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(54) REFLECTION PLATE FOR BACKLIGHT UNIT AND BACKLIGHT UNIT OF LIQUID CRYSTAL DISPLAY HAVING GOOD THERMAL CONDUCTIVITY

REFLEXIONSPLATTE FÜR RÜCKBELEUCHTUNGSEINHEIT UND RÜCKBELEUCHTUNGSEINHEIT IN EINER FLÜSSIGKRISTALLANZEIGE MIT GUTER WÄRMELEITFÄHIGKEIT

PLAQUE DE RÉFLEXION D´UNITÉ DE RÉTRO-ÉCLAIRAGE ET UNITÉ DE RÉTRO-ÉCLAIRAGE D´ÉCRAN À CRISTAUX LIQUIDES À BONNE CONDUCTIVITÉ THERMIQUE

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(73) Proprietor: **LG Chem, Ltd.**
Youngdungpo-gu, Seoul 150-721 (KR)

(72) Inventors:
- **LEE, Heon Sang**
  Daejeon 305-761 (KR)
- **KIM, Eung Soo**
  Daejeon 302-749 (KR)
- **LEE, Myung Se**
  Daejeon 305-729 (KR)
- **LEE, Bong Keun**
  Daejeon 305-721 (KR)
- **KWAK, Min Han**
  Seoul 135-947 (KR)
- **SON, Seon-mo**
  Daejeon 305-756 (KR)

(74) Representative: **Goddar, Heinz J.**
Boehmert & Boehmert
Anwaltspartnerschaft mbB
Pettenkoferstrasse 22
80336 München (DE)

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Description

Technical Field

[0001] The present invention relates to a reflection plate for a backlight unit and a backlight unit in a liquid crystal display device, and more particularly, to a reflection plate for a backlight unit in a liquid crystal display device for effectively solving the thermal problem of the backlight unit, and having excellent properties such as shock resistance, heat resistance, mechanical strength, and the like, as well as having excellent reflectivity, thereby improving the durability of the liquid crystal display device, and to a backlight unit of a liquid crystal display device, of which all the parts are made of the same material, thereby effectively solving the thermal problem of the backlight unit, and simplifying the manufacturing process.

Background Art

[0002] Unlike a cathode-ray tube, generally, a liquid crystal display (LCD) device does not have a light emitting function in itself, and thus it is required that a light emitting device is maintained at a uniform brightness over an entire screen.

[0003] According to the methods of providing the light source, LCDs can be classified into a transmissive type, in which a separate light and a backlight unit are used, and a reflective type in which an external light is used as the light source. Of these methods, in the case of reflective type LCDs, many studies have been carried out because the backlight unit is not required and their power consumption is low. However, many applications have not been made until now since their visibility is low when the brightness is not sufficient from the external light source. On the other hand, in the case of transmissive type LCDs, which have been actively used in recent years, the key factor is to supply the light source with a uniform brightness through a backlight unit.

[0004] A backlight unit can be classified into a top-down method system, in which a light source is placed at the bottom surface of a liquid crystal panel to illuminate the entire surface of the substrate, and an edge illumination system, in which a light source is placed at both side surfaces of the unit and light is evenly diffused through a light guide plate and a reflection plate.

[0005] Such an edge illumination system backlight unit is mainly used for a small-sized LCD monitor or notebook computer since the brightness is uniform and the power consumption is low, but a light guide plate is definitely required for evenly diffusing the light from the side surfaces.

[0006] In the case of the top-down method system backlight unit on the other hand, the light use rate is high because a light source directly illuminates a substrate, and it is applicable to a large-sized LCD TV or monitor because the size is not limited. However, it causes a problem of increased heat, as a light source is very closely positioned with a liquid crystal panel and a large number of lamps are required to supply the light source. In the case where the heat produced is too high, it can be the main reason for inducing a smudge on the screen, thereby shortening the life of a liquid crystal panel. In recent years, particularly as LCDs have become larger and thinner, the thermal problems of the backlight unit have emerged as a problem to be solved by all means.

[0007] The structure of a typical top-down method system backlight unit is illustrated below.

[0008] In the top-down method system back light unit, a supporting rod for holding a liquid crystal panel is positioned around a lamp, that is, a light source, and also a diffuse sheet, a prism sheet, and a dual brightness enhancement film (DBEF) sheet are sequentially arranged at an upper portion of the lamp. Furthermore, a reflection plate for preventing the light from leaking, an external supporting rod, and a lower plate functioning as a heat sink are arranged at a lower portion of the lamp.

[0009] As a reflection plate material for the components of such a backlight unit, a white polyester film is disclosed in Japanese Laid-Open No. H04-239540; however, there is a problem in that the tint is lowered and the luminance is reduced due to yellowing of a reflection plate caused by the heat generated from a light source.

[0010] A technology for adding various additives and a structural change to improve the reflectivity, transmittance ratio, or the like, of a white polyester film is disclosed in Japanese Laid-Open Nos. 2002-98811, 2002-138150, and 2001-305321, and a technology for using a white porosity polyester film to enhance the reflectivity of a reflective film is disclosed in Japanese Laid-Open Nos. 2002-50222 and 2002-40214. Moreover, a technology for manufacturing a reflection plate using an ultra-fine foam polyester sheet is disclosed in Japanese Laid-Open Nos. 2003-145657 and 2003-121616.

[0011] A technology for the reflectivity and shock resistance of a white polycarbonate resin is disclosed in U.S. Patent No. 5,837,757, Japanese Laid-Open Nos. H07-242781 and H09-176471, and a technology for manufacturing a reflective sheet using a flame-retardant white polycarbonate resin is disclosed in Japanese Laid-Open No. 1999-181267.

[0012] However, in the technology for manufacturing a reflection plate as described above, a method is disclosed for improving the reflectivity, heat resistance, shock resistance, or the like, of a reflection plate material, but a solution to the thermal problem of a backlight unit is not presented. In particular, any attempt at solving the thermal problem by

applying a thermal conductive resin composition to a reflection plate material has not been made.

[0013] A method for applying a high thermal conductive metallic material such as aluminum to a lower plate of the backlight unit is disclosed to solve the thermal problem of the backlight unit in Korean Laid-Open No. 2004-0017718, but there is a problem in that a solution to the thermal problem is obstructed since a reflection plate is positioned between a heating element and a lower plate, and the cost of a product increases

[0014] US 2003/043586 discloses a thermal conductive lamp reflector for an automotive head lamp comprising a lamp reflector shell made of a thermal conductive composition with 3 W/mK or more of thermal conductivity, a reflective, mirror-like layer made of aluminum on the surface of the shell, and a protective coating.

[0015] US 2004/032725 discloses a backlight unit for a LCD device comprising a reflection plate and a heat-dissipating plate.

[0016] US2005/0122724 discloses the preamble of claim 1.

[0017] In order to solve the problems occurring in the prior art as described above, it is an object of the present invention to provide a reflection plate for a backlight unit in a liquid crystal display device for effectively solving the thermal problem of the backlight unit, and having excellent properties such as shock resistance, heat resistance, mechanical strength and the like, as well as having excellent reflectivity, thereby improving the durability of the liquid crystal display device.

[0018] Moreover, it is another object of the present invention to provide a backlight unit of a liquid crystal display device for effectively solving the thermal problem of the backlight unit, and simplifying the manufacturing process.

Disclosure of Invention

Technical Problem

[0019] In order to accomplish the above objects of the present invention, there is provided a reflection plate for a backlight unit of a liquid crystal display device, according to claim 1.

[0020] Hereinafter, the present invention will be described in detail.

[0021] As a reflection plate of a backlight unit is located very close to a light source lamp, it is effective at solving the thermal problem when the thermal conductivity of a reflection plate material is high. The thermal conductivity of plastic is typically low, usually up to 0.2 W/mK, and therefore, even though it is used as a material for the reflection plate of a backlight unit, there is a limit to solving the thermal problem through heat conduction. Therefore, it is also necessary to have a radiating device using a metal material having high thermal conductivity, or a special structure advantageous for heat dissipation.

[0022] Furthermore, for a backlight unit including a reflection plate, a supporting rod, and a lower plate, it is generally effective when the thermal conductivity of a material used as a heat transfer medium is high, as well as the area contacting the external atmosphere is large, in order to effectively emit the heat generated in a heating element such as a light source lamp. However, a reflection plate, a supporting rod, and a lower plate are individually separate products, and so they are typically made of different materials. In the case of the reflection plate and supporting rod, they are mainly manufactured using a polyester or polycarbonate resin composition, and in the case of the lower plate, it is mainly manufactured with a metal material having good thermal conductivity because the role of heat dissipation is important. However, even though the reflection plate, supporting rod, and lower plate manufactured by an existing method are used, it is difficult to effectively solve the heat dissipation problem since the characteristics of each material are different.

Technical Solution

[0023] In order to solve the above problem, for a reflection plate made of a thermoplastic thermal conductive resin composition having a thermal conductivity of at least 0.35 W/ mK, the inventors of the present invention confirmed that the heat dissipation problem can be solved through thermal conductivity in itself even when a radiating device, special structure, or metal material is not additionally used. Furthermore, it is confirmed that a backlight unit including a reflection plate and a lower plate, which are manufactured with the same thermoplastic thermal conductive resin material, has good thermal conductivity to effectively solve the heat dissipation problem, and the manufacturing process is simplified to reduce the cost, and as a result the present invention can be completed.

[0024] Accordingly, the present invention is characterized in that a reflection plate is made of a thermoplastic thermal conductive resin composition having a thermal conductivity of at least 0.35 W/mK.

[0025] The present invention is also characterized in that a backlight unit includes a reflection plate and a lower plate, which are made of the same thermoplastic thermal conductive resin material having a thermal conductivity of at least 0.35 W/mK.

[0026] The thermoplastic thermal conductive resin composition contains 10-95 wt% of a thermoplastic resin and 90-5 wt% of a ceramic solid.

[0027] The thermoplastic resin is not limited, and all kinds of thermoplastic resins can be used. It is preferably used

singly or by mixing two or more kinds of polybutylene terephthalate, polyethylene terephthalate, aromatic polyamide, polyamide, polycarbonate, polystyrene, polyphenylenesulfide, thermotropic liquid-crystalline polymer, polysulfone, polyether sulfone, polyetherimide, polyetheretherketone, polyarylate, polymethylmethylacrylate, polyvinylalcohol, polypropylene, polyethylene, polyacrylonitrilebutadienestyrene copolymer, polytetramethyleneoxide-1,4-butanediol copolymer, copolymer containing styrene, fluorine-based resin, polyvinylchloride, polyacrylonitrile, or the like.

[0028] Preferably, 10-95 wt% of the thermoplastic resin is contained in a thermoplastic thermal conductive resin composition.

[0029] The ceramic solid is used to manufacture a thermoplastic thermal conductive resin composition having a thermal conductivity of at least 0.35 W/mK at room temperature, and it can be used singly or by mixing two or more kinds of boron nitride, silicon carbide, diamond, beryllium oxide, boron phosphide, aluminum nitride, beryllium sulfide, boron arsenide, silicon, gallium nitride, aluminum phosphide, gallium phosphide, or the like, having a thermal conductivity of at least 300 W/mK at room temperature.

[0030] Preferably, 5-90 wt% of the ceramic solid is contained in a thermoplastic thermal conductive resin composition.

[0031] The thermoplastic thermal conductive resin composition may further contain a filler singly or by mixing two or more kinds such as flake, glass fiber, and a halogen or non-halogen flame retardant. Preferably, 5-15 wt% of the filler may be contained in a thermoplastic thermal conductive resin composition.

[0032] For the halogen or non-halogen flame retardant, it may be used singly or by mixing two or more kinds of bromine-based carbonate oligomer, Sb_2O_3, and phosphor or red phosphor-based flame retardant, melamine cyanurate, melamine, triphenyl isocyanurate, melamine phosphate, melamine pyrophosphate, ammonium polyphosphate, alkyl amine phosphate, melamine resin, zinc borate, or the like.

[0033] The thermoplastic thermal conductive resin composition may further contain a white dielectric material for improving the optical reflection factor.

[0034] The white dielectric material may be used singly or by mixing two or more kinds of $BaSO_4$, TiO_2, SiO_2, B_2O_3, Al_2O_3, or the like, and 5-40 wt% of the white dielectric material may be preferably contained in a thermoplastic thermal conductive resin composition.

[0035] Less than 90 wt% of the ceramic solid and white dielectric material may be preferably contained in a thermoplastic thermal conductive resin.

[0036] The thermoplastic thermal conductive resin composition may be manufactured by mixing and extruding the above components in a twin screw extruder. At this time, the barrel temperature of the twin screw extruder should be maintained at 250-340 °C.

Advantageous Effects

[0037] Preferably, the thermal conductivity of the thermoplastic thermal conductive resin composition is at least 0.35 W/mK. When the thermal conductivity is at least 0.35 W/ mK, the thermal conduction rate through a reflection plate is not reduced, thereby effectively solving the thermal problem of a backlight unit, and also it has excellent properties such as workability, reflectivity, mechanical strength, and the like, thereby allowing a structure incorporating a reflection plate together with a lower plate to be manufactured.

Best Mode for Carrying Out the Invention

[0038] Hereinafter, the preferred embodiments of the present invention will be described in detail with reference to the accompanying drawings. Although preferred embodiments are disclosed herein to facilitate an understanding of the present invention, the following embodiments are only illustrative of the present invention, and it will be appreciated by those skilled in the art that various modifications and changes can be made without departing from the principles and spirit of the present invention, the scope of which is defined in the appended claims, and their equivalents.

[Embodiments]

Embodiment 1

[0039] A specimen 10 mm in diameter and 0.3 mm in thickness, which is made of a thermoplastic thermal conductive resin composition comprising 60 wt% of polyethyleneterephthalate resin (manufactured by LG Chemical Ltd.) and 40 wt% of boron nitride, was prepared.

Embodiment 2

[0040] A specimen 10 mm in diameter and 0.3 mm in thickness, which is made of a thermoplastic thermal conductive

resin composition comprising 60 wt% of polyethyleneterephthalate resin (manufactured by LG Chemical Ltd.), 25 wt% of boron nitride, and 15 wt% of TiO_2, was prepared.

Embodiment 3

[0041] A specimen 10 mm in diameter and 0.3 mm in thickness, which is made of a thermoplastic thermal conductive resin composition comprising 60 wt% of polycarbonate resin (manufactured by LG Chemical Ltd.), 20 wt% of boron nitride, and 20 wt% of TiO_2, was prepared.

Embodiment 4

[0042] A specimen 10 mm in diameter and 0.3 mm in thickness, which is made of a thermoplastic thermal conductive resin composition comprising 70 wt% of polycarbonate resin (manufactured by LG Chemical Ltd.), 5 wt% of boron nitride, and 25 wt% of TiO_2, was prepared.

Comparative example 1

[0043] A specimen 10 mm in diameter and 0.3 mm in thickness, which is made of a resin composition comprising 90 wt% of polycarbonate resin (manufactured by LG-DOW) and 10 wt% of TiO_2, was prepared.

[Test example]

[0044] The properties of the thermoplastic thermal conductive resin compositions and specimens prepared in the above embodiments and comparative example, were measured according to the following methods, and the results are shown in Table 1.

* Heat deflection temperature: Measured based on ASTM D648.
* Flextural modulus: Measured based on the ASTM D790.
* Tensile elongation ratio: Measured based on the ASTM D638.
* Thermal conductivity: Shown in terms of the data with less than 10 % error based on three kinds of measurement methods, such as a plate method (Tech Center, LG Chemical Ltd.), a heat wire method (Korea Research Institute of Standards and Science), and Hakke Thermoflixer.
* Reflectivity: Total reflectance was measured at the wave length of 550 nm with a spectrophotometer (Shimadzu UV-3101PC).

Table 1

Item	Embodiment 1	Embodiment 2	Embodiment 3	Embodiment 4	Comparative example 1
Heat deflection temperature (°C)	90	130	130	120	120
Flextural modulus (kg/cm^2)	50000	45000	50000	30000	26000
Tensile elongation ratio (%)	5	4	4	70	130
Thermal conductivity (W/mK)	0.38	0.4	0.42	0.37	0.23
Reflectivity (550nm)(%)	93	92	95	98	85

[0045] As illustrated in Table 1, it was confirmed that the specimens in Embodiments 1 through 3, which were prepared using a thermoplastic thermal conductive resin composition according to the present invention, are superior in mechanical strength such as heat deflection temperature, flextural modulus, and tensile elongation ratio, superior in reflectivity, and have a thermal conductivity of at least 0.35 W/mK, as compared with the specimen in the comparative example.

Industrial Applicability

[0046] According to the present invention, a reflection plate for a backlight unit in a liquid crystal display device has been produced that effectively solves the thermal problem of the backlight unit, and has excellent properties such as shock resistance, heat resistance, mechanical strength, as well as having excellent reflectivity, thereby improving the durability of the liquid crystal display device.

[0047] Furthermore, provided is a backlight unit of a liquid crystal display device, in which a reflection plate and lower plate are made of the same material, thereby effectively solving the thermal problem of the backlight unit, and simplifying the manufacturing process.

Claims

1. A backlight unit of a liquid crystal display device, that includes a reflection plate positioned at a lower portion of a lamp of the backlight unit for reflecting a light coming out of the lamp, and a lower plate functioning as a heat sink, wherein the reflection plate and the lower plate are made of the same material, **characterised in that** said same material is a thermoplastic thermal conductive resin composition having a thermal conductivity of at least 0.35 W/mK, wherein the thermoplastic thermal conductive resin composition contains 10 to 95 wt% of a thermoplastic resin, 90 to 5 wt% of boron nitride, and 5 to 40 wt% of TiO2.

2. The backlight unit of a liquid crystal display device according to claim 1, **characterized in that** the thermoplastic resin is one or more kinds selected from a group comprising polybutylene terephthalate, polyethylene terephthalate, aromatic polyamide, polyamide, polycarbonate, polystyrene, polyphenylenesulfide, thermotropic liquid crystalline polymer, polysulfone, polyether sulfone, polyetherimide, polyetheretherketone, polyarylate, polymethylmethylacrylate, polyvinylalcohol, polypropylene, polyethylene, polyacrylonitilebutadienestyrene copolymer, polytetramethyleneoxide-1,4-butanediol copolymer ,copolymer containing stryrene, flyorine-based resin, polyvinylchloride, and polyacrylonitrile.

3. The backlight unit of a liquid crystal display device according to claim 1, **characterized in that** the thermoplastic thermal conductive resin composition further contains 5-15 wt% of a filler, which is one or more kinds selected from a group comprising flake, glass fiber, and halogen or non-halogen flame retardant.

Patentansprüche

1. Hintergrundbeleuchtungseinheit einer Flüssigkristallanzeigevorrichtung, die eine Reflektionsplatte umfasst, die an einem unteren Teil einer Lampe der Hintergrundbeleuchtungseinheit angeordnet ist, zum Reflektieren eines Lichts, das aus der Lampe kommt, und eine untere Platte, die als eine Wärmesenke dient, wobei die Reflektionsplatte und die untere Platte aus demselben Material gefertigt sind, **dadurch gekennzeichnet, dass** das besagte selbe Material eine thermoplastische thermisch leitfähige Harzzusammensetzung ist, mit einer thermischen Leitfähigkeit von zumindest 0,35 W/mK, wobei die thermoplastische thermisch leitfähige Harzzusammensetzung 10 bis 95 Gew.-% eines thermoplastischen Harzes, 90 bis 5 Gew.-% Bornitrid und 5 bis 40 Gew.-% TiO_2 umfasst.

2. Hintergrundbeleuchtungseinheit einer Flüssigkristallanzeigevorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** das thermoplastische Harz eines oder mehrere ist, ausgewählt aus der Gruppe, umfassend Polybutylenterephthalat, Polyethylenterephthalat, aromatisches Polyamid, Polyamid, Polycarbonat, Polystyrol, Polyphenylensulfid, thermotropes flüssigkristallines Polymer, Polysulfon, Polyethersulfon, Polyetherimid, Polyetheretherketon, Polyarylat, Polymethylmethylacrylat, Polyvinylalkohol, Polypropylen, Polyethylen, Polyacrylnitilbutadienstyrolcopolymer, Polytetramethylenoxid-1,4-butandiolcopolymer, Copolymer enthaltend Styrol, Fluor-basiertes Harz, Polyvinylchlorid und Polyacrylnitril.

3. Hintergrundbeleuchtungseinheit einer Flüssigkristallanzeigevorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** in der thermoplastischen thermisch leitfähigen Harzzusammensetzung ferner 5 bis 15 Gew.-% eines Füllstoffes enthalten sind, der einer oder mehrere ist, ausgewählt aus der Gruppe, umfassend Flocken, Glasfasern und Halogen- oder Nicht-Halogenflammschutzmittel.

Revendications

1. Une unité de rétro-éclairage d'un dispositif d'affichage à cristaux liquides, qui inclut une plaque de réflexion positionnée au niveau d'une partie inférieure d'une lampe de l'unité de rétro-éclairage pour réfléchir la lumière émise par la lampe et une plaque inférieure servant de dissipateur thermique, dans laquelle la plaque de réflexion et la plaque inférieure sont fabriquées dans le même matériau, **caractérisée en ce que** ledit même matériau est une composition de résine thermoplastique ayant une conductivité thermique égale ou supérieure à 0,35 W/mK, dans laquelle la composition de résine thermoplastique à conductivité thermique contient entre 10 et 95% en poids d'une résine thermoplastique, entre 90 et 5% en poids de nitrure de bore et entre 5 et 40% en poids de TiO_2.

2. L'unité de rétro-éclairage d'un dispositif d'affichage à cristaux liquides selon la revendication 1, **caractérisée en ce que** la résine thermoplastique est une ou plusieurs résines thermoplastiques sélectionnées dans un groupe comprenant le polybutylène téréphtalate, le polyéthylène téréphtalate, le polyamide aromatique, le polyamide, le polycarbonate, le polystyrène, le polysulfure de phénylène, le polymère à cristaux liquides thermotropes, le polysulfone, le polyéther sulfone, le polyétherimide, le polyétheréthercétone, le polyarylate, le polyméthylméthylacrylate, l'alcool de polyvinyle, le polypropylène, le polyéthylène, le copolymère de polyacrylonitrile-butadiène-styrène, le copolymère de butanédiol-1,4-oxyde de polytétraméthylène, le copolymère de contenant du styrène, la résine à base de fluor, le polychlorure de vinyle et le polyacrylonitrile.

3. L'unité de rétro-éclairage d'un dispositif d'affichage à cristaux liquides selon la revendication 1, **caractérisée en ce que** la composition de résine thermoplastique à conductivité thermique contient en outre entre 5 et 15% en poids d'un matériau de remplissage qui est un ou plusieurs matériaux de remplissage sélectionnés dans le groupe comprenant une paillette, une fibre de verre et un retardateur de flamme halogène ou non halogène.

REFERENCES CITED IN THE DESCRIPTION

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专利名称(译)	用于背光单元的反射板和具有良好导热性的液晶显示器的背光单元		
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[标]申请(专利权)人(译)	乐金化学股份有限公司		
申请(专利权)人(译)	LG化学有限公司.		
当前申请(专利权)人(译)	LG化学有限公司.		
[标]发明人	LEE HEON SANG KIM EUNG SOO LEE MYUNG SE LEE BONG KEUN KWAK MIN HAN SON SEON MO		
发明人	LEE, HEON SANG KIM, EUNG SOO LEE, MYUNG SE LEE, BONG KEUN KWAK, MIN HAN SON, SEON-MO		
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摘要(译)

用于液晶显示装置中的背光单元的反射板技术领域本发明涉及一种用于液晶显示装置中的背光单元的反射板，更具体地，涉及一种用于液晶显示装置中的背光单元的反射板，其由具有以下的热塑性导热树脂组合物制成：导热率至少为0.35W / mK，从而有效地解决了背光单元的热问题，并具有优异的性能，如抗冲击性，耐热性，机械强度等，并具有优异的反射率，从而改善了液晶显示装置的耐久性。此外，本发明涉及一种液晶显示装置的背光单元，包括位于背光单元的灯的下部的反射板，用于反射从灯发出的光，用于灯的支撑杆，用作散热器的下板，其中反射板和下板由相同的材料制成，从而有效地解决了背光单元的热问题，并简化了制造工艺。

Item	Embodiment 1	Embodiment 2	Embodiment 3	Embodiment 4	Comparative example 1
Heat deflection temperature (°C)	90	130	130	120	120
Flextural modulus (kg/cm^2)	50000	45000	50000	30000	26000
Tensile elongation ratio (%)	5	4	4	70	130
Thermal conductivity (W/mK)	0.38	0.4	0.42	0.37	0.23
Reflectivity (550nm)(%)	93	92	95	98	85