Long obliquely stretched film
Lange, schräg gestreckte Folie
Long film étiré obliquement

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Description

TECHNICAL FIELD

[0001] The present invention relates to a long obliquely stretched film, a method for producing a retarder, and a liquid crystal display device comprising the retarder.

BACKGROUND ART

[0002] In a liquid crystal display device, various retarders are used for optical compensation such as prevention of coloring and expansion of view angles. Retarders used in the liquid crystal display device are in a rectangular shape in general and have an orientation axis in a direction inclined with respect to a side thereof. In a liquid crystal display devices, such a retarder is laminated on a polarization plate such that the orientation axis of the retarder and a polarization transmission axis of the polarization plate get into a desired angle.

[0003] As a method of manufacturing a retarder having an orientation axis in a direction inclined with respect to its side as above, such a method is widely known that a transparent resin film (raw material film) is stretched longitudinally or laterally to be oriented so as to obtain a long stretched film and then the stretched film is cut in a rectangular shape with a predetermined angle with respect to the side of the stretched film. However, with this method, even if cutting is done so that the maximum area can be obtained, a cutting loss is generated all the time to lower use efficiency of the stretched film, which is a problem. On the other hand, a long stretched film oriented obliquely with a predetermined angle can be cut away in parallel with the side to increase use efficiency of the stretched film.

[0004] A method of obtaining a film with an obliquely oriented orientation axis by stretching has been known. For example, in Patent Document 1, a method for producing an obliquely stretched film which is stretched in a direction oblique to a film longitudinal direction is disclosed in which both side ends of a film is grasped between two rows of chucks running on tenter rails arranged so that traveling distances of the chucks in a predetermined traveling section are different and is made to travel.

[0005] Patent Document 2 discloses a method of stretching an optical polymer film characterized in that, in a method of stretching an optical polymer film stretched by giving a tension while holding both side ends of a continuously supplied polymer film by holding means and advancing the holding means in a longitudinal direction of the film, stretching is performed while a locus L1 of the holding means from a substantial hold start point to a substantial hold release point at one side end of the polymer film and a locus L2 of the holding means from the substantial hold start point to the substantial hold release point at another side end of the polymer film, and a distance W between the two substantial hold release points satisfy a relation of |L2 - L1| > 0. 4W, bearing properties of the polymer film are maintained and a state where a volatile component content is 5% or more is present and then, the volatile component content is lowered while the film is made to shrink.

[0006] Patent Document 3 discloses a method for producing a long optical film having an optical axis (orientation axis) being in a direction neither in parallel nor perpendicular to a flow direction of the long film obtained by stretching a long film made of a thermoplastic resin, in which the method for producing a long optical film characterized in that, in a region where the film is substantially stretched, stretching is performed so that magnitude of moving speeds at both opposing side ends in the width direction of the films are equal and the traveling distances are different, and at least one of a pair of jigs holding the width-direction both side ends of the film is moved on a rail in a waved shape with respect to the film surface. Moreover, Patent Document 3 describes that the stretching process may be repeated several times or the stretching process may be performed after stretching in a longitudinal direction or a lateral direction in advance.

[0007] However, with these obliquely stretching methods, wrinklies or twists can easily occur obliquely. Thus, it is substantially impossible to obtain a wide film having a uniform thickness in the width direction and an orientation axis uniformly oriented in an oblique direction at 40° or more and 85° or less. Thus, it has not been possible to mass-produce a long and wide optical film industrially in which an orientation axis is oriented obliquely (in a direction largely offset from the film width direction or longitudinal direction).

[0008] JP 2003-215337 A discloses an optical compensating film and a production method thereof, circularly polarizing plates and a graphic display device. US 2004/241344 A1 discloses an optical compensation film, a manufacturing method thereof, circularly polarizing plates comprising the optical compensation film and a liquid crystal display device. JP 2004-205972 A discloses a polarizing plate, a method for producing the polarizing plate, and a liquid crystal display device. These patent documents provide a polarizing film obtained by oblique extension, but do not disclose the present invention.

DISCLOSURE OF THE INVENTION

[0009] The object of the present invention is to provide a wide and long obliquely stretched film and a retarder, respectively, having a uniform thickness in the width direction, and a liquid crystal display device comprising the retarder made from said wide and long obliquely stretched film.

[0010] The inventors have found that in two-stage stretching which obliquely stretching is performed after longitudinal stretching, by controlling a relation of average retardations generated in the longitudinal stretching and obliquely stretching, respectively, and a stretching angle of the obliquely stretching, or specifically by stretching a film with an average retardation $R_{e1}$ obtained by longitudinally stretching in a direction with an angle $\theta_e$ oblique to the width direction under a condition that a long obliquely stretched film sample with the average retardation $R_{e2}$ ($R_{e2}$ is smaller than $R_{e1}$) is obtained from a raw material film with substantially zero average retardation, an obliquely stretched film with a uniform width-direction thickness having an orientation axis in a direction at 40° or more and 85° or less from the width direction and in a direction with an angle larger than the above $\theta_e$ and no wrinkles or twists can be obtained. And the present invention has been completed based on this finding.

[0011] The present invention provides the long obliquely stretched film according to claim 1, the long laminate film according to claim 13, the method for producing a retarder according to claim 14, the method for producing a polarizing plate according to claim 15, the liquid crystal display device according to claim 16 and the liquid crystal display device according to claim 17. Preferred embodiments of the long obliquely stretched film are defined in claims 2 to 12. The present disclosure also describes the following which does not form part of the invention:

1. A method for producing a long obliquely stretched film having an orientation axis in a direction with an angle $\theta_s$ of 40° or more and 85° or less from the width direction, the method comprising:
   a) a step of longitudinally stretching a long raw material film to obtain a longitudinally stretched film with an average retardation $R_{e1}$; and a step of stretching the longitudinally stretched film in a direction with an angle $\theta_e$ oblique to the width direction, wherein
   b) the step of stretching in the direction with the angle $\theta_e$ is performed under a condition that a long obliquely stretched film sample with the average retardation $R_{e2}$ ($R_{e2}$ is smaller than $R_{e1}$) is obtained from the long raw material film;

2. the method for producing a long obliquely stretched film according to the above (1), in which a stretching temperature of the stretching step in the direction of the angle $\theta_e$ is higher than a stretching temperature of the step of longitudinal stretching; and

3. the method for producing a long obliquely stretched film according to the above (1) or (2), in which a stretching magnification of the stretching step in the direction at the angle $\theta_e$ is smaller than a stretching magnification of the longitudinal stretching step;

4. a method for producing a long obliquely stretched film having an orientation axis in a direction with an angle $\theta_s$ of 40° or more and 85° or less from the width direction, the method comprising:
   a) a step of winding a longitudinally stretched film off a winding body of the longitudinally stretched film with an average retardation $R_{e1}$ obtained by longitudinally stretching a long raw material film; a step of grasping both side ends in the width direction of the longitudinally stretched film by grasping means; a step of stretching the longitudinally stretched film in the direction of the angle $\theta_e$ oblique to the width direction through a preheating zone, a stretching zone and a fixing zone to obtain an obliquely stretched film; a step of releasing the both side ends of the obliquely stretched film from the grasping means; and a step of taking up the obliquely stretched film around a winding core, wherein
   b) the step of stretching in the direction of the angle $\theta_e$ is performed under a condition that a long obliquely stretched film sample with the average retardation $R_{e2}$ ($R_{e2}$ is smaller than $R_{e1}$) is obtained from the long raw material film; and
   c) traveling speeds of the grasping means are substantially equal at both side ends of the film;

5. a method for producing a long obliquely stretched film according to the above (4), in which a film running direction in the fixing zone is inclined with an angle of $\theta_1$ from the film running direction in the preheating zone and the angle $\theta_1$ is not more than $\theta_e$;
(6) a long obliquely stretched film obtained by the method according to any one of the above (1) to (5);

(7) a long laminate film obtained by laminating the long obliquely stretched film according to the above (6) and a long polarizer with their longitudinal directions aligned;

(8) a method for producing a retarder comprising a step of trimming the long obliquely stretched film according to the above (6) to a predetermined size along a direction perpendicular to or parallel with its longitudinal direction;

(9) a method for producing a polarizing plate including a step of trimming the long laminate film according to the above (7) to a predetermined size;

(10) a liquid crystal display device comprising the retarder obtained by the method according to the above (8);

(11) a liquid crystal display device comprising a polarizing plate obtained by the method according to the above (9); and

(12) a liquid crystal display device according to the above (10) or (11) comprising a reflective-type liquid crystal panel.

ADVANTAGES OF THE INVENTION

According to a producing method described above, the wide and long obliquely stretched film of the present invention can be easily obtained in which a thickness in the width direction is uniform and an orientation axis is uniformly oriented in a direction at 40° or more and 85° or less, preferably 51° or more and 85° or less with respect to the width direction. The long stretched film with the obliquely oriented orientation axis is suitable as a retarder of a liquid crystal display device and the like. Specifically, when laminated with other long optical elements used for a liquid crystal display device such as a polarizing plate with an orientation axis inclined at a given angle, by using the stretched film having an orientation axis oblique to the longitudinal direction, lamination by roll-to-roll with other long optical elements can be realized. Since a film having an orientation axis in parallel with the width direction (TD direction) or longitudinal direction (MD direction) of a long film needs diagonal trimming, that leaves a large waste portion. Since the stretched film having an orientation axis oblique to the MD direction obtained by the above producing method may be trimmed in parallel with the MD direction or TD direction, that leaves little film waste portion, which is excellent in productivity. Also, the retarder obtained by the producing method of the present invention has a wider view angle of its display screen when used in a liquid crystal display device, particularly in a reflective-type liquid crystal display device, and can result in preventing drop in contrast or coloring of the display screen.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a conceptual diagram illustrating an example of a tenter stretching machine to which the above producing method can be suitably applied.

Fig. 2 is a diagram illustrating grasping means of a rail portion in the stretching machine in Fig. 1.

Fig. 3 is a diagram for explaining rail arrangement in the stretching machine in Fig. 1.

EXPLANATION OF SYMBOLS

film
temperature-controlled room
rail
grasping means
boundary between preheating zone and stretching zone
boundary between stretching zone and fixing zone
wind-off roll
wind-up roll
running direction of film in preheating zone
BEST MODE FOR CARRYING OUT THE INVENTION

[0015] A method for producing a long obliquely stretched film having an orientation axis in a direction with an angle θ of 40° or more and 85° or less from the width direction according to the present invention comprises a) a step of longitudinally stretching a long raw material film to obtain a longitudinally stretched film with an average retardation Re1; and a step of stretching the longitudinally stretched film in a direction with an angle θ oblique to the width direction; b) in which the step of stretching in the direction with the angle θ is performed under a condition that a long obliquely stretched film sample with the average retardation Re2 (Re2 is smaller than Re1) is obtained from the long raw material film.

[0016] The long raw material film used in producing the long obliquely stretched film of the present invention is a long film made of a transparent resin. The term long means those having a length of at least approximately 5 times or more of a width of a film or a laminate body, and preferably having a length of 10 times or more; and more specifically having a length being such an extent that is wound in a roll state for storage or transport. The transparent resin is a resin which is transparent to a desired wavelength. The transparent resin is preferably a thermoplastic resin. Also, the transparent resin is preferably a resin with a positive specific birefringence value. The transparent resins include polycarbonate resin, polyethersulphone resin, polyethylene terephthalate resin, polyimide resin, polyethylene resin, polyvinyl chloride resin, polystyrene resin, polyarylate resin, polyethylene resin, poly(vinyl chloride) resin, diacetylcellulose, triacetylcellulose, polystyrene resin, polyacryl resin, olefin polymer having alicyclic structure (alicyclic olefin polymer) and the like. Among them, alicyclic olefin polymer is preferable.

[0017] The olefin polymers having alicyclic structure include norbornene resin, single-ring cyclic olefin resin, cyclic conjugated diene resin, vinyl alicyclic hydrocarbon resin, and hydrogenated product thereof. Among them, norbornene resin has favorable transparency and molding property and can be suitably used.

[0018] The norbornene resins include a ring-opening polymer of monomer having a norbornene structure or a ring-opening copolymer of monomer having a norbornene structure and another monomer, or hydrogenated product thereof, an addition polymer of monomer having a norbornene structure or an addition copolymer of monomer having a norbornene structure and another monomer, or hydrogenated product thereof and the like.

[0019] The transparent resin used in producing the long obliquely stretched film of the present invention has a glass transition temperature of preferably 80°C or more, and more preferably 100 to 250°C. Also, an absolute value of photoelastic coefficient of the transparent resin is preferably 10 × 10^{-12} Pa^{-1} or less, more preferably 7 × 10^{-12} Pa^{-1} or less, and particularly preferably 4 × 10^{-12} Pa^{-1} or less. The photoelastic coefficient C is a value represented by C = Δn/Δε when birefringence is Δn and a stress is Δε. Using the transparent resin with the photoelastic coefficient in this range can result in restricting a phenomenon of a change in a hue at an edge portion of a display screen in a liquid crystal display device when an obliquely stretched film obtained by the above method is applied to the liquid crystal display device.

[0020] The transparent resin used in producing the long obliquely stretched film of the present invention may be mixed with compounding agent such as coloring agent such as pigment and dye, fluorescent brightening agent, dispersing agent, heat stabilizer, light stabilizer, ultraviolet absorber, antistatic agent, antioxidant, lubricant, solvent and the like as appropriate.

[0021] The raw material film used in producing the long obliquely stretched film of the present invention may be a single-layer film or multi-layer film. Also, the raw material film is preferably supplied as a winding body that the raw material film is wound around a winding core.

[0022] The longitudinal stretching is to stretch the film in a direction in parallel with the longitudinal direction of the raw material film. A method of longitudinal stretching is not particularly limited, for example, a method of stretching by a difference in rotating speeds between rolls can be mentioned.

[0023] A longitudinally stretched film having the orientation axis in the direction substantially parallel with the longitudinal direction and the average retardation Re1 can be obtained by the longitudinal stretching. The average orientation angle of the orientation axis of the longitudinally stretched film is usually more than 85° and no more than 90°, and preferably more than 89° and no more than 90° with respect to the film width direction. The longitudinally stretched film is preferably wound around a winding core to have a winding body to be supplied to the subsequent processes. Stretching conditions such as a stretching temperature T1, stretching magnification R1, speed V1 and the like in the longitudinal stretching are not particularly limited, but the stretching temperature T1 is preferably Tg-20°C or more and Tg+30°C or less, the stretching magnification R1 is preferably 1.01 times or more and 10.0 times or less, and the speed V1 is preferably 1 mm/min or more and 200 mm/min or less. Tg is a glass transition temperature of the transparent resin constituting the raw material film. In this specification, angles are noted by inferior angles (smaller angles).

[0024] Next, this longitudinally stretched film is stretched in a direction with the angle θ oblique to the width direction.
A condition of stretching at the oblique angle $\theta_e$ is a condition by which a long obliquely stretched film sample with the average retardation $R_{e2}$ is obtained from the long raw material film. Here, $R_{e2}$ is smaller than $R_{e1}$, preferably smaller than 0.5 times of $R_{e1}$. An obliquely stretched film having an orientation axis in a direction larger than the angle $\theta_e$ and largely different from the angle $\theta_e$, small retardation (Re) fluctuation or small thickness fluctuation in the plane direction, and the orientation axis uniformly oriented can be obtained by the stretching under such conditions.

Therefore, with the above method, the angle $\theta_e$ can be made smaller than the angle $\theta_e$. By making the angle $\theta_e$ smaller, Re fluctuation, orientation angle fluctuation and thickness fluctuation of the obliquely stretched film obtained by the above method can be further reduced over the wide width of 1300 mm or more.

In order to make $R_{e2}$ smaller than $R_{e1}$, the stretching temperature of the step of stretching in a direction of the angle $\theta_e$ is set higher than the stretching temperature of the step of longitudinal stretching; the stretching magnification of the step of stretching in a direction of the angle $\theta_e$ is set smaller than the stretching magnification of the step of longitudinal stretching; the stretching speed and stretching means (uniaxial stretching or biaxial stretching) are adjusted; or these conditions are combined.

The stretching magnification of the longitudinal stretching is acquired from the amount of length change in the longitudinal direction, while the stretching magnification of the oblique stretching is acquired from the amount of length change in the width direction.

The angle $\theta_e$ is preferably 5° or more and 45° or less, more preferably 5° or more and 30° or less, and further preferably 5° or more and 15° or less. The angle $\theta_e$ is an angle by which a film having an orientation axis in a direction of an angle $\Phi$ with respect to the width direction can be obtained from a long raw material film. The angle $\Phi$ is preferably 5° or more and 45° or less, more preferably 5° or more and 30° or less, further preferably 5° or more and 15° or less. If the angle $\theta_e$ or the angle $\Phi$ is in this range, fluctuations in retardation (Re) in the in-plane direction, orientation angle and thickness of the obliquely stretched film obtained by the above method can be further reduced over the wide width of 1300 mm or more.

In order to have this obliquely stretching step specifically understood, explanation will be made referring to figures showing an example of the obliquely stretching step.

Fig. 1 is a conceptual diagram illustrating an example of a tenter stretching machine that can suitably put the above producing method into practice. Fig. 2 is a diagram illustrating grasping means of a rail portion in the stretching machine in Fig. 1. Fig. 3 is a diagram for explaining rail arrangement in the stretching machine in Fig. 1. The angle $\theta_e$ is a smaller angle (inferior angle) formed by a line connecting stretch end points E1 and E2 and the film width direction in the fixing zone. A definition of the stretch end point will be described later.

The tenter stretching machine shown in Fig. 1 comprises a wind-off roll (winding body of longitudinally stretched film) 21, a wind-up roll 22, a temperature-controlled room 10 composed of a preheating zone A, a stretching zone B and a fixing zone C, a rail 11 on which the grasping means travels to transport the film and the grasping means 12 (the grasping means is not shown in Figs. 1 and 3).

The grasping means 12 grasps the both side ends of the longitudinally stretched film wound off the wind-off roll 21, the longitudinally stretched film is guided into the temperature-controlled room composed of the preheating zone A, the stretching zone B and the fixing zone C to be obliquely stretched. And the obliquely stretched film is released before the wind-up roll 22. The obliquely stretched film released from the grasping means is taken up by the wind-up roll 22. The pair of right and left rails 11 have a continuous endless track without a terminal and returns the grasping means having traveled as above from an outlet side to an inlet side of the temperature-controlled room.

A longitudinally stretched film 1 is stretched by a tension from the grasping means while passing through the temperature-controlled room composed of the preheating zone, the stretching zone and the fixing zone.

In the preheating zone, the stretching zone and the fixing zone, a predetermined temperature can be set respectively and the temperature is usually kept constant in each zone. The temperature of each zone can be selected as appropriate, but with respect to the glass transition temperature $T_g$ (°C) of the transparent resin composing the film, the preheating zone has $T_g$ to $T_g +30$ (°C), the stretching zone has $T_g$ to $T_g +20$ (°C), and the fixing zone has $T_g$ to $T_g +15$ (°C).

In the present invention, a temperature difference may be provided in the width direction in the stretching zone for controlling thickness fluctuation in the width direction. Particularly in the present invention, the temperature close to the grasping means is preferably set higher than that of the film center portion. In order to provide the temperature difference in the width direction of the stretching zone, employed can be a known method such as a method of adjusting an opening degree of a nozzle for feeding hot air into the temperature-controlled room so that the degree is different depending on the width direction or a method of controlling heaters aligned in the width direction for heating. The lengths of the preheating zone, the stretching zone, and the fixing zone can be selected as appropriate, and with respect to the length of the stretching zone, the length of the preheating zone is usually 100 to 150% and the length of the fixing zone is usually 50 to 100%.

The grasping means 12 travels on the rail 11 capable of deformation of arrangement, for example. The rail 11 is arranged so that the film is stretched with the desired angle $\theta_e$. In Fig. 1, the rail arrangement is set so that the film
with the average retardation \( R_e \) (= \( (n_x - n_y) \times d \)) generated by molecular orientation is uniform in the width direction. According to the above producing method, a film \( \theta \) is taken up by the wind-up roll. The film obtained as above has an orientation axis inclined by an angle \( \theta \) to the wind-off roll and usually is perpendicular to the rotating shaft of the wind-off roll.

The film passed through the temperature-controlled room as above is released from the grasping means before the wind-up roll and taken up by the wind-up roll. The film obtained as above has an orientation axis inclined by an angle \( \theta \) to the wind-off roll and usually is perpendicular to the rotating shaft of the wind-off roll.

The rail is bent downward in Fig. 3, but it may be bent upward in line symmetry with the line of the film running direction 49 in the stretching zone. The film running direction in the stretching zone is a direction parallel with the direction in which the film is wound off the wind-off roll and it usually is perpendicular to a rotating shaft of the wind-up roll.

In the stretching zone, the film running direction may be straight without changing the direction, or may be changed in stepwise or continuously. The spread angle of the rail can be selected as appropriate according to the stretching magnification.

The film obtained as above has an orientation axis inclined by an angle \( \theta \) to the wind-off roll and usually is perpendicular to the rotating shaft of the wind-off roll.

In the above producing method, the film faces in the preheating zone, stretching zone and fixing zone are preferably substantially parallel with each other. That is, the film wound off the wind-off roll preferably passes the preheating zone, stretching zone and fixing zone without being twisted but staying flat and is taken up by the wind-up roll.

In the above producing method, c) traveling speeds of the grasping means are substantially equal at both sides of the film. In Fig. 2, a broken line is shown between the opposing pair of grasping means. Stretching starts in the neighborhood of the stretching start point and ends in the neighborhood of the stretching end point. The stretching start point is a point where an interval between the pair of grasping means begins to be widened, and it is S1 and S2 in Fig. 2. The stretching end point is a point where the interval between the pair of grasping means begins to be constant, and it is E1 and E2 in Fig. 2.

A difference in traveling speeds of the right and left pair of grasping means is usually 1% or less, preferably 0.5% or less, more preferably 0.1% or less of the traveling speed.

In the above producing method, film faces in the preheating zone, stretching zone and fixing zone are preferably substantially parallel with each other. That is, the film wound off the wind-off roll preferably passes the preheating zone, stretching zone and fixing zone without being twisted but staying flat and is taken up by the wind-up roll.

The travel speed of the grasping means can be selected as appropriate but it is usually 10 to 100 m/minute. A difference in traveling speeds of the right and left pair of grasping means is usually 1% or less, preferably 0.5% or less, more preferably 0.1% or less of the traveling speed.

In the method for producing the obliquely stretched film of the present invention, as shown in Fig. 3, c) the film running direction 49 in the fixing zone is inclined by an angle \( \theta_1 \) from the film running direction 47 in the preheating zone. The rail is bent downward in Fig. 3, but it may be bent upward in line symmetry with the line of the film running direction of the preheating zone in Fig. 3 as its axis. The angle \( \theta_1 \) is preferably the angle \( \theta_e \) or less, more preferably \( (\theta_e-\epsilon^*) \) or more and \( \epsilon_e \) or less.

In the method for producing the obliquely stretched film of the present invention, as shown in Fig. 3, c) the film running direction 49 in the fixing zone is inclined by an angle \( \theta_1 \) from the film running direction 47 in the preheating zone. The rail is bent downward in Fig. 3, but it may be bent upward in line symmetry with the line of the film running direction of the preheating zone in Fig. 3 as its axis. The angle \( \theta_1 \) is preferably the angle \( \theta_e \) or less, more preferably \( (\theta_e-\epsilon^*) \) or more and \( \epsilon_e \) or less.

Also, since the tension from the grasping means acts on the film uniformly in the width direction, birefringence generated by molecular orientation is uniform in the width direction. According to the above producing method, a film with the average retardation \( R_e \) (= \( (n_x - n_y) \times d \)) and \( n_x \) and \( n_y \) are in-plane principal refractive indexes of the film, \( d \) is a thickness of the film) of 100 to 300 nm can be easily obtained. Also, by reducing the angle \( \Phi \) or by increasing \( R_{e1} \) and \( R_{e2} \), an obliquely stretched film having a large Nz coefficient can be obtained, while by increasing the angle \( \Phi \) or by reducing \( R_{e1} \) and \( R_{e2} \), an obliquely stretched film having a small Nz coefficient can be obtained. The Nz coefficient is a value represented by \( (n_x - n_z) / (n_x - n_y) \) when the refractive index in the film thickness direction is \( n_z \).
In order to have the Nz coefficient of 2.1 or more, Re 1 is set at 250 nm or more and 1000 nm or less and Re 2 layer film can be mentioned. The thickness of the polarizer is usually 5 to 80 µm, and then, uniaxially stretched, or the one obtained by uniaxially stretching the hydrophilic polymer film and having dichroic hydrophilic polymer film such as a polyvinyl alcohol film and ethylene-vinyl acetate partially saponified film and the like another. For example, a polarizer obtained by having iodine or dichroic substances such as dichroic dye adsorbed to a long laminate film.

Group in a thermoplastic resin, for example, and a resin without a polar group is preferable. The obliquely stretched film of the present invention can be adjusted to the above value by reducing an amount of polar measurement is made by dipping in water with a temperature of 23°C for 24 hours. The saturated water absorption in a test film sample in water at a given temperature for a given time to a test sample mass before dipping. Usually, the display of the display device stable and favorable for a long time. The residual volatile component is a substance with a molecular weight of 200 or less which is contained in a small amount in the film, and for example, is a residual monomer, solvent or the like. The content of the residual volatile component can be quantified by analysis of the film using gas chromatography as a total of substances with the molecular weight of 200 or less contained in the film.

In order to have the Nz coefficient of 1.5 or more, more preferably more than 2.0, and particularly preferably 2.1 or more, while the upper limit value of the Nz coefficient is 10, preferably 5, and more preferably 3.

In order to have the Nz coefficient of 1.5 or more, Re 1 is set at 150 nm or more and 1000 nm or less and Re 2 at 0.4 times or more and less than 1 times of Re 1. Moreover, at this time, Re 1 is preferably 5° or more and 30° or less. In order to have the Nz coefficient in a range exceeding 2.0, Re 1 is set at 250 nm or more and 1000 nm or less and Re 2 at 0.5 times or more and less than 1 times of Re 1. Moreover, at this time, Re 1 is preferably 5° or more and 20° or less. In order to have the Nz coefficient of 2.1 or more, Re 1 is set at 250 nm or more and 1000 nm or less and Re 2 at 0.7 times or more and less than 1 times of Re 1. Moreover, at this time, Re 1 is preferably 5° or more and 20° or less.

The content of a residual volatile component in the obliquely stretched film of the present invention is not particularly limited but it is preferably 0.1 % by weight or less, more preferably 0.05% by weight or less, and further preferably 0.02 % by weight or less. If the content of the residual volatile component exceeds 0.1 % by weight, there is a fear that its optical characteristics will change over time. By keeping the content of the volatile component in the above range, dimensional stability is improved, temporal change in average retardation (Re) in the in-plane or average retardation (Rth) in the thickness direction can be reduced, and moreover, deterioration of a polarizing plate or liquid crystal display device having an obliquely stretched film of the present invention can be restricted, which can keep display of the display device stable and favorable for a long time. The residual volatile component is a substance with a molecular weight of 200 or less which is contained in a small amount in the film, and for example, is a residual monomer, solvent or the like. The content of the residual volatile component can be quantified by analysis of the film using gas chromatography as a total of substances with the molecular weight of 200 or less contained in the film.

A saturated water absorption of the obliquely stretched film of the present invention is preferably 0.03 % by weight or less, more preferably 0.02 % by weight or less, and particularly preferably 0.01 % by weight or less. By having the saturated water absorption in the above range, temporal change in average retardation (Re) in the in-plane and average retardation (Rth) in the thickness direction can be reduced, and moreover, deterioration of a polarizing plate or liquid crystal display device having an obliquely stretched film of the present invention can be restricted, which can keep display of the display device stable and favorable for a long time.

The saturated water absorption is a value expressed in percentage of an increased mass obtained by dipping a test film sample in water at a given temperature for a given time to a test sample mass before dipping. Usually, measurement is made by dipping in water with a temperature of 23°C for 24 hours. The saturated water absorption in the obliquely stretched film of the present invention can be adjusted to the above value by reducing an amount of polar group in a thermoplastic resin, for example, and a resin without a polar group is preferable.

The long obliquely stretched film of the present invention can be laminated with a long polarizer to obtain a long laminate film.

The polarizer used in the present invention transmits one of two linear polarized lights at right angles to one another. For example, a polarizer obtained by having iodine or dichroic substances such as dichroic dye adsorbed to a hydrophilic polymer film such as a polyvinyl alcohol film and ethylene-vinyl acetate partially saponified film and the like and then, uniaxially stretched, or the one obtained by uniaxially stretching the hydrophilic polymer film and having dichroic substance absorbed or a polyene oriented film such as dehydrated polyvinyl alcohol or dehydrochlorinated polyvinyl chloride and the like can be mentioned. In addition, reflective polarizers such as grid polarizer and anisotropic multilayer film can be mentioned. The thickness of the polarizer is usually 5 to 80 µm.

The obliquely stretched film of the present invention may be laminated either on both faces or one face of a polarizer, and the number of laminating layers is not particularly limited and two or more layers may be laminated.

If the obliquely stretched film is laminated only on one face of the polarizer, a protective film with a purpose of protecting the polarizer may be laminated on the other face through an appropriate adhesive layer.
As the protective film, an appropriate transparent film may be used. Among them, a film having resin with transparency, excellent mechanical strength, thermal stability, water shielding performance and the like is preferably used. Examples of such a resin include acetate polymer such as triacetylcellulose, alicyclic olefin polymer, polyolefin polymer, polycarbonate polymer, polyester polymer such as polyethylene terephthalate, polyvinyl chloride polymer, polystyrene polymer, polycarboxylite polymer, polyvinyl chloride polymer, polyethersulfone polymer, polyamide polymer, polyimide polymer, acrylic polymer and the like.

A suitable method for producing a long laminate film in the present invention is a method comprising close contact between an obliquely stretched film and a polarizer while winding them off an obliquely stretched film winding body and a polarizer winding body, respectively, at the same time. An adhesive may be interposed in a close-contact face between the obliquely stretched film and the polarizer. As a method of bringing the obliquely stretched film and the polarizer into close contact, a method of inserting the obliquely stretched film and the polarizer together into a nip of two rolls aligned in parallel for pressure sandwiching.

A long obliquely stretched film or long laminate film in the present invention is used as a retarder or a polarizing plate by cutting it into a desired size according to its use form. In this case, it is preferable to cut out along a direction perpendicular or parallel to the longitudinal direction of the long film.

A liquid crystal display device in the present invention is composed of a retarder or a polarizing plate cut out of the long obliquely stretched film or the long laminate film. An example of the liquid crystal display device of the present invention includes a device constituted by a liquid crystal panel whose polarizing transmission axis can be changed by adjustment of an electric voltage and the polarizing plate of the present invention arranged so as to sandwich the panel. Also, the retarder of the present invention is used in a liquid crystal display device for optical compensation and polarizing light conversion and the like. The liquid crystal display device is usually provided with a backlight device for a transmission type liquid crystal display device or a reflecting plate for reflective type liquid crystal display device on the back side of a display face in order to feed light into the liquid crystal panel. A light source used for the back light includes cold cathode-ray tube, mercury plane lamp, light-emitting diode, EL and the like.

A liquid crystal display device of the present invention, a reflective type liquid crystal display device composed of a reflective type liquid crystal panel is preferable. The liquid crystal panel is not particularly limited by its display mode. For example, TN (Twisted Nematic) mode, STN (Super Twisted Nematic) mode, HAN (Hybrid Alignment Nematic) mode, VA (Vertical Alignment) mode, MVA (Multi-domain Vertical Alignment) mode, IPS (In Plane Switching) mode and the like can be cited. In the liquid crystal display device of the present invention, an appropriate part such as prism array sheet, lens array sheet, diffusing sheet, light diffusing plate, light guide plate, brightness improving film and the like may be arranged in one or two layers or more at an appropriate position in addition to the above.

The obliquely stretched film of the present invention can be applied to an organic EL display device, plasma display device, FED (Field Emission Display) device, and SED (Surface-conduction Electron-emitter Display) device other than the liquid crystal display device.

EXAMPLES

Evaluation is made by the following method in the examples.

Average thickness, thickness fluctuation
A thickness was measured with a 5-cm interval in the film width direction using a snap gauge (produced by Mitutoyo corporation, ID-C112BS) and an average value was acquired. The thickness fluctuation was set as a difference between the maximum value and the minimum value in the thickness.

Average orientation angle, orientation angle fluctuation
A retardation axis in a plane was measured with a 5-cm interval in the film width direction using a polarizing microscope (produced by NICON, BX51) and an average value of an angle (orientation angle) formed by a direction of the retardation axis and the width direction was acquired. The orientation angle fluctuation was set as a difference between the maximum value and the minimum value of the orientation angle.

Average Re, average Nz coefficient
Re and Nz coefficient were measured with a 5-cm interval in the film width direction using a phase difference detector (produced by Oji Scientific Instruments, KOBRA21-ADH) according to formulas (1) and (2) and an average value was acquired. The Re fluctuation was set as a difference between the maximum value and the minimum value of Re.

\[
Re = (n_x-n_y) \cdot d \quad \text{(1)}
\]

\[
Nz = \frac{(n_x-n_z)}{(n_x-n_y)} \quad \text{(2)}
\]
three-dimensional refractive indexes, $n_x$, $n_y$, $n_z$, thickness $d$

**Example 1**

[A pellet of norbornene resin (by Zeon corporation, ZEONOR 1420)](#) was molded by a T-die type film extrusion molding machine so as to have a long unstretched film (A) with a width of 1000 mm and a thickness of 130 μm. The unstretched film (A) was taken up by a roll.

[0075] Then, the unstretched film (A) was wound off the roll, supplied to a longitudinal stretching machine, and longitudinally stretched under a stretching condition shown in Table 1 so as to have a longitudinally stretched film (B) with characteristics shown in Table 2. The longitudinally stretched film (B) was taken up by another roll.

[0076] Moreover, the longitudinally stretched film (B) was wound off the roll, supplied to a tenter stretching machine shown in Figs. 1 to 3, stretched under the stretching condition shown in Table 1 in a direction obliquely at $10^\circ$ to the width direction of the longitudinally stretched film (B) so as to have an obliquely stretched film (C), and the film (C) was further taken up by an added roll so as to have an obliquely stretched film winding body. The film (C) had an orientation axis of an average orientation angle of $75^\circ$ with respect to the width direction. The properties of the film (C) are shown in Table 2.

---

**Table 1**

<table>
<thead>
<tr>
<th>Film (A)</th>
<th>Ex. 1</th>
<th>Ex. 2</th>
<th>Ex. 3</th>
<th>Comp. Ex. 1</th>
<th>Comp. Ex. 2</th>
<th>Comp. Ex. 3</th>
<th>Comp. Ex. 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Re [nm]</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Stretching Temp. [°C]</td>
<td>142</td>
<td>142</td>
<td>142</td>
<td>-</td>
<td>-</td>
<td>142</td>
<td>142</td>
</tr>
<tr>
<td>Stretching magnification [times]</td>
<td>1.8</td>
<td>1.8</td>
<td>1.8</td>
<td>-</td>
<td>-</td>
<td>1.8</td>
<td>1.8</td>
</tr>
<tr>
<td>Take-up speed [m/min.]</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>-</td>
<td>-</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Stretching direction [°]</td>
<td>90</td>
<td>90</td>
<td>90</td>
<td>-</td>
<td>-</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>Re₁ [nm]</td>
<td>273</td>
<td>273</td>
<td>273</td>
<td>2</td>
<td>2</td>
<td>273</td>
<td>273</td>
</tr>
<tr>
<td>Re₂ [nm]</td>
<td>85</td>
<td>238</td>
<td>55</td>
<td>200</td>
<td>160</td>
<td>382</td>
<td>365</td>
</tr>
<tr>
<td>θ₁ [°]</td>
<td>7</td>
<td>32</td>
<td>16</td>
<td>75</td>
<td>70</td>
<td>7</td>
<td>19</td>
</tr>
<tr>
<td>Stretching temp. [°C]</td>
<td>148</td>
<td>142</td>
<td>145</td>
<td>145</td>
<td>155</td>
<td>145</td>
<td>143</td>
</tr>
<tr>
<td>Stretching magnification [times]</td>
<td>1.5</td>
<td>1.8</td>
<td>1.3</td>
<td>1.6</td>
<td>1.8</td>
<td>2.5</td>
<td>2</td>
</tr>
<tr>
<td>Take-up speed [m/min.]</td>
<td>20</td>
<td>18</td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>20</td>
<td>18</td>
</tr>
<tr>
<td>θₑ [°]</td>
<td>10</td>
<td>35</td>
<td>20</td>
<td>75</td>
<td>70</td>
<td>10</td>
<td>23</td>
</tr>
<tr>
<td>L [mm]*</td>
<td>276</td>
<td>1315</td>
<td>494</td>
<td>6231</td>
<td>5161</td>
<td>460</td>
<td>877</td>
</tr>
<tr>
<td>Width after stretching [mm]</td>
<td>1565</td>
<td>1878</td>
<td>1357</td>
<td>1670</td>
<td>1878</td>
<td>2609</td>
<td>2086</td>
</tr>
<tr>
<td>Stretched film</td>
<td>(C)</td>
<td>(D)</td>
<td>(E)</td>
<td>(F)</td>
<td>(G)</td>
<td>(H)</td>
<td>(I)</td>
</tr>
</tbody>
</table>

*L is a distance between a stretching end point E₂ - a fixing zone start point in Fig. 2

---

**Table 2**

<table>
<thead>
<tr>
<th>Film</th>
<th>Ex. 1</th>
<th>Ex. 2</th>
<th>Ex. 3</th>
<th>Comp. Ex. 1</th>
<th>Comp. Ex. 2</th>
<th>Comp. Ex. 3</th>
<th>Comp. Ex. 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A)</td>
<td>(B)</td>
<td>(C)</td>
<td>(D)</td>
<td>(E)</td>
<td>(F)</td>
<td>(G)</td>
<td>(H)</td>
</tr>
</tbody>
</table>
Example 2 (for comparison only)

[0077] The long longitudinally stretched film (B) obtained in Example 1 was wound off the roll, supplied to a tenter stretching machine, stretched in a direction obliquely at 10° with respect to the width direction of the longitudinally stretched film (B) under the stretching condition shown in Table 1 so as to obtain an obliquely stretched film (D). And the film (D) was taken up by an added roll so as to have an obliquely stretched film winding body. The film (D) had an orientation axis of an average orientation angle of 45° with respect to the width direction and had properties shown in Table 2.

Example 3

[0078] The long longitudinally stretched film (B) obtained in Example 1 was wound off the roll, supplied to a tenter stretching machine, stretched in a direction obliquely at 15° with respect to the width direction of the longitudinally stretched film (B) under the stretching condition shown in Table 1 so as to obtain an obliquely stretched film (E). Moreover the film (E) was taken up by an added roll so as to have an obliquely stretched film winding body. The film (E) had an orientation axis of an average orientation angle of 75° with respect to the width direction and had properties shown in Table 2.

Comparative Example 1

[0079] According to the method described in Japanese Patent Laid-Open No. 2-113920, the long unstretched film (A) obtained in Example 1 was supplied to the tenter stretching machine set to angle, temperature and stretching magnification shown in Table 1 so as to have an obliquely stretched film (F). The film (F) had wrinkles left on the entire face and can not be taken up by a added roll. The properties of the stretched film (F) are shown in Table 2.

Comparative Example 2

[0080] The long unstretched film (A) obtained in Example 1 was supplied to the tenter stretching machine set to angle,
temperature and stretching magnification shown in Table 1 so as to have an obliquely stretched film (G). The film (G) had wrinkles left on the entire face and cannot be taken up by an added roll. The properties of the stretched film (G) are shown in Table 2.

Comparative Example 3

[0081] The long longitudinally stretched film (B) obtained in Example 1 was wound off the roll, supplied to the tenter stretching machine, stretched in a direction obliquely at 10° with respect to the width direction of the longitudinally stretched film (B) under the stretching condition in Table 1 so as to have an obliquely stretched film (H). The film (H) was further taken up by a added roll so as to have an obliquely stretched film winding body. An average orientation angle of the film (H) with respect to the width direction was 8°. The other properties are shown in Table 2.

Comparative Example 4

[0082] The long longitudinally stretched film (B) obtained in Example 1 was wound off the roll, supplied to the tenter stretching machine, stretched in a direction obliquely at 23° with respect to the width direction of the longitudinally stretched film (B) under the stretching condition in Table 1 so as to have an obliquely stretched film (I). The film (I) was further taken up by a added roll so as to have an obliquely stretched film winding body. An average orientation angle of the film (I) with respect to the width direction was 20°, but the result was a large orientation-angle fluctuation. The other properties are shown in Table 2.

[0083] From the results of Comparative Examples 1 and 2, it is known that even if an obliquely stretched film with an average orientation angle of 45° or more to the width direction is to be obtained, wrinkles are generated and the film cannot be used as an optical film. Also, from the results of Comparative Examples 1 to 4, it is known that if Re2 is at Re1 or more, an orientation axis emerges in a direction substantially equal to the angle θe. At this time, it is known that if the orientation angle becomes large, fluctuation in physical properties of the obtained stretched film also becomes large (see Comparative Example, 1, 2, and 4).

[0084] On the other hand, according to the producing method for producing the film of the present invention, it is known that an obliquely stretched film with an average orientation angle of 45° or more with respect to the width direction (Examples 1 to 3) can be manufactured without generating a wrinkle. Also, even if the stretching angle θe in the obliquely stretching process is small, an orientation angle of the obtained stretched film can be increased, and an orientation axis of the stretched film can be generated with accuracy in a direction between the stretching direction in the longitudinal stretching process and the stretching direction in the obliquely stretching process. Moreover, the obtained stretched film has a large width and small fluctuation of thickness or of Re.

Claims

1. A long obliquely stretched film, characterized in that the long obliquely stretched film has an orientation axis inclined at an angle of 40° to 85° with respect to a width direction of the film and an Nz coefficient in the range of 1.5 to 10, in which the Nz coefficient is a value calculated by \((nx - nz)/(nx - ny)\), nx and ny are in-plane principal refractive indexes of the film and nz is a refractive index in the film thickness direction.

2. The long obliquely stretched film according to claim 1, in which the orientation axis is inclined at an angle of 51° to 85° with respect to the width direction of the film.

3. The long obliquely stretched film according to claim 1, in which the long obliquely stretched film has an average retardation Re of 100 nm to 300 nm.

4. The long obliquely stretched film according to claim 1, in which the long obliquely stretched film has a fluctuation of retardation of not more than 10 nm.

5. The long obliquely stretched film according to claim 1, in which the long obliquely stretched film comprises a resin having a positive specific birefringence value.

6. The long obliquely stretched film according to claim 1, in which the long obliquely stretched film is 1300 mm or more in width and 30 μm to 80 μm in an average thickness.

7. The long obliquely stretched film according to claim 1, in which the long obliquely stretched film is not more than 3
1. The long obliquely stretched film according to claim 1, in which the long obliquely stretched film is not more than 0.1% by weight in a content of a residual volatile component.

2. The long obliquely stretched film according to claim 1, in which the long obliquely stretched film is not more than 0.03% by weight in a saturated water absorption.

3. The long obliquely stretched film according to claim 1, in which the long obliquely stretched film is obtained by obliquely stretching a longitudinally stretched film.

4. The long obliquely stretched film according to claim 10 in which the long obliquely stretched film has an average retardation $R_{e1}$ of 150 nm to 1000 nm.

5. A long laminate film, characterized in that the long laminate film is obtained by laminating the long obliquely stretched film according to any one of claims 1 to 11 and a long polarizer with their longitudinal directions aligned.

6. A method for producing a retarder, characterized in that the method comprises a step of trimming the long obliquely stretched film according to any one of claims 1 to 11 to a predetermined size along a direction perpendicular to or parallel with its longitudinal direction.

7. A liquid crystal display device, characterized in that the liquid crystal display device comprises the retarder obtained by the method according to claim 13.

8. A liquid crystal display device, characterized in that the liquid crystal display device comprises a polarizing plate obtained by the method according to claim 14.

9. A long laminate film, characterized in that the long laminate film is not more than 0.1% by weight in a fluctuation of thickness.

Patentansprüche

1. Lange, schräg gestreckte Folie, dadurch gekennzeichnet, dass die lange, schräg gestreckte Folie eine geneigte Orientierungsachse mit einem Winkel von 40° bis 85° bezüglich einer Breitenrichtung der Folie und einen NZ-Koeffizienten in dem Bereich von 1,5 bis 10 hat, bei welchem der NZ-Koeffizient ein Wert ist, welcher durch $(n_x - n_z) / (n_x - n_y)$ berechnet wurde, $n_x$ und $n_y$ Hauptbrechungsindizes in der gleichen Ebene der Folie sind und $n_z$ ein Brechungsindex in der Foliendickenrichtung ist.

2. Lange, schräg gestreckte Folie gemäß Anspruch 1, in welcher die Orientierungsachse mit einem Winkel von 51° bis 85° bezüglich der Breitenrichtung der Folie geneigt ist.

3. Lange, schräg gestreckte Folie gemäß Anspruch 1, in welcher die lange, schräg gestreckte Folie eine Durchschnittsretardation $R_{e1}$ von 100 nm bis 300 nm hat.

4. Lange, schräg gestreckte Folie gemäß Anspruch 1, in welcher die lange, schräg gestreckte Folie eine Schwankung der Verzögerung von nicht mehr als 10 nm hat.

5. Lange, schräg gestreckte Folie gemäß Anspruch 1, in welcher die lange, schräg gestreckte Folie ein Harz mit einem positiven spezifischen Doppelbrechungswert umfasst.

6. Lange, schräg gestreckte Folie gemäß Anspruch 1, in welcher die lange, schräg gestreckte Folie 1300 mm oder mehr in der Breite und 30 $\mu$m bis 80 $\mu$m in einer mittleren Dicke ist.

7. Lange, schräg gestreckte Folie gemäß Anspruch 1, in welcher die lange, schräg gestreckte Folie nicht mehr als 3 $\mu$m Schwankung der Dicke hat.

8. Lange, schräg gestreckte Folie gemäß Anspruch 1, in welcher die lange, schräg gestreckte Folie nicht mehr als 0,1
Gew.-% eines Gehalts einer restlichen flüchtigen Komponente hat.

9. Lange, schräg gestreckte Folie gemäß Anspruch 1, in welcher die lange, schräg gestreckte Folie nicht mehr als 0,03 Gew.-% an einer gesättigten Wasserabsorption hat.

10. Lange, schräg gestreckte Folie gemäß Anspruch 1, in welcher die lange, schräg gestreckte Folie durch schräges Strecken einer längsgestreckten Folie erhalten wird.

11. Lange, schräg gestreckte Folie gemäß Anspruch 10, in welcher die lange, schräg gestreckte Folie eine Durchschnittsretardation Re₁ von 150 nm bis 1000 nm hat.

12. Lange Laminatfolie, dadurch gekennzeichnet, dass die lange Laminatfolie durch Laminieren der langen, schräg gestreckten Folie gemäß einem der Ansprüche 1 bis 11 und eines langen Polarisators erhalten wird, wobei ihre Längsrichtungen ausgerichtet werden.


15. Flüssigkristallanzeigevorrichtung, dadurch gekennzeichnet, dass die Flüssigkristallanzeigevorrichtung den Retarder, welcher durch das Verfahren gemäß Anspruch 13 erhalten wurde, umfasst.

16. Flüssigkristallanzeigevorrichtung, dadurch gekennzeichnet, dass die Flüssigkristallanzeigevorrichtung eine Polarisatorplatte, welche durch das Verfahren gemäß Anspruch 14 erhalten wurde, umfasst.

Revendications

1. Film allongé étiré obliquement, caractérisé en ce que le film allongé étiré obliquement présente un axe d'orientation incliné selon un angle de 40 ° à 85 ° par rapport à un sens transversal du film et un coefficient Nz compris dans la plage allant de 1,5 à 10, dans lequel le coefficient Nz est une valeur calculée par (nx - nz) / (nx - ny), nx et ny sont des indices de réfraction principaux dans le plan du film et nz est un indice de réfraction dans le sens de l’épaisseur du film.

2. Film allongé étiré obliquement selon la revendication 1, dans lequel l’axe d’orientation est incliné selon un angle de 51 ° à 85 ° par rapport au sens transversal du film.

3. Film allongé étiré obliquement selon la revendication 1, dans lequel le film allongé étiré obliquement présente un retard moyen de 100 nm à 300 nm.

4. Film allongé étiré obliquement selon la revendication 1, dans lequel le film allongé étiré obliquement présente une variation de retard inférieure ou égale à 10 nm.

5. Film allongé étiré obliquement selon la revendication 1, dans lequel le film allongé étiré obliquement comprend une résine présentant une valeur de biréfringence spécifique positive.

6. Film allongé étiré obliquement selon la revendication 1, dans lequel le film allongé étiré obliquement présente une largeur supérieure ou égale à 1 300 mm et une épaisseur moyenne de 30 μm à 80 μm.

7. Film allongé étiré obliquement selon la revendication 1, dans lequel le film allongé étiré obliquement présente une variation d’épaisseur inférieure ou égale à 3 μm.

8. Film allongé étiré obliquement selon la revendication 1, dans lequel le film allongé étiré obliquement présente une teneur en constituant volatil résiduel inférieure ou égale à 0,1 % en poids.
9. Film allongé étiré obliquement selon la revendication 1, dans lequel le film allongé étiré obliquement présente une absorption d’eau à saturation inférieure ou égale à 0,03 % en poids.

10. Film allongé étiré obliquement selon la revendication 1, dans lequel le film allongé étiré obliquement est obtenu en étirant obliquement un film étiré longitudinalement.

11. Film allongé étiré obliquement selon la revendication 10, dans lequel le film allongé étiré obliquement présente un retard moyen $\Re_1$ de 150 nm à 1 000 nm.

12. Film allongé stratifié, caractérisé en ce que le film allongé stratifié est obtenu par superposition du film allongé étiré obliquement selon l’une quelconque des revendications 1 à 11 et d’un filtre polarisant avec leurs sens longitudinaux alignés.

13. Procédé de production d’un retardateur, caractérisé en ce que le procédé comprend une étape d’ébarbage du film allongé étiré obliquement selon l’une quelconque des revendications 1 à 11 jusqu’à une taille prédéfinie le long d’un sens perpendiculaire à ou parallèle à son sens longitudinal.

14. Procédé de production d’une plaque de polarisation, caractérisé en ce que le procédé comprend une étape d’ébarbage du film allongé étiré obliquement selon la revendication 12 jusqu’à une taille prédéfinie.

15. Dispositif d’affichage à cristaux liquides, caractérisé en ce que le dispositif d’affichage à cristaux liquides comprend le retardateur obtenu par le procédé selon la revendication 13.

16. Dispositif d’affichage à cristaux liquides, caractérisé en ce que le dispositif d’affichage à cristaux liquides comprend une plaque de polarisation obtenue par le procédé selon la revendication 14.
REFERENCES CITED IN THE DESCRIPTION

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