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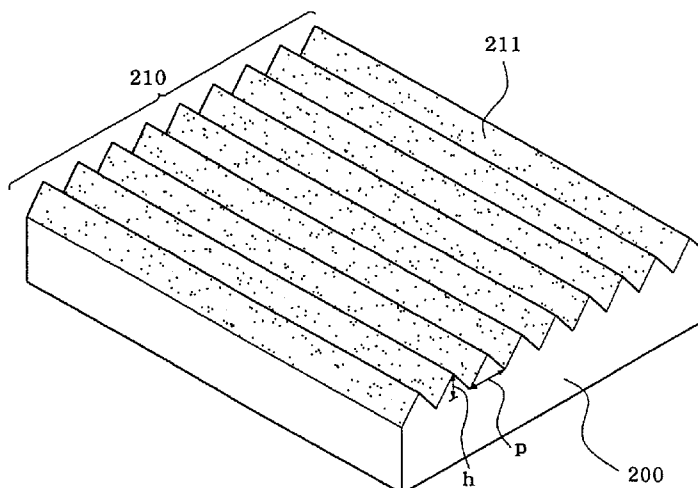
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(54) Title: OPTICAL PRISM SHEET HAVING A CERTAIN ROUGHNESS THEREON

[Fig. 2]



(57) Abstract: Disclosed herein is an optical prism sheet having both functions of refracting and diffusing light. The optical prism sheet includes an optical refracting part comprising a plurality of unit prisms having a predetermined cross-section on one side of the optical prism sheet, and an optical diffusion part comprising fine irregularity and having a predetermined roughness on a surface of the optical refracting part. A unit surface area of the optical refracting part having the fine irregularity is 1.1 to 100 times, and more preferably, 1.5 to 20 times that of the optical refracting part having only the unit prisms without the fine irregularity. Further, a liquid crystal display backlight unit using the optical sheet is provided.

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【DESCRIPTION】**【Invention Title】****OPTICAL PRISM SHEET HAVING A CERTAIN ROUGHNESS THEREON**5 **【Technical Field】**

The present invention relates to an optical sheet and a liquid crystal display (LCD) backlight unit using the same. More particularly, the present invention relates to an optical prism sheet and an LCD backlight unit using the same, on which an optical refracting part having a predetermined roughness is formed to refract light emitted from a light guide plate in a predetermined direction while diffusing the light.

【Background Art】

In general, liquid crystal display (LCD) refers to a device that displays numerals or images through application of an electric field to liquid crystals, which are an intermediate phase material between a liquid and a solid, and which are arranged between two glass substrates acting as electrodes.

Since the LCD is not an emissive device, it must be provided with a backlight unit acting as a light source for emitting light. Then, images are displayed on a liquid crystal panel which has the liquid crystals arranged in a predetermined pattern and adjust transmittance of light emitted from the backlight unit.

Fig. 1 is an exploded perspective view of a conventional LCD backlight unit.

Referring to Fig. 1, the conventional LCD backlight unit includes a light source 105, a light guide plate 110, a reflector plate 115, a diffuser sheet 120, prism sheets 125, and a protector sheet 130.

The light source 105 serves to emit light initially in the liquid crystal display.

Although various types of light source can be used, the LCD generally employs a cold cathode fluorescence lamp (CCFL) that consumes very little power and emits very bright white light.

5 The light guide plate 110 is located at one side of the light source 105 below the LCD panel 100 and serves to project light in front of the light guide plate after converting spot light of the light source 105 into plane light.

 The reflector plate 115 is located at the rear of the light guide plate 110 and serves to reflect light emitted from the light source 105 towards the LCD panel 100 positioned in front of the reflector plate.

10 The diffuser sheet 120 is located at an upper side of the light guide plate 110 and serves to provide uniform light that has passed through the light guide plate 110.

 The prism sheets 125 serve to improve brightness by refracting and collecting light that tends to undergo a rapid decrease in brightness due to diffusion in both directions, i.e., horizontal and vertical directions while passing through the
15 diffuser sheet 120.

 The protector sheet 130 is disposed on the prism sheet, and serves to protect the prism sheets 125 from damage such as scratches and to prevent the Moire phenomenon that occurs when using prism sheets 125 stacked in two layers in the horizontal and vertical directions.

20 The conventional LCD backlight unit is generally configured as described above. In contrast, the present invention applies a different technical idea to the prism sheet 125.

 In the prism sheet 125, a plurality of unit prisms are densely arranged with a specific orientation on one side of a transparent film.

25 The prism sheet 125 serves to refract the light, emitted from the light guide plate 110 and diffused through the diffuser sheet 120, to have the specific orientation.

 Generally, when light is transmitted through and reflected from a narrow area, the narrow area appears brighter than other portions. On the other hand, if the same light is transmitted through and reflected from a wide area, the wide area looks

darker than the narrow area while occupying a larger area.

Recently, LCD techniques for a monitor of 17 or 19 inches have been applied large-scale panels of 40 inches or more. For such a large-scale panel, important techniques are to make light emitted from the backlight unit have a predetermined intensity or more and have uniform diffusion throughout the whole area.

Meanwhile, the intensity of light generally has a critical value at which there is no need to increase the intensity of light so long as a predetermined brightness level is maintained. Particularly, it has become relatively easy to secure a certain level or more intensity of light as light sources have recently been developed to emit the higher intensity light. However, much further research into efficiently and uniformly diffusing the light throughout the whole area of the large-scale panel is still needed.

【Disclosure】

15 【Technical Problem】

The present invention has been made in view of the above problems, and an aspect of the present invention is to provide an optical prism sheet capable of effectively diffusing light while refracting the light to have a specific orientation.

It is another aspect of the present invention to provide an LCD backlight unit using the optical prism sheet.

It can be understood by those skilled in the art that the technical aspects of the present invention are not limited to the foregoing problems and other aspects not mentioned will be apparent through the following descriptions.

【Technical Solution】

25 In accordance with an aspect of the present invention, an optical prism sheet includes an optical refracting part comprising a plurality of unit prisms having a

predetermined cross-section on one side of the optical prism sheet, and an optical diffusion part comprising fine irregularity and having a predetermined roughness on a surface of the optical refracting part, wherein a unit surface area of the optical refracting part having the fine irregularity is 1.1 to 100 times, and more preferably, 1.5 to 20 times that of the optical refracting part having only the unit prisms without the fine irregularity.

In accordance with another aspect of the present invention, a liquid crystal display backlight unit includes: a light guide plate; a light source located at a lateral or rear side of the light guide plate; and the optical prism sheet disposed on a light-exit side of the light guide plate and having both functions of refracting and diffusing light.

【Advantageous Effects】

According to an exemplary embodiment of the present invention, the optical prism sheet has both functions of refracting and diffusing light, so that a light guide plate for an LCD backlight unit can exhibit excellent diffusion and transmittance. Further, since the optical prism sheet of the present invention permits elimination of the conventional diffuser sheet, it is possible to reduce manufacturing costs and to decrease the thickness of the light guide plate.

【Description of Drawings】

Fig. 1 is an exploded perspective view of a conventional LCD backlight unit;

Fig. 2 is a schematic perspective view of an optical sheet according to an exemplary embodiment of the present invention;

Fig. 3 is an electron micrograph showing one example of the optical sheet according to the exemplary embodiment of the present invention;

Figs. 4 and 5 are enlarged views of the micrograph of Fig. 3;

Fig. 6 is a photograph showing an experimental result from a sample based on a comparative example; and

Fig. 7 is a photograph showing an experimental result from a sample based on the example of the optical sheet.

5 **【Best Mode】**

In accordance with an aspect of the present invention, an optical prism sheet includes an optical refracting part comprising a plurality of unit prisms having a predetermined cross-section on one side of the optical prism sheet; and fine irregularity having a predetermined roughness and a function of diffusing light on
10 a surface of the optical refracting part, wherein a unit surface area of the optical refracting part having the fine irregularity is 1.1 to 100 times that of the optical refracting part having the unit prisms without the fine irregularity.

In accordance with another aspect of the present invention, a liquid crystal display backlight unit includes: a light guide plate; a light source located at a lateral
15 or rear side of the light guide plate; and the optical prism sheet disposed on a light-exit side of the light guide plate and having both functions of refracting and diffusing light.

【Mode for Invention】

Fig. 2 is a schematic perspective view of an optical sheet according to an exemplary embodiment of the present invention, and Fig. 3 is an electron
20 micrograph showing one example of the optical sheet according to the exemplary embodiment of the present invention;

Figs. 4 and 5 are enlarged views of the micrograph of Fig. 3.

Referring to Fig. 2, the optical prism sheet 20 according to the embodiment
25 of the present invention includes a base film 200, an optical refracting part 210, and an optical diffusing part having a minute concave-convex structure.

The base film 200 constitutes a base layer of the optical prism sheet, and generally comprises a transparent material, such as a transparent synthetic resin, for example polyethylene, polypropylene, polycarbonate, polymethylmethacrylate (PMMA), and the like; glass, and other metal plates.

5 The base film 200 generally has a thickness of μm scale, but is not limited thereto.

The optical refracting part 210 is formed on one side of the base film 200 and serves to refract light having passed through the base film 200 and to give the light a specific orientation.

10 According to the present invention, the optical refracting part 210 has a prism shape.

In other words, the optical refracting part 210 is provided as a plurality of unit prisms 211 on one side of the base film 200 so that light emitted from the base film 200 can be refracted and oriented in a specific direction.

15 Fig. 2 shows the optical refracting part 210 in which each unit prism 211 has a triangular cross-section and is wholly shaped like a triangular prism. However, each cross-section of the unit prisms 211 constituting the optical refracting part 210 is not limited to the triangular shape, and may have various shapes such as a semi-circular shape (i.e., a semi-cylinder or lenticular shape), a trapezoidal shape, or a
20 rounded wedge shape so long as such shape effectively refracts the light.

Here, the cross-section of the unit prism 211 which will be employed in the diffuser prism sheet 20 according to the present invention is determined according to practical device properties, required viewing angles, screen size, etc.

25 It is desirable that the plurality of unit prisms 211 constituting the optical refracting part 210 be arranged closely with no space therebetween. However, if collimation is more important than refraction, the unit prisms 211 may be spaced from each other with a flat surface present therebetween.

In the unit prism 211, a ratio of height (h) to pitch (p) may range from 1:2 to 1:100. For example, the height (h; a mean value because all heights are not the

same) may be 2~100 μm , and the pitch may be 5~300 μm , more preferably 2~100 μm . In the case that the unit prism 211 has a triangular cross-section, a vertical angle (θ) may range from 30° to 120°.

Further, an outer surface around the vertical angle of the unit prism 211 is preferably rounded to prevent scratches when another film is stacked on and contacts the unit prism 211.

The optical diffusing part is regularly or irregularly provided in the form of a minute concave-convex structure on the surface of the optical refracting part 210.

The optical diffusing part having the fine irregularity comprises a plurality of lens-shaped concave and convex patterns each having a rounded surface covering the surface of the optical refracting part 210 while being arranged closely or partially spaced apart from each other a predetermined distance. At this time, a surface roughness (Ra) of the optical diffusing part has to be smaller than the height of the unit prisms 211 constituting the optical refracting part 210. Specifically, the optical diffusing part may have an Ra of 0.05~30 μm , and more preferably have an Ra of 0.1~10 μm .

The reason why the optical diffusing part has to have such a range is that the refraction is improved to increase frontal brightness but the diffusion decreases if the Ra is smaller than 0.05 μm , and that the diffusion is enhanced but the frontal brightness decreases if the Ra is larger than 30 μm .

Further, the fine irregularity enlarge a unit surface area of the optical diffusing part 210 as compared to the optical diffusing part 210 having only the unit prisms 211 without the fine irregularity by 1.1~100 times, and more preferably by 1.5~20 times.

The optical diffusing part is formed to slightly diffuse light, having passed through the base film 200 and the optical refracting part 210, to the surface of the optical refracting part 210. Here, "slightly diffuse" means that the light is diffused as much as possible while keeping a brightness decrease of the refracted light to about 5~10%.

The optical diffusing part may be formed by a separate process with a different member from that of the optical diffusing part 210. However, according to the embodiment of the present invention, the optical diffusing part is formed along with the optical refracting part 210, i.e., the optical diffusing part and the optical refracting part 210 are formed as a single body.

The optical refracting part 210 is generally manufactured by pressing a transparent film having a predetermined thickness with a prism-engraved mold, so that the transparent film can have a prism-embossed pattern corresponding to the prism-engraved mold. Here, the top of the transparent film becomes the optical refracting part having the prism shape, and the bottom becomes the base film.

As described above, to form the optical refracting part 210 and the optical diffusing part at the same time in the process of manufacturing the prism sheet, a concave and convex pattern is formed on the prism-engraved mold, and the pressing is performed with this mold, thereby manufacturing the prism sheet in which the optical refracting part 210 and the optical diffusing part are formed integrally with each other.

With this manufacturing process, the optical sheet was manufactured and photographed using an electron microscope. Photographs are shown in Figs. 3, 4 and 5. Referring to Figs. 3, 4 and 5, the prism-shaped optical diffusing part is formed on the film having a predetermined thickness, and the surface of the optical diffusing part is not smooth but rough with the concave-convex structure. This concave-convex structure corresponds to the optical diffusing part.

The optical sheet 20 is stacked on a light-exit surface of the light guide plate. As the optical sheet 20 of the present invention is used, a conventional diffuser sheet is no longer necessary.

In the foregoing description, the optical refracting part and the optical diffusing part are formed on the base film. However, the technical idea of the present invention is characterized in that the optical diffusing part or a similar minute concave-convex structure is added in order to facilitate light diffusion on the

surface of the prism-shaped optical refracting part having a polygonal cross-section, such as a triangular prism, and the height, the pitch and the mean roughness of the fine irregularity are limited to certain values.

5 Therefore, a base film or similar layer need not be used in the practical manufacturing process, and these structures may be integrated into a single layer.

According to the embodiment of the present invention, the optical sheet 20 can be employed not only for an edge type wherein the light source is located at a lateral side of the light guide plate, but also for a direct type wherein the light source is located directly at the rear of the light guide plate. Further, the optical sheet 20 may be used regardless of the kind of the light source, e.g., a cold cathode fluorescence lamp (CCFL), a light emitting diode (LED), etc.

Hereinafter will be described experimental examples to show that transmittance and a haze value indicating a degree of light diffusion are superior without a remarkable brightness decrease in the case that the light guide plate is manufactured using the optical sheet according to the present invention. Matters apparent to those skilled in the art will be omitted herein.

<Inventive Example>

20 A sample was manufactured with an optical refracting part having a vertical angle of 90° and a height or a pitch of about 50 μm . The sample had a concave-convex structure having a mean surface roughness of about 2 μm on the surface.

<Comparative Example>

25 A sample was manufactured with an optical refracting part having a vertical angle of 90° and a height or a pitch of about 50 μm .

The inventive and comparative examples were compared under the same conditions of physical values of the base film, such as kind, transmittance, haze value, thickness, etc.

Further, surface brightness, haze, and transmittance were measured using

samples manufactured by the foregoing inventive and comparative examples.

Fig. 6 is a photograph showing an experimental result from a sample based on a comparative example; and Fig. 7 is a photograph showing an experimental result from a sample based on the example of the optical sheet.

5 The following Table 1 shows brightness, haze and transmittance of samples manufactured by the foregoing inventive and comparative examples.

Table 1

	Comparative example	Inventive example
Brightness (cd/m ²)	6557	6066
Haze (%)	85.87	92.70
Transmittance (%)	6.24	33.99

10 Referring to Fig. 6, it can be understood that the sample according to the comparative example has a high center brightness and poor light diffusion. Specifically, as shown in Table 1, the sample based on the comparative example shows a center brightness of 6,557 cd/m², a haze of 85.87% and a transmittance of 6.24%.

15 Referring to Fig. 7, it can be understood that the sample based on the inventive example has the similar center brightness to the comparative example, but exhibits superior light diffusion to the sample based on the comparative example. Specifically, as shown in Table 1, the sample based on the comparative example has a center brightness of 6,066 cd/m², a haze of 92.70%, and a transmittance of 33.99%.

20 As described above, the optical sheet according to the present invention yields excellent light diffusion and transmittance even with a center brightness decrease less than about 5~10%.

Although several embodiments of the present invention have been shown and described with reference to the drawings and table, it will be apparent to those skilled in the art that various modifications and variations can be made without

departing from the spirit or essential features of the present invention. Thus, it should be understood that the above embodiments are not given by way of limitation but by way of illustration only.

【CLAIMS】**【Claim 1】**

An optical prism sheet, comprising:
an optical refracting part comprising a plurality of unit prisms having a
5 predetermined cross-section on one side of the optical prism sheet; and
fine irregularity having a predetermined roughness and a function of
diffusing light on a surface of the optical refracting part,
wherein a unit surface area of the optical refracting part having the fine
irregularity is 1.1 to 100 times that of the optical refracting part having the unit
10 prisms without the fine irregularity.

【Claim 2】

The optical prism sheet according to claim 1, wherein the unit surface area
of the optical refracting part having the fine irregularity is 1.5 to 20 times that of the
optical refracting part having only the unit prisms.

15 【Claim 3】

The optical prism sheet according to claim 1, wherein the optical refracting
part has a mean roughness of 0.05 to 30 μm .

【Claim 4】

The optical prism sheet according to claim 1, wherein the optical refracting
20 part has a mean roughness of 0.1 to 10 μm .

【Claim 5】

The optical prism sheet according to claim 1, wherein the cross-section of the unit prism has a triangular shape, a semicircular shape, a trapezoidal shape, or a rounded wedge shape.

【Claim 6】

- 5 The optical prism sheet according to claim 1, wherein, when the unit prism has a triangular cross-section, a vertical angle of the triangular cross-section is in the range of 30~120°.

【Claim 7】

- 10 The optical prism sheet according to claim 1, wherein the unit prism has a height of 2~100 μm .

【Claim 8】

The optical prism sheet according to claim 1, wherein the unit prism has a pitch of 5~300 μm .

【Claim 9】

- 15 The optical prism sheet according to claim 1, wherein the unit prism has a pitch of 10~200 μm .

【Claim 10】

The optical prism sheet according to claim 1, wherein an outer surface around a vertical angle of the unit prism is rounded.

- 20 **【Claim 11】**

The optical prism sheet according to claim 1, wherein the optical sheet comprises a base film comprising one selected from a transparent synthetic resin, such as polymethylmethacrylate (PMMA) and polystyrene (PS), glass, and a metal plate.

5 **【Claim 12】**

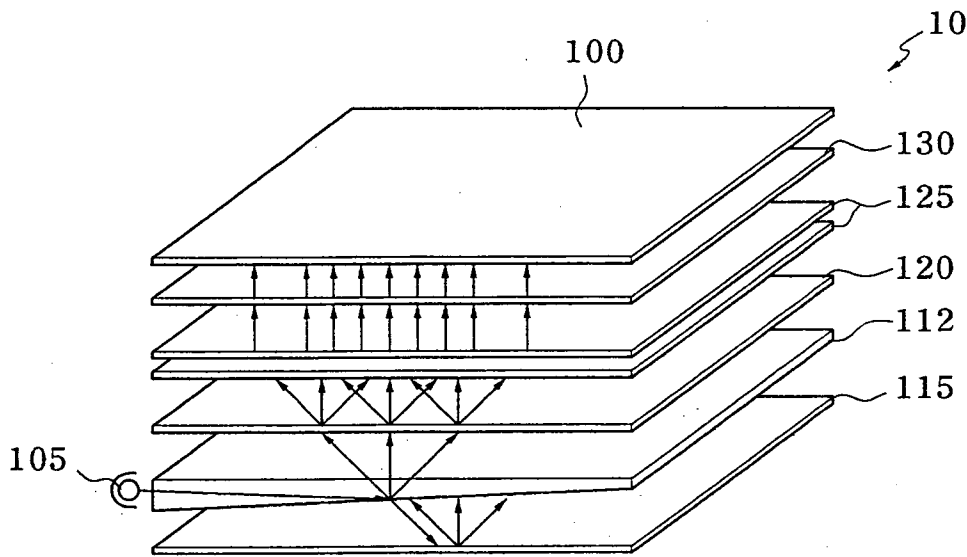
The optical prism sheet according to claim 1, wherein the optical refracting part is made of the same material as the base film.

【Claim 13】

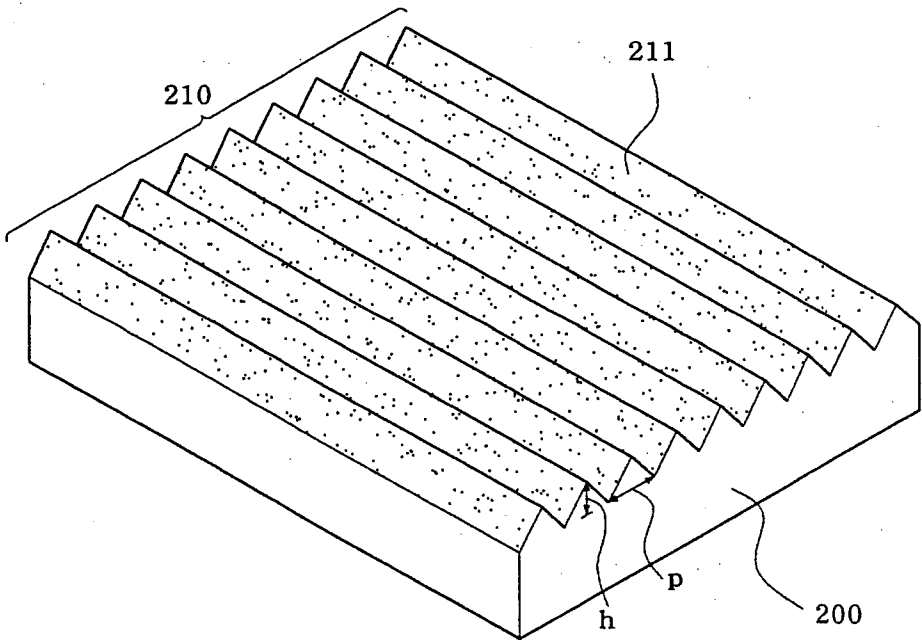
10 A liquid crystal display backlight unit comprising:
 a light guide plate;
 a light source located at a lateral or rear side the light guide plate; and
 the optical prism sheet according to claim 1, the optical prism sheet being disposed on a light-exit side of the light guide plate and having both functions of refracting and diffusing light.

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[Fig. 1]

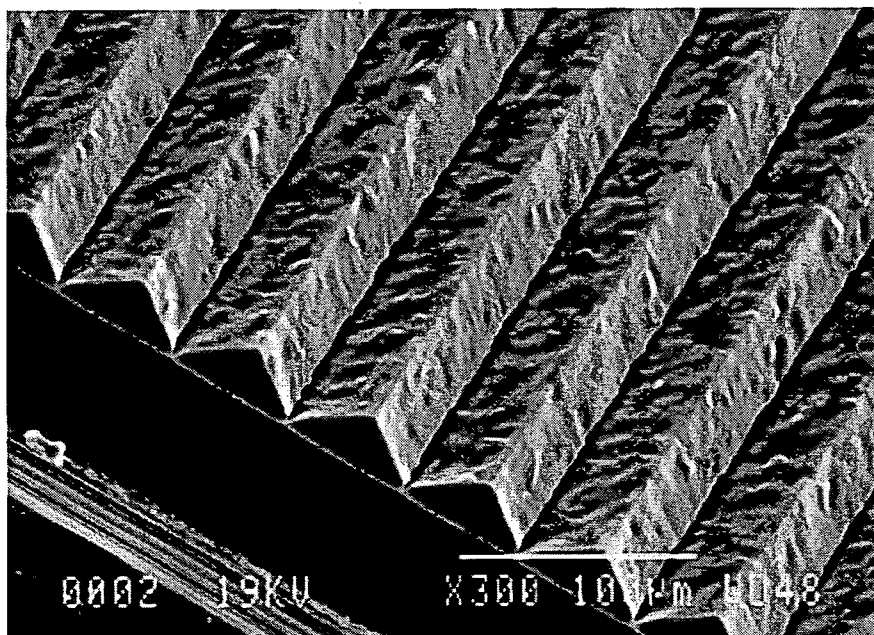


[Fig. 2]

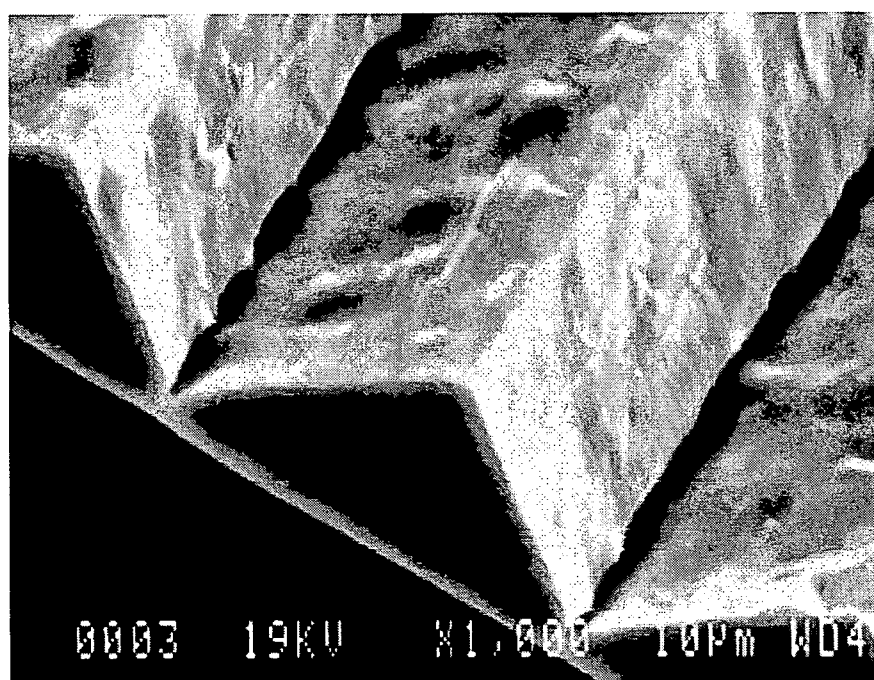


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[Fig. 3]

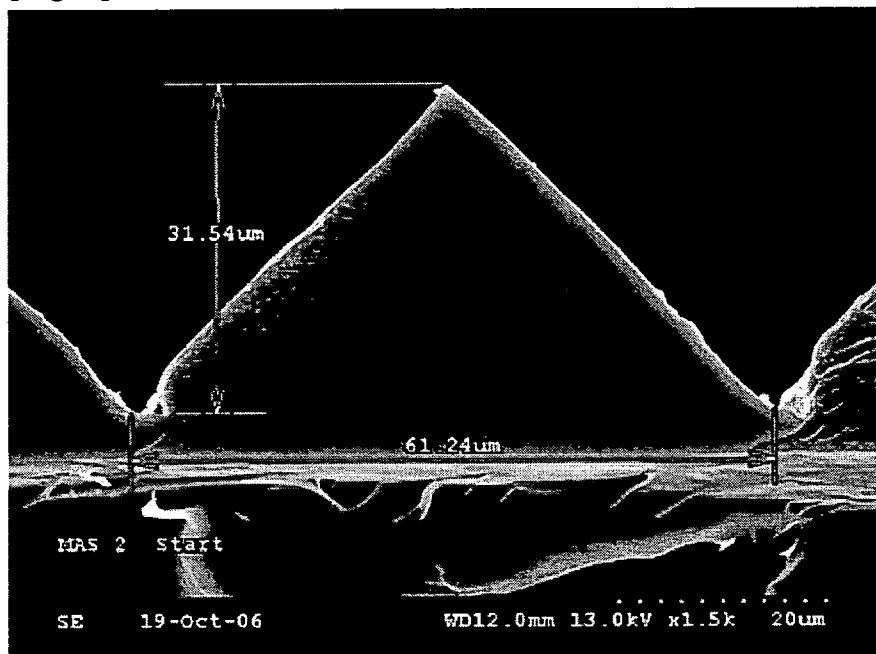


[Fig. 4]

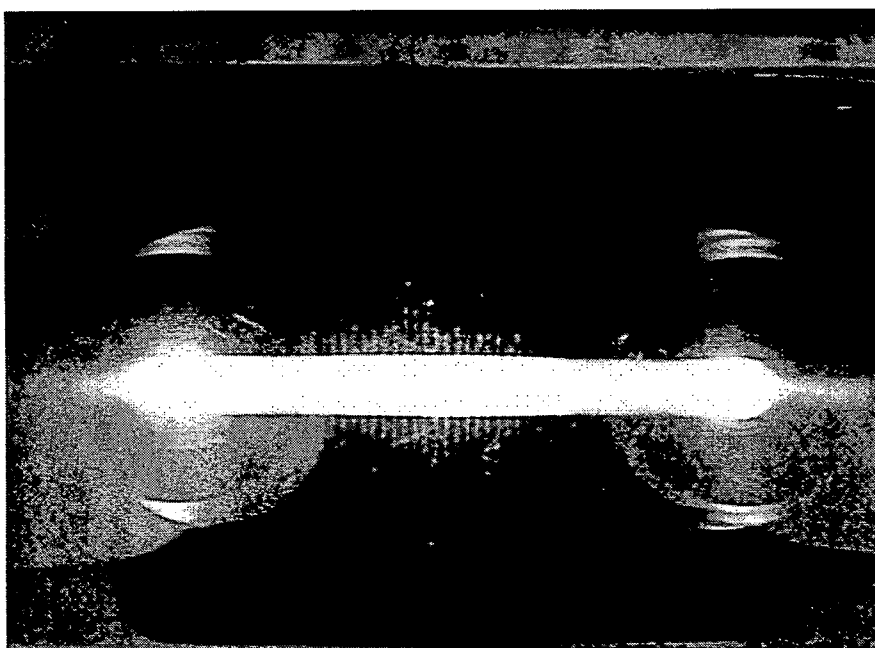


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[Fig. 5]

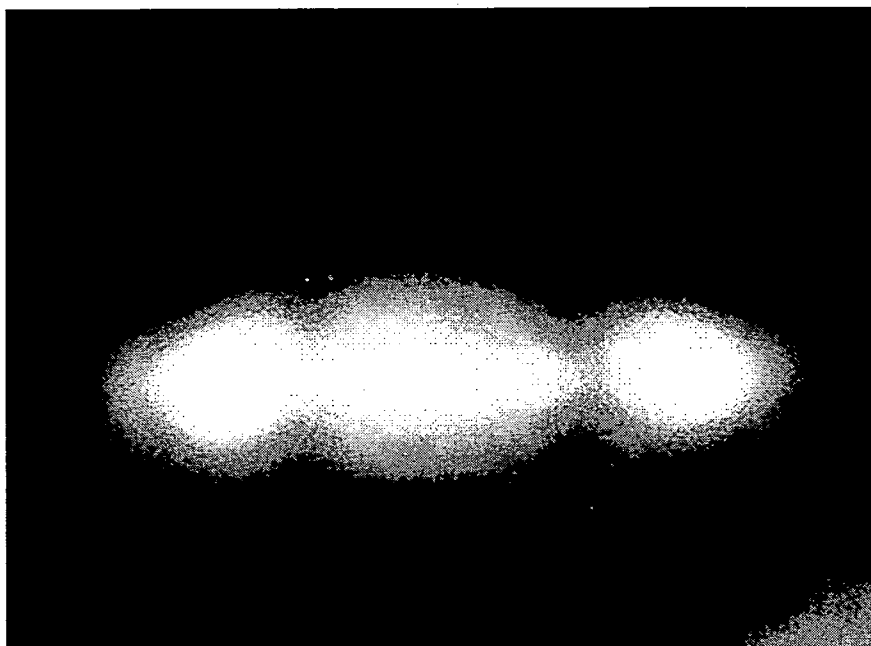


[Fig. 6]



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[Fig. 7]



A. CLASSIFICATION OF SUBJECT MATTER**G02B 5/02(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)

IPC 8 : G02B 5/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean Utility Models and applications for Utility Models since 1975

Japanese Utility Models and applications for Utility Models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKIPASS(KIPO internal) "Keywords : refraction, LCD, prism, sheet"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 08-054503 A (DAINIPPON PRINTING CO., LTD.) 27 February 1996 See abstract, claim 1, pages 2-5 and figures 1-9	1-13
A	JP 2005-142164 A (SAMSUNG ELECTRONICS CO., LTD.)) 02 June 2005 See abstract, claim 1 and figures 1-10	1-13
A	KR 2002-61802 A (SONG SAN CO., LTD.) 25 July 2002 See abstract and figures 1-6	1-13
A	KR 2005-103329 A (RAYGEN CO., LTD.) 31 October 2005 See abstract and figure 1	1-13



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

30 JUNE 2008 (30.06.2008)

Date of mailing of the international search report

30 JUNE 2008 (30.06.2008)

Name and mailing address of the ISA/KR

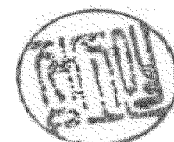
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 08-054503 A	27.02.1996	JP 3492775 B2	03.02.2004
JP 2005-142164 A	02.06.2005	CN 1614471 A KR 20050044961 A TW 289688 A US 2005-0099815 A1	11.05.2005 16.05.2005 11.11.2007 12.05.2005
KR 10-2002-0061802 A	25.07.2002	JP 2004-524556 T2 US 2004-0061959 A1 US 6798574 B2 WO 02-057816 A1	12.08.2004 01.04.2004 28.09.2004 25.07.2002
KR 10-2005-0103329 A	31.10.2005	None	