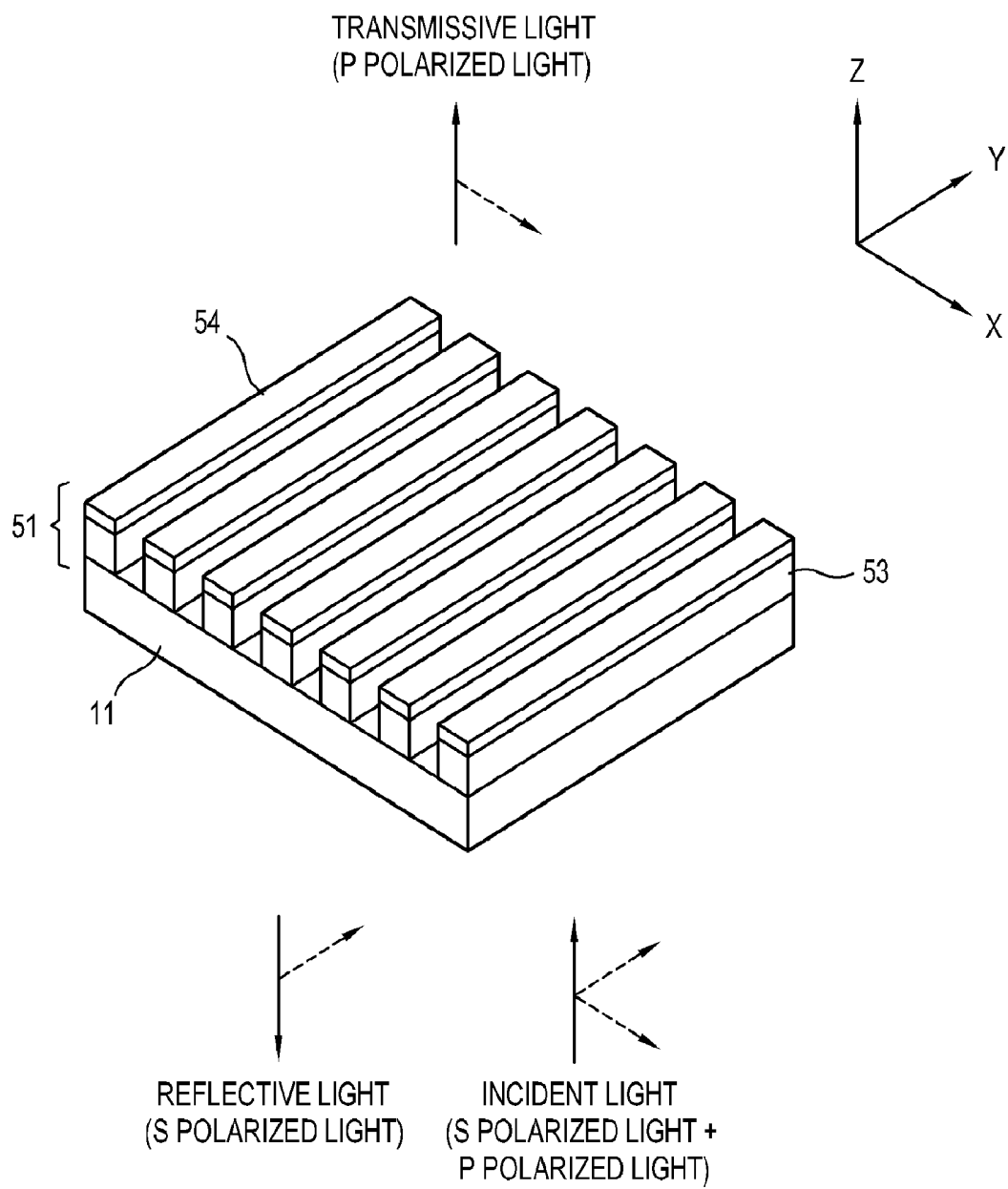


FIG. 3

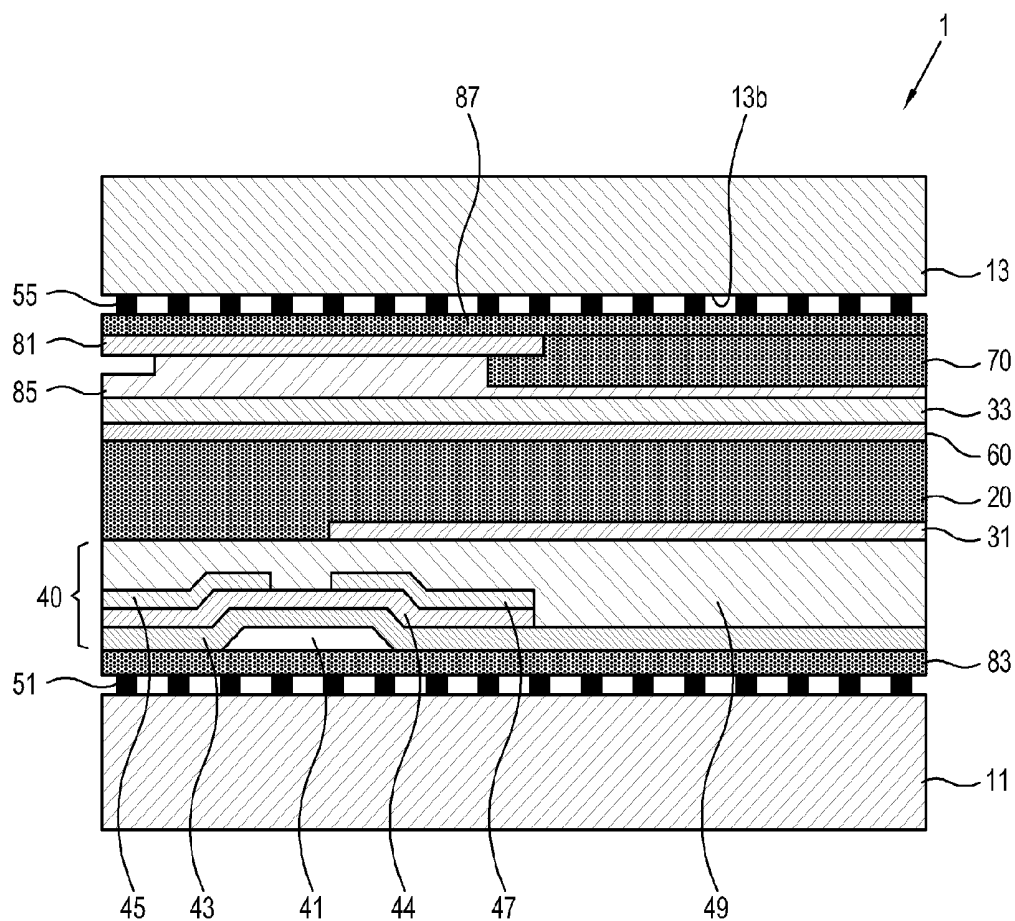


FIG. 4

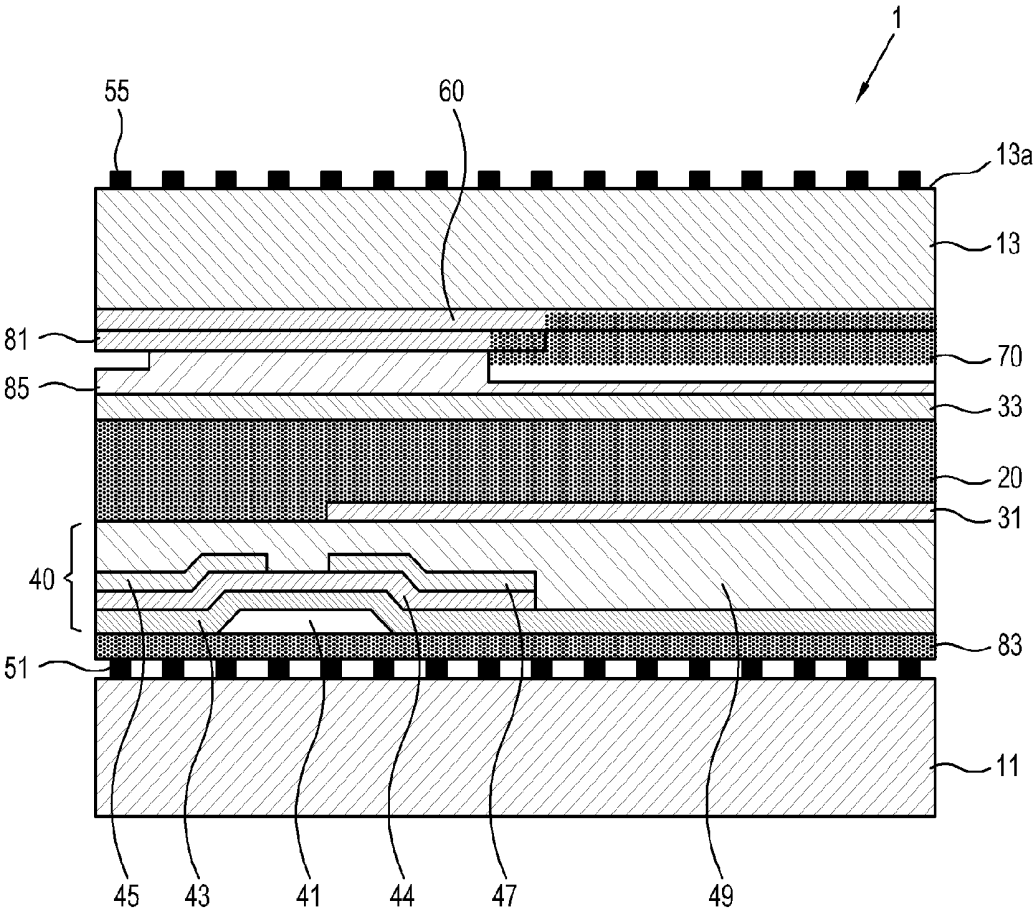
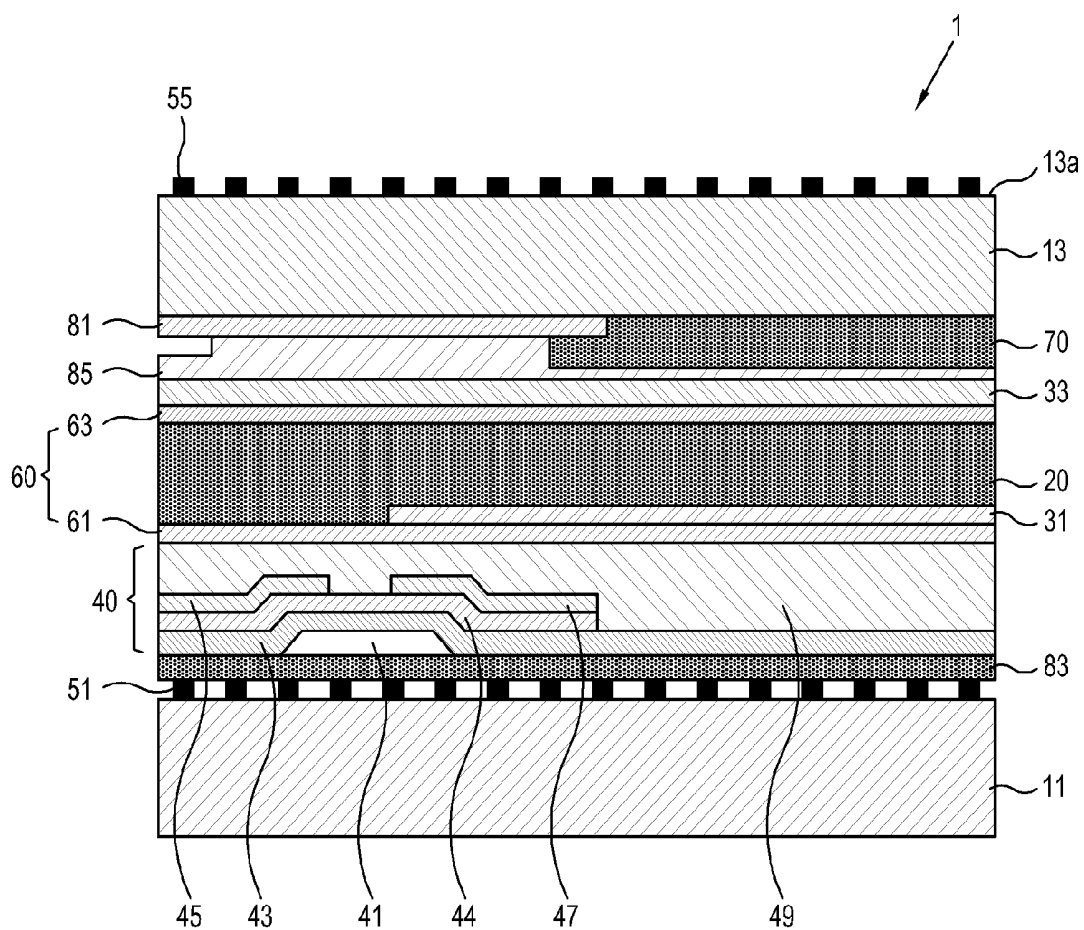


FIG. 5



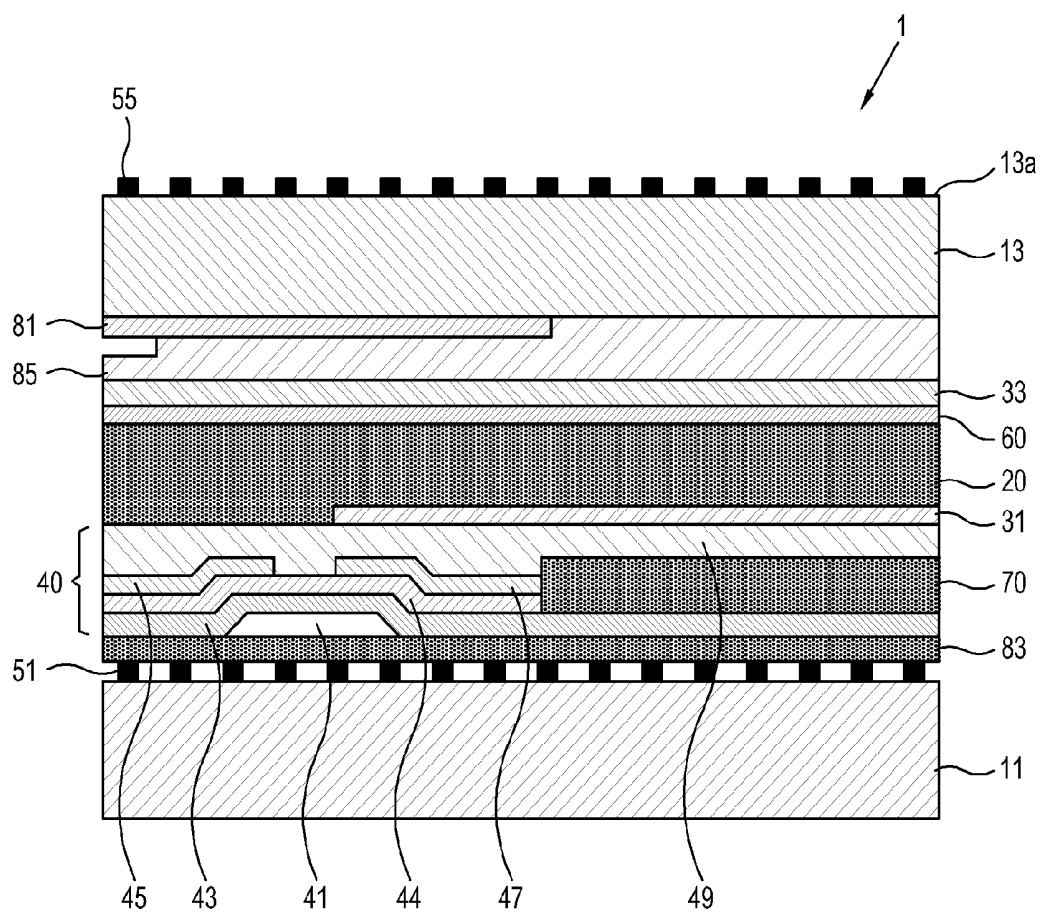
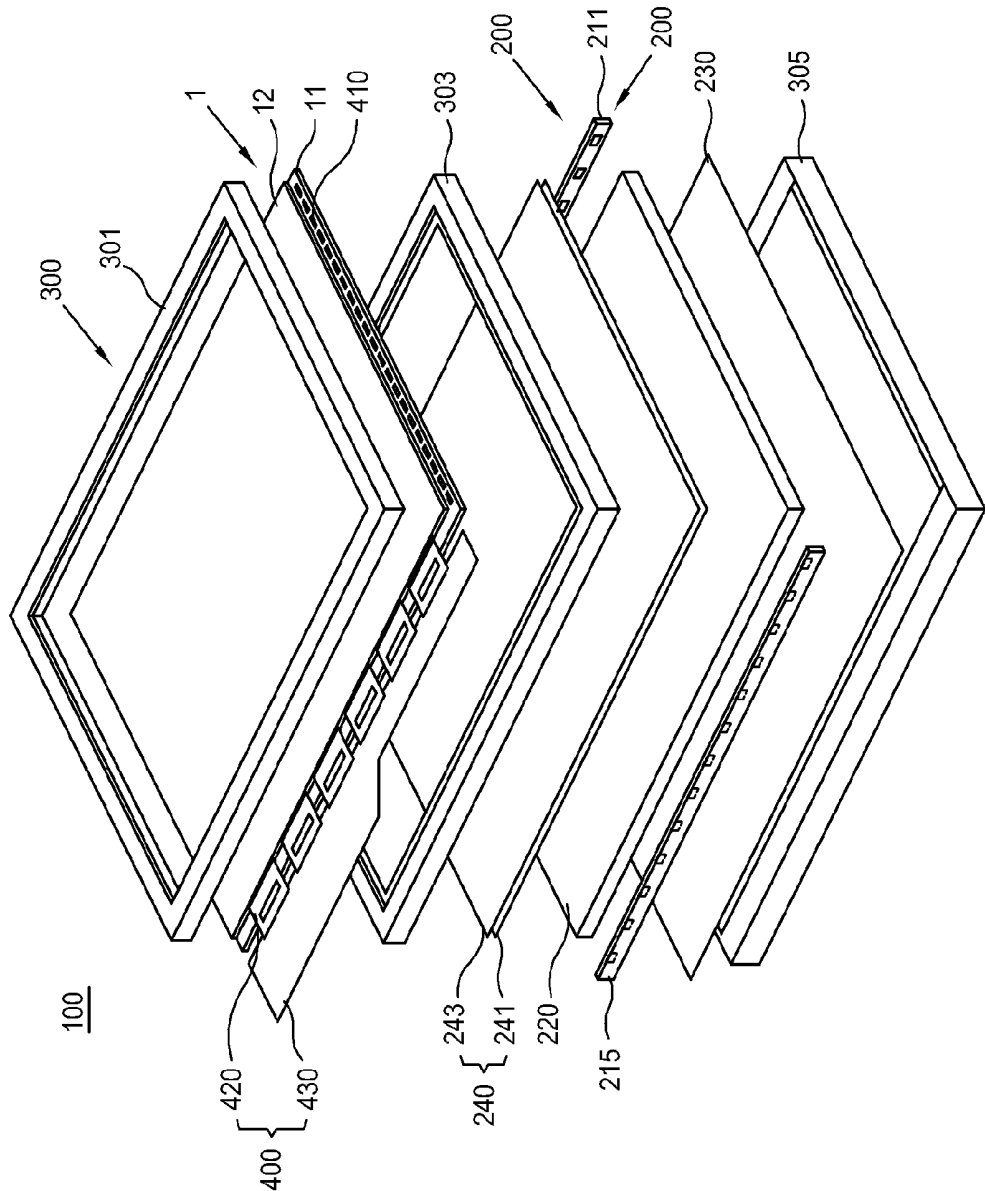


FIG. 7



DISPLAY PANEL AND DISPLAY APPARATUS COMPRISING THE SAME

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority from Korean Patent Application No. 10-2011-0077477, filed on Aug. 3, 2011 in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference.

BACKGROUND

[0002] 1. Field

[0003] Apparatuses and methods consistent with the exemplary embodiments relate to a display panel including a liquid crystal layer and a display apparatus comprising the same, and more particularly, to a display panel and a display apparatus comprising the same which employs a wire grid polarizing plate.

[0004] 2. Description of the Related Art

[0005] Generally, a liquid crystal panel which is employed in a liquid crystal display apparatus as a flat panel display apparatus does not emit light itself, and thus, generally includes a backlight unit that is provided in a rear surface of the liquid crystal panel and emits surface light.

[0006] Light emitted by a light source of the backlight unit passes through optical elements such as a light guide plate, a diffusion plate and a prism sheet forming the backlight unit, and thus is incident to the liquid crystal panel with considerable part of light lost.

[0007] The liquid crystal panel is driven and controlled pixel by pixel, and each pixel selectively receives incident light to thereby realize an image. To accomplish the foregoing, the liquid crystal panel includes first and second substrates, a liquid crystal layer interposed between the first and second substrates and a polarizing plate which allows predetermined polarized light out of incident light to be selectively transmitted therethrough. The polarizing plate allows predetermined polarized light to be transmitted therethrough and absorbs the remaining polarized light, to thereby absorb approximately 50% of incident light.

[0008] A display apparatus which includes the foregoing backlight unit and the liquid crystal panel suffers from a deterioration of brightness, as light from the light source is lost greatly after passing through the optical elements of the backlight unit and the liquid crystal panel.

[0009] To compensate for the light lost by the polarizing plate, a related art liquid crystal panel employs a dual brightness enhancement film (DBEF) including a multi-layer polymer thin film instead of an absorbent polarizing plate. In this case, part of the light reflected by the DBEF may be reused to compensate for the light loss to some extent. However, the DBEF with the multi-layer polymer incurs high manufacturing costs and requires complicated manufacturing processes.

SUMMARY

[0010] Exemplary embodiments address at least the above problems and/or disadvantages and other disadvantages not described above. However, an exemplary embodiment is not required to overcome the disadvantages described above, and an exemplary embodiment may not overcome any of the problems described above.

[0011] Accordingly, one or more exemplary embodiments provide a display panel and a display apparatus having the

same which may minimize light loss, reduce manufacturing costs and provide a simplified manufacturing process and an improved viewing angle.

[0012] According to an aspect of an exemplary embodiment, there is provided a display panel including: a first substrate; a second substrate; a liquid crystal layer which is interposed between the first and second substrates; first and second electrodes which are configured to apply power to the liquid crystal layer, wherein the first electrode is interposed between the first substrate and the liquid crystal layer and the second electrode is interposed between the liquid crystal layer and the second substrate; first and second wire grid polarizing plates which are configured allow a polarized light to be transmitted therethrough, wherein the first wire grid polarizing plate is disposed formed on a surface of the first substrate and the second wire grid polarizing plate is disposed on a surface of the second substrate; and a phase difference compensation film which is interposed between the first and second wire grid polarizing plates and is configured to compensate for a phase difference of incident light.

[0013] The first wire grid polarizing plate may be provided on a surface of the first substrate facing the liquid crystal layer.

[0014] The display panel may further include a first insulating layer which is interposed between the first wire grid polarizing plate and the first electrode and which electrically insulates the first wire grid polarizing plate and the first electrode.

[0015] The second wire grid polarizing plate may be provided on a surface of the second substrate opposite to the liquid crystal layer.

[0016] The second wire grid polarizing plate may be provided on a surface of the second substrate facing the liquid crystal layer, and further comprises a second insulating layer, which is interposed between the second wire grid polarizing plate and the second electrode and which electrically insulates the second wire grid polarizing plate and the second electrode.

[0017] The phase difference compensation film may be interposed at least one of between the first wire grid polarizing plate and the liquid crystal layer and between the liquid crystal layer and the second wire grid polarizing plate.

[0018] The phase difference compensation film may be interposed between the liquid crystal layer and the second electrode.

[0019] The phase difference compensation film may be interposed between the between the second electrode and the second wire grid polarizing plate.

[0020] The phase difference compensation film may have a same, but negative value with respect to a retardation value of the liquid crystal layer.

[0021] The phase difference compensation film may include a triacetyl cellulose film of a predetermined thickness.

[0022] The display panel may further include a color filter which is interposed between the first substrate and the liquid crystal layer, and allows a predetermined amount of light out of an incident light to be transmitted therethrough and realizes a color image.

[0023] The display panel may further include a color filter which is interposed between the liquid crystal layer and the second substrate and allows a predetermined amount of light out of an incident light to be transmitted therethrough and realizes a color image.

[0024] According to an aspect of another exemplary embodiment, there is provided a display apparatus including: a display panel according to claim 1; and a backlight unit which emits light to the display panel.

[0025] The display apparatus may further include a first insulating layer which is interposed between the first wire grid polarizing plate and the first electrode to electrically insulate the first wire grid polarizing plate and the first electrode.

[0026] The display apparatus may further include a color filter which is interposed between the first substrate and the liquid crystal layer, and allows a predetermined quantity of light out of an incident light to be transmitted therethrough and realizes a color image.

[0027] The display apparatus may further include a color filter which is interposed between the liquid crystal layer and the second substrate, and allows a predetermined quantity of light out of an incident light to be transmitted therethrough and realizes a color image.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] The above and/or other aspects will become apparent and more readily appreciated from the following description of the exemplary embodiments, taken in conjunction with the accompanying drawings, in which:

[0029] FIG. 1 is a sectional view of a display panel according to a first exemplary embodiment;

[0030] FIG. 2 is a perspective view of a first wire grid polarizing plate of the display panel according to the first exemplary embodiment;

[0031] FIG. 3 is a sectional view of a display panel according to a second exemplary embodiment;

[0032] FIG. 4 is a sectional view of a display panel according to a third exemplary embodiment;

[0033] FIG. 5 is a sectional view of a display panel according to a fourth exemplary embodiment;

[0034] FIG. 6 is a sectional view of a display panel according to a fifth exemplary embodiment; and

[0035] FIG. 7 is an exploded perspective view of a display apparatus according to an exemplary embodiment.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0036] Below, exemplary embodiments will be described in detail with reference to accompanying drawings so as to be easily realized by a person having ordinary knowledge in the art. The exemplary embodiments may be embodied in various forms without being limited to the exemplary embodiments set forth herein. Descriptions of well-known parts are omitted for clarity, and like reference numerals refer to like elements throughout. Additionally, in the drawings, the thicknesses of layers, for example, may be exaggerated for clarity.

[0037] FIG. 1 is a sectional view of a display panel according to an exemplary embodiment. FIG. 2 is a perspective view of a first substrate and a first wire grid polarizing plate in FIG. 1.

[0038] Referring to drawings, a display panel 1 according to the exemplary embodiment includes first and second substrates 11 and 13 which are disposed to face each other; a liquid crystal layer 20 which is interposed between the first and second substrates 11 and 13; first and second electrodes 31 and 33; a pixel layer 40; first and second wire grid polarizing plates 51 and 55; and a phase difference compensation

film 60. The display panel 1 according to the exemplary embodiment may further include a color filter 70 which realizes a color image.

[0039] The display panel 1 according to the present exemplary embodiment may be employed in an image device such as a television (TV) or a monitor, a mobile terminal or a display apparatus for exhibition and advertisement. etc. For example, the mobile terminal may include a mobile phone, a portable multimedia player (PMP), a netbook, a laptop and an electronic book terminal. etc.

[0040] The first and second substrates 11 and 13 include a transparent material through which light is transmitted from a backlight unit (not shown).

[0041] The liquid crystal layer 20 includes pixels which are individually controlled in arrangement by a voltage applied to the first and second electrodes 31 and 33 to realize an image. The liquid crystal layer 20 may include a liquid crystal mode such as a vertical alignment (VA) mode, a patterned vertical alignment (PVA) mode, a twisted nematic (TN) mode, and an in-plane switching (IPS) mode. The liquid crystal layer 20 may divide or pattern sub-pixels or adjust a refractive index of liquid crystals uniformly to improve a viewing angle of light.

[0042] The pixel layer 40 includes a thin film transistor (TFT), and controls the first and second electrodes 31 and 33 to thereby control a liquid crystal arrangement of the liquid crystal layer 20 pixel by pixel. Each pixel may include a plurality of sub-pixels.

[0043] The sub-pixel according to the present exemplary embodiment means the smallest unit of pixel to which an image gray scale corresponding to red, green and blue colors is input. A plurality of sub-pixels which represents a single image signal is defined as a pixel.

[0044] The pixel layer 40 includes a gate electrode 41, a gate insulating layer 43, a drain electrode 45, a source electrode 47 and a passivation film 49 which form the TFT.

[0045] The gate electrode 41 may include a metal single or multi layers. A gate wire (not shown) and a gate pad (not shown) are formed on the same layer as the gate electrode 41. The gate wire is connected to the gate electrode 41 and is arranged in a transverse direction of the display panel 1. The gate pad is connected to a gate driver (not shown) and transmits a driving signal to the gate wire. A maintenance electrode (not shown) may be further formed on the same layer as the gate electrode 41 to accumulate electric charge. The gate insulating layer 43 includes silicon nitride (SiNx) and covers the gate electrode 41 and the maintenance electrode.

[0046] A semiconductor layer 44 includes a semiconductor such as amorphous silicon and is formed on the gate insulating layer 43. An ohmic contact layer (not shown) which includes n+ hydrogenated amorphous silicon highly doped with silicide or an n-type dopant may be formed on the semiconductor layer 44. In this case, the ohmic contact layer is removed from a channel between the drain electrode 45 and the source electrode 47. A data wire (not shown) which includes a metal single or multi-layer is formed on the gate insulating layer 43. The source electrode 47 is separated from the drain electrode 45.

[0047] A passivation film 49 is formed on the drain electrode 45, the source electrode 47 and the semiconductor layer 44 which is not covered by the drain electrode 45 and the source electrode 47.

[0048] The first electrode 41 is a pixel electrode formed between the first substrate 11 and the liquid crystal layer 20, i.e., on the passivation film 49. The first electrode 41 includes

a transparent conductive material such as indium tin oxide (ITO) or indium zinc oxide (IZO). The first electrode **41** is electrically connected to the source electrode **47**.

[0049] A black matrix **81** and a second electrode **33** are formed on the second substrate **13**. The black matrix **81** divides sub-pixels, and prevents external light from being introduced to the TFT. The black matrix **81** may typically include a photosensitive organic material added with a black pigment such as carbon black or titanium oxide.

[0050] The second electrode **33** is interposed between the second substrate **13** and the liquid crystal layer **20**, and includes a common electrode forming a voltage corresponding to the first electrode **31**. Like the first electrode **31**, the second electrode **33** includes a transparent conductive material such as ITO or IZO. The second electrode **33** directly applies a voltage to the liquid crystal layer **20** together with the first electrode **31**.

[0051] An overcoating layer **85** is formed on the second electrode **33**. The overcoating layer **85** makes the black matrix **81** and the color filter **70** flat and protects the black matrix **81**. The overcoating layer **85** may include acrylic epoxy.

[0052] The first wire grid polarizing plate **51** is formed in a surface of the first substrate **11**, and allows predetermined polarized light to be transmitted therethrough and reflects other polarized light again. As shown in FIG. 2, the first wire grid polarizing plate **51** is shaped like a bar which is arranged in a certain direction on the first substrate **11**. It should be noted that when an item is referred to as being "on" a layer or a substrate, it can be disposed on the layer or substrate, or embedded within the layer or substrate. Additionally, other intervening layers may be present.

[0053] The first wire grid polarizing plate **51** includes a metal layer **53** and a hard mask **54**. The manufacturing process of the first wire grid polarizing plate **51** includes a process of depositing the metal layer **53** on the first substrate **11**, a process of forming the hard mask **54** in a predetermined pattern on the metal layer **53**, and a process of patterning the metal layer **53** by nano imprint lithography (NIL).

[0054] The metal layer **53** may include metal such as aluminum (Al), silver (Ag) or copper (Cu) or a high strength alloy such as molybdenum-tungsten (MoW). The metal layer **53** may include conductive polymer. The hard mask **54** protects the metal layer **53** and improves polarizing performance of the metal layer **53**. The hard mask **54** may include a dielectric substance such as SiO₂.

[0055] The first wire grid polarizing plate **51** is regularly arranged by a unit grid with predetermined height (H) and width (W). A cycle of the unit grid forming the first wire grid polarizing plate **51**, i.e., a pitch is varied by color of light to be emitted. That is, if the pitch of the unit grid is adjusted into $\frac{1}{2}$ or less of a wavelength of incident light, a diffracted wave is not formed, and only transmissive light and reflective light exist. The first wire grid polarizing plate **51** allows light having a certain polarizing component to be transmitted therethrough, and includes a pitch to allow light in all wavelengths to be transmitted therethrough. In particular, the pitch may be smaller than $\frac{1}{2}$ of a wavelength of blue light. The first wire grid polarizing plate **51** according to the present exemplary embodiment is 150 nm in height and 100 to 150 nm in pitch. The ratio of height to width of the first wire grid polarizing plate **51** may be approximately 1:3 or more.

[0056] If the first wire grid polarizing plate **51** has the foregoing configuration, S polarized light in parallel with the

grid is reflected and P polarized light vertical to the grid out of light received by the first wire grid polarizing plate **51** is transmitted. That is, out of light as non-polarized light received by the backlight unit, the P polarized light is transmitted through the first wire grid polarizing plate **51** to the liquid crystal layer **20** whereas the S polarized light is reflected to the backlight unit and reused.

[0057] Referring to FIG. 1, the first wire grid polarizing plate **51** may be formed on a surface of the first substrate **11** facing the liquid crystal layer **20**. Then, the display panel **1** may further include a first insulating layer **83** which is interposed between the first wire grid polarizing plate **51** and the pixel layer **40** to electrically insulate the first wire grid polarizing plate **51** and the pixel layer **40**. The arrangement of the first wire grid polarizing plate **51** is not limited to that as shown in FIG. 1. Alternatively, the first wire grid polarizing plate **51** may be formed in another surface of the first substrate **11**, i.e., on a surface not facing the liquid crystal layer **20**.

[0058] The second wire grid polarizing plate **55** may be formed in a surface of the second substrate **13**, and allows predetermined polarized light to be transmitted therethrough to thereby realize an image according to an arrangement direction of liquid crystals controlled by sub-pixel of the liquid crystal layer **20**. The second wire grid polarizing plate **55** is manufactured in a substantially same method as that of the first wire grid polarizing plate **51**, and a grid arrangement direction thereof is vertical or same direction as that of the first wire grid polarizing plate **51**.

[0059] As shown in FIG. 1, the second wire grid polarizing plate **55** may be provided on a first surface **13a** of the second substrate **13** which is disposed on a surface opposite to a surface facing the liquid crystal layer **20**. In this case, light with polarizing direction that is individually selected pixel by pixel is transmitted from the liquid crystal layer **20** to the second substrate **13** and then selectively transmitted through the second wire grid polarizing plate **55** to thereby realize a predetermined image.

[0060] As shown in FIG. 3, in a display panel according to a second exemplary embodiment, a second wire grid polarizing plate **55** may be provided on a second surface **13b** of the second substrate **13** facing the liquid crystal layer **20**. In this case, the display panel may further include a second insulating layer **87** which electrically insulates the second wire grid polarizing plate **55**.

[0061] The display panel including the liquid crystal layer **20** has the liquid crystal layer that is optically anisotropic. Therefore, if the linearly polarized light which is transmitted through the first wire grid polarizing plate **51** passes through liquid crystal cells of the liquid crystal layer **20** vertically or at a slant, a retardation value varies and causes a phase difference. Then, properties of transmissive light according to a viewing angle vary and a viewing angle becomes narrow.

[0062] The phase difference compensation film **60** may be employed to solve the problem of a narrowed viewing angle that may arise when the polarized light is converted by the wire grid polarizing plate in a liquid crystal mode such as VA mode or TN mode. That is, the phase difference compensation film **60** is a phase difference plate which has the same, but negative value with respect to the retardation value of the liquid crystal, and compensates for the retardation value of the liquid crystal and improves the viewing angle.

[0063] The phase difference compensation film **60** may be provided in at least one area between the first and second wire grid polarizing plates **51** and **55**. That is, the phase difference

compensation film 60 may be interposed at least one of between the first wire grid polarizing plate 51 and the liquid crystal layer 20 and between the liquid crystal layer 20 and the second wire grid polarizing plate 55.

[0064] FIGS. 1 and 3 illustrate the phase difference compensation film 60 which is interposed between the liquid crystal layer 20 and the second electrode 33. FIG. 4 illustrates the phase difference compensation film 60 which is interposed between the second electrode 33 and the second substrate 13.

[0065] The phase difference compensation film 60 may include a triacetyl cellulose (TAC) film in a predetermined thickness. As shown in FIGS. 1, 3 and 4, the phase difference compensation film 60 may include one sheet of V-TAC film in a thickness corresponding to a predetermined reference wavelength λ of incident light. As shown in FIG. 5, the phase difference compensation film 60 may include two sheets of N-TAC films 61 and 63 in a thickness of $\lambda/2$.

[0066] As the phase difference compensation film 60 compensates for the phase difference as described above, the narrowed viewing angle which arises from the display panel including the wire grid polarizing plate may be prevented.

[0067] The color filter 70 allows light in a predetermined wavelength to be selectively transmitted therethrough to thereby realize a color image. As shown in FIG. 1, the color filter 70 may be interposed between the liquid crystal layer 20 and the second substrate 13. If light is emitted from a lower part of the first substrate 11, light having a certain polarizing light component and being transmitted through the first wire grid polarizing plate 51 is transmitted through the liquid crystal layer 20 and the color filter 70 and is emitted by light in a predetermined color. As shown in FIG. 6, the color filter 70 may be provided in the pixel layer 40, in which case the light in a predetermined color determined through the transmission of the color filter 70 is transmitted through the liquid crystal layer 20 to thereby realize an image.

[0068] According to the present exemplary embodiment, the light is transmitted from the first substrate 11 to the liquid crystal layer 20, but not limited thereto. Alternatively, the light may be transmitted from the second substrate 13 to the liquid crystal layer 20.

[0069] The display panel 1 according to the exemplary embodiment may further include a reflection restricting layer (not shown) which is arranged on an external surface of one of the first substrate 11 and the second substrate 13, i.e., an external surface of the substrate from which light is emitted substantially. The reflection restricting layer reduces reflection of external light from the surface of the display panel 1 and prevents damage to definition due to the external light. The reflection restricting layer may include an anti-reflection film or anti-glare film or a moth-eye pattern layer formed by a nano technology on an external surface of the substrate.

[0070] The display panel 1 may further include a panel driver 400 shown in FIG. 7.

[0071] FIG. 7 is a perspective view of the display apparatus according to the exemplary embodiment.

[0072] Referring to FIG. 7, the display apparatus 100 includes a display panel 1, a backlight unit 200 and a housing 300 which accommodates the foregoing elements, and an image provider (not shown).

[0073] The display panel 1 includes a first substrate 11, a second substrate 13 facing the first substrate 11, a liquid crystal layer (not shown) interposed between the first and second substrates 11 and 13, and a panel driver 400 driving a

pixel layer (not shown) to display an image signal. The display panel 1 receives light from the outside and controls the quantity of light transmitted through the liquid crystal layer interposed between the first and second substrates 11 and 13 to thereby display an image. The display panel 1 is substantially the same as the display panel according to the exemplary embodiment described by referring to FIGS. 1 to 6, and thus detailed description of elements other than the panel driver 400 will be omitted.

[0074] The panel driver 400 may include a gate driving integrated circuit (IC) 410, a data chip film package 420 and a printed circuit board (PCB) 430. The gate driving IC 410 may be formed on the first substrate 11 and connected to each gate line formed in the first substrate 11. The data chip film package 420 may be connected to each data line formed in the first substrate 11. The data chip film package 420 may include a wire pattern in which a semiconductor chip is formed in a base film, and a tape automated bonding (TAB) tape connected by TAB technology. For example, the data chip film package may include a tape carrier package (TCP) or a chip on film (COF).

[0075] Various parts may be mounted in the PCB 430 to input a gate driving signal to the gate driving IC 410 and input a data driving signal to the data chip film package 420.

[0076] The backlight unit 200 may be classified into a direct type and an edge type depending on an optical arrangement of a light source and application/non-application of a light guide plate. FIG. 7 illustrates the edge type backlight unit 200. In this case, the backlight unit 200 may include a light source 210, a light guide plate 220 to guide light emitted by the light source 210, a reflection sheet 230 provided below the light guide plate 220 and at least one optical sheet 240. The light source 210 is provided in at least one edge of the light guide plate 220. The light source 210 may include a light emitting diode (LED) array, a cold cathode fluorescent lamp (CCFL) or a hot cathode fluorescent lamp (HCFL). FIG. 7 illustrates first and second LED arrays 211 and 215 which are provided at opposite edges of the light guide plate 220. The first and second LED arrays 211 and 215 may be electrically connected to an inverter (not shown) to receive power therefrom.

[0077] The light guide plate 220 converts a progress path of light emitted by the light source 210, and guides light to be transmitted to the display panel 1 as plane light. The light guide plate 220 may include a panel including a transparent material such as acrylic or plastic. Various patterns may be formed in a rear surface of the light guide plate 220 to change the progress direction of the light incident to the light guide plate 220 to the display panel 1.

[0078] The reflection sheet 230 is installed in a lower surface of the light guide plate 220 and reflects light from a lower side to an upper side of the light guide plate 220. More specifically, the reflection sheet 230 reflects light that has not been reflected by fine dot patterns formed in the rear surface of the light guide plate 220 back to an emission surface of the light guide plate 220 to thereby reduce loss of light incident to the display panel 1 and to improve uniformity of light transmitted to the emission surface of the light guide plate 220.

[0079] At least one optical sheet 240 is installed in the emission surface of the light guide plate 220 and diffuses and focuses light emitted by the light guide plate 220. The optical sheet 240 may include a diffusion sheet 241, a prism sheet 243 and a protection sheet (not shown). The diffusion sheet 241 may be interposed between the light guide plate 220 and the

prism sheet **243** and scatter light transmitted by the light guide plate **220** and prevent light from being partially focused. The prism sheet **243** may have prisms in a predetermined shape in a certain arrangement to focus light diffused by the diffusion sheet **241** in a vertical direction of the display panel **1**. The protection sheet may be formed on the prism sheet **243**, protect a surface of the prism sheet **243** and diffuse light to distribute light uniformly. According to the present exemplary embodiment, the backlight unit includes an edge type, but not limited thereto. Alternatively, the backlight unit may include a direct type.

[0080] The housing **300** may include a bezel **301**, a main body **303** and a rear cover **305**. The rear cover **305** accommodates therein the backlight unit **200** and the display panel **1**. The rear cover **305** may include a metal material to ensure strength to external shock and the connection to the ground.

[0081] The image provider is connected to the display panel **1** and provides the display panel **1** with an image signal.

[0082] As described above, a display panel and a display apparatus according to an exemplary embodiment employs a polarizing plate to thereby minimize light loss, reduce manufacturing costs and provide a simplified manufacturing process.

[0083] Further, the display panel and the display apparatus according to an exemplary embodiment has a phase difference compensation film interposed between first and second wire grid polarizing plates to compensate for a phase difference and to improve a viewing angle.

[0084] Although a few exemplary embodiments have been shown and described, it will be appreciated by those skilled in the art that changes may be made in these exemplary embodiments without departing from the principles and spirit of the present inventive concept, the range of which is defined in the appended claims and their equivalents.

What is claimed is:

1. A display panel comprising:
 - a first substrate;
 - a second substrate;
 - a liquid crystal layer which is interposed between the first and second substrates;
 - first and second electrodes which are configured to apply power to the liquid crystal layer, wherein the first electrode is interposed between the first substrate and the liquid crystal layer and the second electrode is interposed between the liquid crystal layer and the second substrate;
 - first and second wire grid polarizing plates which are configured allow a polarized light to be transmitted therethrough, wherein the first wire grid polarizing plate is disposed formed on a surface of the first substrate and the second wire grid polarizing plate is disposed on a surface of the second substrate; and
 - a phase difference compensation film which is interposed between the first and second wire grid polarizing plates and is configured to compensate for a phase difference of incident light.
2. The display panel according to claim 1, wherein the first wire grid polarizing plate is disposed on a surface of the first substrate facing the liquid crystal layer.
3. The display panel according to claim 2, further comprising a first insulating layer which is interposed between the first wire grid polarizing plate and the first electrode and which electrically insulates the first wire grid polarizing plate and the first electrode.

4. The display panel according to claim 1, wherein the second wire grid polarizing plate is disposed on a surface of the second substrate opposite to the liquid crystal layer.

5. The display panel according to claim 1, wherein the second wire grid polarizing plate is provided on a surface of the second substrate facing the liquid crystal layer, and further comprises a second insulating layer, which is interposed between the second wire grid polarizing plate and the second electrode and which electrically insulates the second wire grid polarizing plate and the second electrode.

6. The display panel according to claim 1, wherein the phase difference compensation film is interposed at least one of between the first wire grid polarizing plate and the liquid crystal layer and between the liquid crystal layer and the second wire grid polarizing plate.

7. The display panel according to claim 6, wherein the phase difference compensation film is interposed between the liquid crystal layer and the second electrode.

8. The display panel according to claim 6, wherein the phase difference compensation film is interposed between the second electrode and the second wire grid polarizing plate.

9. The display panel according to claim 1, wherein the phase difference compensation film has a same, but negative value with respect to a retardation value of the liquid crystal layer.

10. The display panel according to claim 1, wherein the phase difference compensation film comprises a triacetyl cellulose film of a predetermined thickness.

11. The display panel according to claim 1, further comprising a color filter which is interposed between the first substrate and the liquid crystal layer, and is configured to allow a predetermined amount of light out of an incident light to be transmitted therethrough and realize a color image.

12. The display panel according to claim 1, further comprising a color filter which is interposed between the liquid crystal layer and the second substrate and is configured to allow a predetermined amount of light out of an incident light to be transmitted therethrough and realize a color image.

13. A display apparatus comprising:

- a display panel according to claim 1; and
- a backlight unit which emits light to the display panel.

14. The display apparatus according to claim 13, wherein the first wire grid polarizing plate is disposed on a surface of the first substrate facing the liquid crystal layer.

15. The display apparatus according to claim 14, further comprising a first insulating layer which is interposed between the first wire grid polarizing plate and the first electrode to electrically insulate the first wire grid polarizing plate and the first electrode.

16. The display apparatus according to claim 15, wherein the second wire grid polarizing plate is disposed on a surface of the second substrate opposite to the liquid crystal layer.

17. The display apparatus according to claim 16, wherein the second wire grid polarizing plate is disposed on a surface of the second substrate facing the liquid crystal layer, and further comprises a second insulating layer, which is interposed between the second wire grid polarizing plate and the second electrode, and which electrically insulates the second wire grid polarizing plate and the second electrode.

18. The display apparatus according to claim 15, wherein the phase difference compensation film is interposed at least one of between the first wire grid polarizing plate and the

liquid crystal layer and between the liquid crystal layer and the second wire grid polarizing plate.

19. The display apparatus according to claim **18**, wherein the phase difference compensation film is interposed between the liquid crystal layer and the second electrode.

20. The display apparatus according to claim **18**, wherein the phase difference compensation film is interposed between the between the second electrode and the second wire grid polarizing plate.

21. The display apparatus according to claim **13**, wherein the phase difference compensation film has a same, but negative value with respect to a retardation value of the liquid crystal layer.

22. The display apparatus according to claim **13**, wherein the phase difference compensation film comprises a triacetyl cellulose film of a predetermined thickness.

23. The display apparatus according to claim **13**, further comprising a color filter which is interposed between the first substrate and the liquid crystal layer, and is configured to allow a predetermined quantity of light out of an incident light to be transmitted therethrough and realize a color image.

24. The display apparatus according to claim **13**, further comprising a color filter which is interposed between the liquid crystal layer and the second substrate, and is configured to allow a predetermined quantity of light out of an incident light to be transmitted therethrough and realize a color image.

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专利名称(译)	显示面板和包括该显示面板的显示设备		
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摘要(译)

提供一种显示面板和包括该显示面板的显示装置，其采用线栅偏振片。显示面板包括：第一和第二基板；液晶层，介于第一和第二基板之间；第一和第二电极分别插在第一基板和液晶层之间以及液晶层和第二基板之间，并向液晶层供电；第一和第二线栅偏振片，其形成在第一和第二基板中的每一个的表面上并允许偏振光透过其中；以及相位差补偿膜，其插入在第一和第二线栅偏振片之间并补偿入射光的相位差。

