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(54) BASE FABRIC FOR CHEMICAL LACE AND PROCESS FOR PRODUCTION THEREOF

(57) A base fabric for producing chemical lace of the present invention is fabricated from dyed embroidery yarn and nonwoven fabric formed of a water-soluble poly (vinyl alcohol)-based fiber random web, which base fabric satisfies the following conditions: (1) a binder to be adhered onto the nonwoven fabric is formed of a foamy aqueous solution containing a poly (vinyl alcohol)-based resin, and the binder is deposited onto the nonwoven fabric in an amount of 2 to 20 mass% with respect to the total mass of the nonwoven fabric; (2) the nonwoven fabric has a 10% modulus strength in the widthwise direction of 15 to 80 N/50·mm width; and (3) the nonwoven fabric has a bending resistance of 40 to 150 mm. The base fabric for producing chemical lace is soft and easy to handle, has high dimensional stability and low dissolution temperature, prevents skips and non-uniformity in embroidery motifs, and is produced at low cost.

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Description

TECHNICAL FIELD

[0001] The present invention relates to a base fabric for producing chemical lace (hereinafter referred to as "a chemical lace base fabric") which is soft, has high dimensional stability and low dissolution temperature, and is produced at low cost.

BACKGROUND ART

[0002] Conventionally, chemical lace base fabric has usually been produced from woven fabric formed from filament of a polymer based on water-soluble poly (vinyl alcohol) (hereinafter abbreviated as PVA). Such woven fabric has a variety of advantages; For example, it has high dimensional stability and facilitates reproduction of accurate embroidery motifs. Also, it allows easy removal of base fabric through dissolution at low temperature. However, since the filament *per se* are expensive, and the fabric must be produced through a particular weaving step, the woven fabric products are considerably expensive, which is disadvantageous. In addition, woven fabric which is hard cloth, often causes breakage of needles during embroidering, which is also disadvantageous.

[0003] In recent years, the for chemical lace has seen consistent growth in response to increased demand for chemical lace in countries, particularly Asian countries. In relation to the above demand, piece-dyed lace products generally fabricated from non-colored embroidery yarn have been replaced by colorful yarn-dyed lace products fabricated from dyed rayon yarn, dyed polyester yarn, etc. Among colored yarn products, colored polyester embroidery yarn which has been dyed with a dispersion dye has come to be more widely employed, since the colored polyester yarn is an environment-friendly material i.e., a material which can be produced from recycled polyester, and has excellent gloss, general durability, and durability to washing.

[0004] Thus, presumably, there will be increasing demand for a base fabric which can be removed through dissolution at 80°C or lower so as to prevent dye transfer from colored polyester yarn; which is inexpensive, easy to handle, and soft; which has high dimensional stability; and which facilitates reproduction of accurate embroidery motifs.

[0005] One candidate base fabric for replacing the aforementioned expensive water-soluble fabric is water-soluble nonwoven fabric, and hitherto, extensive studies have been carried out on such nonwoven fabric products. For example, Japanese Patent Application Laid-Open (kokai) No. 11-217759 discloses nonwoven fabric formed of PVA-based fiber which is dissolved in water at 10°C or lower (i.e., has a water dissolution temperature of 10°C or lower) and undergoes melt adhesion. However, such unusual fiber is expensive to its low productivity. From another aspect, if a nonwoven fabric sheet an increased percent of emboss area, dimensional stability of the sheet during embroidering can be ensured. However, in this case, the fabric sheet has poor softness, resulting in needle breakage during embroidering. Therefore, hitherto, a nonwoven fabric sheet having high dimensional stability during embroidering can be obtained by increasing the weight per unit area thereof, but high-quality base fabric has been difficult to provide.

[0006] Japanese Patent Application Laid-Open (kokai) No. 2001-279568 discloses embossed nonwoven fabric produced through formation of a PVA-based spun bond web. The method is suitable for mass production. However, when the method is employed, the degree of polymerization of feedstock resin must be reduced in order to attain consistent spinning, and crystallization (molecular orientation) through heat treatment cannot fully be attained. Thus, base fabric having excellent dimensional stability has been difficult to provide.

[0007] Japanese Patent Application Laid-Open (kokai) No. 2003-129383 discloses a product obtained by bonding a random web nonwoven fabric sheet to a cloth sheet with a water-soluble adhesive or a similar material. However, a specially designed apparatus is required fox producing such a cloth product, resulting in difficulty in provision of base fabric for general use at low cost.

[0008] Meanwhile, there are some base fabric products having high dimensional stability which are formed by bonding random, webs made of PVA-based fiber with an aqueous binder solution containing a water-soluble resin. For example, Japanese Patent Application Laid-Open (kokai) No. 7-054257 discloses nonwoven fabric formed by bonding webs made of PVA-based long fiber with the aforementioned aqueous binder solution. However, when nonwoven fabric is produced from PVA-based long fiber, non-continuous production steps must be employed, resulting in difficulty in provision of base fabric for general use at low cost. In addition, when the base fabric that has been produced by bonding filament with an aqueous binder solution containing a water-soluble resin is subjected to heat treatment, shrinkage of the fabric problematically increases.

[0009] In addition to the aforementioned methods, Japanese Patent Application Laid-Open (kokai) No. 1-018182 discloses a method including spraying an aqueous binder solution to a PVA-based fiber sheet formed through fluid intertwining or impregnating the sheet with the binder solution, followed by tension, treatment in a widthwise direction during drying. However, when this method is employed, a large amount of binder resin must be used to form base fabric, and therefore, dimensional stability and softness cannot be fully attained simultaneously. Furthermore, when the method is employed for producing low-temperature-dissolving PVA base fabric formed from colored polyester embroidery yarn, which readily causes dye transfer, the produced fabric undergoes water swelling and shrinkage. Thus, base fabric having excellent texture been difficult to produce.

DISCLOSURE OF THE INVENTION

[0010] As mentioned above, there are many problems in realization of producing chemical lace base fabric which is soft, has high dimensional stability and low dissolution temperature, and is produced at low cost. Therefore, there is keen demand for the development of chemical lace base fabric that can solve the aforementioned problems.

[0011] Thus, an object of the present invention is to provide chemical lace base fabric which is soft and easy to handle, which has high dimensional stability and low dissolution temperature, which prevents skips and non-uniformity in embroidery motifs, and which is produced at low cost. Another object of the invention is to provide a method for producing the chemical lace base fabric.

[0012] The present inventors have conducted extensive studies in order to solve the aforementioned problems, have found that chemical lace base fabric which is inexpensive and soft and has high dimensional stability low dissolution, temperature be produced by impregnating a random web made of water-soluble PVA-based fiber with a foamy binder produced from an aqueous solution a PVA-based resin (hereinafter may be referred to simply as "an aqueous foamy binder solution") and drying. The process including application of the above aqueous binder solution is simple and widely adaptable and is capable of reducing the amount of water adhered onto a fiber web as compared with conventional techniques such as spraying and impregnation. Therefore, failure in texture which would otherwise caused by swelling and shrinkage can be prevented, and the energy required for drying can be reduced. Thus, the method attains the objects of the present invention. The present inventors have also found that, when the method including application of a foamy binder is employed, a binder resin contained in the binder solution is supplied more preferentially to fiber-intertwined portions, as compared with conventional techniques, whereby base fabric having high dimensional stability and maintaining softness can be advantageously produced by use of a binder resin of a relatively small amount. The present invention has been accomplished in the basis of these findings.

[0013] Accordingly, the present invention provides a chemical lace base fabric comprising dyed embroidery yarn and nonwoven fabric formed of a water-soluble PVA-based fiber random web, which fabric satisfies the following conditions:

(1) a binder to be adhered onto the nonwoven fabric assumes a foamy aqueous solution containing a PVA-based resin, the binder is bonded onto the nonwoven fabric in an amount of 2 to 20 mass% with respect to the total mass of the nonwoven fabric;
(2) the nonwoven fabric a 10% modulus strength in the widthwise direction of 15 to 80 N/50-mm width; and
(3) the nonwoven fabric has a bending resistance of 40 to 150 mm.

[0014] Preferably, in the chemical lace base fabric according to the present invention, the difference between the water dissolution temperature (A°C) of the water-soluble vinyl alcohol-based fiber forming the nonwoven fabric and the water dissolution temperature (B°C) of the nonwoven fabric formed of a poly (vinyl alcohol)-based fiber random web, B-A, is 5°C or less.

[0015] More preferably, in the chemical lace base fabric according to the present invention, the PVA-based fiber forming the nonwoven fabric has a water dissolution temperature of 50 to 80°C.

[0016] The present invention also provides a method for producing a chemical lace base fabric, the method comprising adhering a foamy aqueous solution containing a PVA-based resin onto base fabric comprising dyed embroidery yarn and nonwoven fabric formed of a water-soluble PVA-based fiber random web and, subsequently, heat-drying the base fabric.

[0017] The present invention enables to provide a chemical lace base fabric which is soft and easy to handle, which has high dimensional stability and low dissolution temperature, which prevents skips and non-uniformity in embroidery motifs, and which is produced at low cost, and a method for producing the chemical lace base fabric.

THE MOST PREFERRED EMBODIMENT TO CARRY OUT THE INVENTION

[0018] In the present invention, a water-soluble PVA-based polymer must be used to resin fiber. In the case where a partially saponified PVA (i.e., PVA formed from a vinyl acetate and a vinyl alcohol unit) is employed as the water-soluble PVA-based polymer in the present invention, the degree of saponification of the partially saponified PVA is preferably 95 to 99.95 mol%, in order to attain a water dissolution temperature of 50 to 80°C, which is preferred, in the present invention. When the degree of saponification is in excess of 99.95 mol%, crystallization of the polymer excessively proceeds during dry-beat stretching or dry-heat shrinking, possibly resulting in a water dissolution temperature higher than 80°C.

[0019] In the case where a modified PVA formed from a structural unit other than the vinyl acetate unit and the vinyl alcohol unit is employed, the modifying unit exhibits strong crystallization inhibitory effect, even a modified PVA-based polymer having a modifying unit content of about 0.5 mol% may be suitably employed in the present invention. However, in general, a modified PVA-based polymer having a modifying unit content of 1 mol% or more is preferably employed. Although the modified PVA-based polymer has higher degree of saponification than that of the unmodified PVA-based polymer, the modified PVA-based polymer can be dissolved in water at low temperature by virtue of the crystallization inhibitory effect. A modifying unit content in excess of 20 mol% is not preferred, since crystallinity considerably decreases, thereby impairing fiber characteristics and spinnability.

[0020] Examples of the monomer forming the modifying unit include ethylene, allyl alcohol, itaconic acid, acrylic acid, vinylamine, maleic anhydride and a ring-opened product thereof, sulfonic acid-containing vinyl compounds, C≥4 fatty acid vinyl esters such as vinyl pivalate, vinylpyrrolidone, and compounds derived through total or partial neutralization of an ionic group the above monomers. The modifying unit may be introduced to PVA through copolymerization or post-reaction. No particular limitation is imposed on the arrangement of the modifying units in a polymer chain, and the modifying units may be linked in the random, block, or graft manner. No particular limitation is imposed on the degree of polymerization of the polymer. The degree of polymerization is preferably 1,000 or more, particularly preferably 1,1500 or more, from the viewpoint of adaptability and mechanical performance of the produced fiber. From the viewpoint of spinnability, the degree of polymerization is preferably 4,000 or less.

[0021] The method for producing the PVA-based fiber employed in the present invention will next be described.

[0022] In the present invention, the PVA-based fiber is produced from a spinning liquid prepared by dissolving a water-soluble corresponding polymer in water or an organic solvent, whereby highly water-soluble fiber exhibiting excellent mechanical performance can be effectively produced. Needless to say, the spinning liquid may further contain an additive and a polymer other than those described above, without impairing the effects of the present invention. Examples of the solvent forming the spinning liquid include water; polar solvents such as dimethyl sulfoxide (DMSO), dimethylacetamide, dimethylformamide, and N-methylpyrrolidone; polyhydric alcohols such as glycerin and ethylene glycol; mixtures thereof with a swelling metallic salt such as a Rhodan salt, lithium chloride, calcium chloride, or zinc chloride; mixtures of the solvents; mixtures thereof with water. Of these, water and DMSO are most preferred, from the viewpoint of low-temperature solubility, low toxicity, low corrosiveness, etc.

[0023] The polymer concentration of the spinning liquid, which varies in accordance with the composition, degree of polymerization, and type of solvent, is preferably 8 to 40 mass%. The temperature of the spinning liquid upon discharge is controlled so as to fall within a range where the spinning liquid is not gelled, decomposed, nor colored. Specifically, the temperature preferably falls within a range of 50 to 150°C.

[0024] The above spinning liquid is subjected to wet spinning or dry-jet-wet spinning by discharging the liquid through nozzles into a solidification liquid that is capable of solidifying PVA polymer. Particularly when the spinning liquid is discharged through manifold nozzles, wet spinning method is more preferable than dry-jet-wet spinning method from the viewpoint of prevention of adhesion between fiber filaments during discharge of the liquid. As used herein, the "wet spinning method" refers to a spinning technique in which a spinning liquid is discharged through a spinneret directly into a solidification bath, whereas the "dry-jet-wet spinning method" refers to a spinning technique in which a spinning liquid is discharged through a spinneret into air or inert gas, followed by introducing the discharged liquid to a solidification bath.

[0025] The composition of the solidification liquid in the solidification bath varies depending on the type of the solvent of the spinning liquid; i.e., organic solvent or water. In the case where the liquid is on the basis of organic solvent, the solidification liquid is preferably formed of a liquid mixture containing a solidification solvent and a spinning liquid solvent, from the viewpoint of strength of the produced fiber and other factors. The solidification solvent may be an organic solvent which is capable of solidifying PVA polymer, and examples include alcohols such as methanol and ethanol and ketones such as acetone and methyl ethyl ketone. Of these, an organic solvent formed of methanol and DMSO is preferred. The liquid mixture preferably has a solidification solvent/spinning liquid solvent ratio of 25/75 to 95/5, more preferably 55/45 to 80/20, from the viewpoint of spinning step performance (spinning stability) and recovery of solvent. The solidification bath temperature is preferably 30°C or lower, and particularly in the case in which uniform gelling through cooling is to be attained, 20°C or lower, more preferably 15°C or lower.

[0026] In the: where an aqueous spinning liquid is employed, the solvent employed in the solidification bath may be an aqueous inorganic salt solution which is capable of solidifying PVA polymer, and examples of preferred inorganic salts include sodium sulfate, sodium chloride, and sodium carbonate. Needless to say, the solidification liquid in the solidification bath may be acidic or alkaline.

[0027] Subsequently, the solvent of the spinning liquid is removed from the thus-solidified threads through extraction. Upon extraction, the threads are preferably wet-stretched, from the viewpoint of suppression of interfilament adhesion during drying and enhancing fiber strength of the produced fiber. The draw ratio upon wet stretching is preferably 1.5 to 6. The extraction is generally performed through passage through a plurality of extraction baths. The extraction bath composition may be solely a solidification solvent or a liquid mixture of the solidification solvent and a spinning liquid, solvent. The extraction bath temperature is generally 0 to 50°C.

[0028] Subsequently, the threads are dried in accordance with needs, with an oily agent or a similar agent being applied thereto. The drying temperature is preferably 210°C or lower. Particularly, a preferably employed drying method is multi-step drying which the threads are dried at a temperature as low as 160°C or lower in an initial drying stage, and at a high temperature in the subsequent stage. Then, dry-heat stretching and, if required, heat crimping are performed, to thereby enhance orientation (crystallization) of PVA molecular and regulate strength, water resistance, and heat resistance of fiber. In order to enhance mechanical performance of the fiber, dry-beat stretching is preferably performed at 150 to 250°C at a total draw ratio of 3 or more, particularly preferably 5 or more. When the stretching is performed at a total draw ratio of 3 or more, a fiber strength of 1.5 to 4.0 cN/dtex can be attained. Furthermore, when the stretching is performed at a total draw ratio of 5 or more, a fiber strength of 4 cN/dtex or more can be attained. In the present invention, the term "total draw ratio" refers to a draw ratio obtained through multiplication of a wet draw ratio and a dry draw ratio.

[0029] Subsequently, the threads are crimped in accordance with needs, by application of an oily agent or a similar agent thereto. A conventionally known crimping method may be employed. In a preferred mode for imparting sufficient crimp to PVA-based fiber, the threads are subjected to preliminary heat-drying, crimped by means of a mechanical curing apparatus, and cooling to a temperature lower than the glass transition temperature so as to intensively stabilize the crimping state.

[0030] The thus-produced fiber employed in the present invention preferably has a fiber fineness of 0.5 to 5 dtex. When the fiber fineness is less than 0.5 dtex, fiber strength is poor, and severe damage is caused by needles during embroidering, whereas when the fiber fineness is in excess of 5 dtex, texture of nonwoven fabric is impaired, resulting in skips and non-uniformity in embroidery motifs, thereby disturbing favorable embroidering. More preferably, the fiber fineness is 1 to 3 dtex.

[0031] The PVA-based fiber employed in the present invention preferably has a water dissolution temperature of 50 to 80°C. When the water dissolution temperature is lower than 50°C, swelling by water and shrinkage tend to occur, and shrinkage increases in a drying step carried out after application of an aqueous resin binder solution, thereby failing to obtain nonwoven fabric with good texture. Although, the shrinkage in the drying step can generally be mitigated by means of a pin tenter or a sandwich net, local texture spots are difficult to prevent. When the fiber has a water dissolution temperature higher than 80°C, complete removal of base fabric from embroidered products through dissolution is difficult, which is not preferred. Thus, the dissolution temperature is more preferably 55 to 75°C.

[0032] The method of the present invention for producing the nonwoven fabric formed of PVA-based fiber will next be described.

[0033] The random web nonwoven fabric of the present invention is preferably dry nonwoven fabric, in which fiber filaments forming the nonwoven fabric are oriented at random. Webs employed in the invention may be produced through a conventionally known curding method or air-laid method. Random fiber orientation is realized through a conventionally known method such as the cross-wrap method or the crisscross method. When the nonwoven fabric is employed as a base fabric for chemical lace, random fiber orientation is preferred in order to suppress any failure such as omitted motifs and disarrangement of motifs, since high tension is applied in the widthwise direction particularly during the embroidering operation.

[0034] The nonwoven fabric of the present invention produced through the aforementioned method preferably has a weight per unit area of 15 to 50 g/m^2. When the weight per unit area is less than 15 g/m^2, uniform texture cannot be obtained due to decrease in a number of fiber filaments, readily causing skips and non-uniformity in embroidery motifs. In addition, since the strength of the base fabric *per se* is reduced, a large number of failure products are provided after carrying out an embroidering step. When the weight per unit area is in excess of 50 g/m^2, the products will be expensive. Furthermore, softness of nonwoven fabric is impaired, thereby reducing operability during sewing to join base fabric products by means of a sewing machine or during setting of the base fabric with tension in an embroidering machine. In addition, the mass of the base fabric to be removed through dissolution increases, thereby elevating costs for dissolution wastewater treatment, which is not preferred. Thus, the weight per unit area is more preferably 20 to 40 g/m^2.

[0035] In the present invention, a foamy binder is applied to the nonwoven fabric produced through the aforementioned method, or the nonwoven fabric is impregnated with the foamy binder, followed by heat drying, whereby nonwoven fabric having excellent softness and dimensional stability can be produced.

[0036] When the nonwoven fabric which has been treated with the foamy binder is embroidered with colored embroidery yarn, chemical lace base fabric having few skips and non-uniformitys in embroidery motifs can be produced.

[0037] No particular limitation is imposed on the type of the colored embroidery yarn, and polyester or rayon embroidery yarn is preferably used.

[0038] The binder to be adhered onto the nonwoven fabric of the present invention is an aqueous solution which contains a PVA-based resin and which is in the form of foam. The foamy binder solution having the aforementioned composition may be produced through dissolving a PVA-based resin in water under stirring by means of a dissolution apparatus, to thereby prepare an aqueous PVA solution of a predetermined concentration; adding an aid and a penetrant to the solution in accordance with needs; and air-bubbling the aqueous solution placed in the dissolution apparatus under stirring, to thereby foam the solution. The method for applying the thus-prepared aqueous foamy binder solution may be feeding an aqueous foamy binder solution through nozzles down to a web produced through curding or a similar technique; or bringing a web into contact with an aqueous foamy binder solution adhered on a roller, to thereby impregnate the web with the solution. According to the present invention, heat drying is performed after an impregnation/application step. Therefore, a binder resin contained in the foamy aqueous binder solution is supplied more preferentially to fiber-intertwined portions upon breakage of foam of the binder solution, and conventionally attained adhesion can be obtained through deposition of the binder in a relatively small amount, as compared with conventional techniques such as spraying and impregnation. In one advantage, softness (i.e., bending resistance described later) of the nonwoven fabric is readily maintained, as compared with a conventional technique in which a resin is deposited on portions other than fiber-intertwined portions. In addition, since the amount of water deposited on the nonwoven fabric is reduced, the energy required for drying can be reduced. In the case where a low-temperature-dissolving PVA-based fiber which readily swells by water and shrinks is employed, the amount of deposited water can be reduced, and swelling and shrinkage can be suppressed. Thus, base fabric having good texture can be produced without employing a special apparatus such as a pin tenter or a sandwich net.

[0039] Since swelling and shrinkage of the base fabric can be suppressed, physical properties at high draw ratio of fiber filaments forming the base fabric are not impaired, and strength of the base fabric can be enhanced even under low stretch conditions. Therefore, sufficient 10% modulus strength (described in detail later) can be readily attained.

[0040] The adhering amount of the aqueous foamy binder solution of the present invention is required to be 2 to 20 mass% on the basis of the total mass of the nonwoven fabric. When the adhering amount is less than 2 mass%, adhesion between the nonwoven fabric and the binder is poor, to attain a strength required to the base fabric, whereas when the coating amount, is in excess of 20 mass%, the amount of the resin adhered on portions other than fiber-intertwined portions increases, resulting in impairment of softness of the nonwoven fabric and failure to attain further enhancement in strength of the nonwoven fabric. In addition, increase in binder resin concentration elevates viscosity of the solution, and thus trouble (e.g., sticking) may readily occur during rolling of the nonwoven fabric on a roller or a similar member. The coating amount is preferably 3 to 17 mass%, more preferably 4 to 15 mass%. The aqueous binder solution preferably contains a surfactant exhibiting a foaming/penetration effect. Examples of the surfactant include alkyl ether sulfonates, dodecyl benzenesulfonates, and castor oil sulfates. In addition to the above surfactant, additives such as a softening agent and a pH-controlling agent may be incorporated into the binder solution.

[0041] Subsequently, drying based on heat drying is performed. No particular limitation is imposed on the heat drying conditions, and hot air drying or cylinder drying may be employed. The drying is preferably performed in a hot air furnace at 100°C or higher.

[0042] Through the above heat drying treatment, there can be produced a chemical lace base fabric which has excellent softness and dimensional stability and can hold thereon vividly colored, high-end embroidery patterns.

[0043] Among the qualities required for chemical lace base fabric, the 10% modulus strength in the widthwise direction is one of the most important factors. Generally, embroidering is carried out while base fabric is bound with clips or similar means and stretched at some % in the widthwise direction. Under such conditions, the base fabric is required to have not high break strength, but high 10% modulus strength in the widthwise direction (i.e., resistance to elongation in the widthwise direction during embroidering). In the present invention, the nonwoven fabric must have a 10% modulus strength in the widthwise direction of 15 to 80 N/50-mm width. When the 10% modulus strength in the widthwise direction is less than 15 N/50-mm width, elongation of the nonwoven fabric is caused by tension applied during embroidering, promoting skips and non-uniformity in embroidery motifs and failing to obtain fine embroidery patterns, which is not preferred. When the 10% modulus strength in the widthwise direction is in excess of 80 N/50-mm width, problematic skips and non-uniformity in embroidery motifs can be prevented. However, softness of the nonwoven fabric is impaired, thereby considerably reducing operating efficiency during sewing to join base fabric products by means of a sewing machine or during setting the base fabric with tension in an embroidering machine table. Thus, the 10% modulus strength in the widthwise direction is preferably 20 to 70 N/50-mm width, more preferably 25 to 60 N/50-mm width.

[0044] The 10% modulus strength of nonwoven fabric in the lengthwise direction, which is not an important factor as compared with the 10% modulus strength in the widthwise direction, is preferably 10 N/50-mm width or more. When the 10% modulus strength in the lengthwise direction is excessively low, trouble may occur in cutting the nonwoven fabric along the longitudinal direction upon embroidering with application of tension and in a shirring step performed after embroidering.

[0045] The nonwoven fabric of the present invention is required to have a bending resistance of 40 to 150 mm. When the bending resistance is less than 40 mm, the nonwoven fabric is excessively soft, causing skips and non-uniformity in embroidery motifs during embroidering. When the bending resistance is in excess of 150 mm, the base fabric has a hard sensation. Specifically, operating efficiency is considerably reduced in the case where operation for which softness of the base fabric is suitable; e.g., sewing the base fabric to tulle by means of a sewing machine, sewing to join base fabric products by means of a sewing machine, or setting the base fabric with tension in an embroidering machine. In addition, wrinkles are readily occurred during rolling of raw fabric performed after embroidering, impeding continuous feed of raw fabric. Thus, the bending of the nonwoven fabric is preferably 50 to 140 mm, more preferably 60 to 130 mm.

Bending resistance of nonwoven fabric is determined through a method described later.

[0046] Among the qualities required of chemical lace base fabric, in addition to the 10% modulus in the widthwise direction, water dissolution temperature of nonwoven is of the most important factors. Generally, the lower the water dissolution temperature of nonwoven fabric, the more effectively the prevention of dye removal and during removal of base fabric through dissolution preformed after embroidering. Therefore, when colored embroidery yarn made of rayon or polyester fiber is employed, water dissolution temperature is the most important factor for selecting base fabric. Specifically, difference in water dissolution temperature between A°C and B°C, B-A, preferably satisfies the relationship: B-A≤5°C, more preferably B-A≤4°C, still more preferably B-A≤2°C,

wherein A represents a water dissolution temperature of employed PVA-based fiber, and B represents a water dissolution temperature of nonwoven fabric produced from the PVA-based fiber. According to the present invention, the relationship B-A≤5°C can be attained by applying a foamed aqueous binder solution of water-soluble PVA-based resin to nonwoven fabric. When B-A≤5°C is satisfied, the energy required for a dissolution step can be reduced, and chemical lace base fabric having softer feeling can be readily produced. When B-A is in excess of 5°C, dye removal from colored embroidery yarn and re-coloring during removal of base fabric through dissolution preformed after embroidering may occur. Particularly, when a conventional method such as spraying or impregnation is employed, B-A exceeds 5°C, resulting in removal of color from colored embroidery yarn and re-coloring, which is not preferred.

[0047] The present invention also provides a method for producing chemical lace base fabric, the method comprising adhering a foamy aqueous solution containing a poly (vinyl alcohol)·based resin onto base fabric comprising dyed embroidery yarn and nonwoven fabric formed of a water-soluble poly (vinyl alcohol)-based fiber random web and, subsequently, heat-drying the base fabric.

EXAMPLES

[0048] The present invention will next be described in detail by way of example, which should not be construed as limiting the invention thereto. In the preset invention, water dissolution temperature of fiber or nonwoven fabric, 10% modulus strength, bending resistance, and fiber strength were determined through the following procedures.

(1) Water dissolution temperature A (°C) of fiber

[0049] Water-soluble fiber cut strands (length: 1 to 2 mm, some 10 mg) were fed into water (100 cm^3). The mixture was heated at an elevation rate of 1°C/min under stirring. The temperature at which fiber strands had been completely dissolved was determined as water dissolution temperature A.

(2) Water dissolution temperature B (°C) of nonwoven fabric

[0050] Three cut pieces (2 cm × 2 cm) of nonwoven fabric or paper were fed into water (400 cm^3). The mixture was heated at an elevation rate of 1°C/min under stirring at 280 rpm. The temperature at which fiber had been completely dissolved was determined as water dissolution temperature B.

(3) 10% Modulus strength (N/50-mm width)

[0051] Samples (each 50 mm × 170 mm) were cut from nonwoven fabric along the lengthwise direction and the widthwise direction. Tensile strength of each sample was determined by means of an Instron type testing machine under the conditions (grip interval: 100 mm, grip width: 25 mm, and tensile speeds: 100 mm/min), and tensile strength at 10% elongation was determined as the 10% modulus strength.

(4) Bending strength (mm)

[0052] Determined in accordance with cantilever 40.5° method as stipulated in JIS.

(5) Fiber strength (cN/dtex)

[0053] Determined in accordance with JIS L1013.

Example 1

[0054]

(1) PVA (degree of polymerization: 1,750, degree of saponification : 99 mol%) was fed to dimethyl sulfoxide (DMSO), and the mixture was stirred at 90°C and 240 rpm for 10 hours under nitrogen flow so as to dissolve the polymer, whereby a spinning liquid having a polymer concentration of 20 mass% was produced. The thus-produced spinning liquid was wet-spun through a spinneret (holes: 15,000, hole size: 0.16 mm) into a solidification bath formed of methanol/DMSO (70/30 by mass, at 10°C). Subsequently, the thus-formed product was wet-stretched at a draw ratio of 3.0 while DMSO was extracted with an extracting agent (methanol, 25°C). The obtained fiber was dried at 150°C for 8 minutes under nitrogen, and dry-stretched at 170°C and a draw ratio of 2.0, followed by crimping and cutting, to thereby produce a PVA-based crimped fiber. The fiber was found to have a fiber size of 33,000 dtex, a fiber strength of 7.2 cN/dtex, and a water dissolution temperature A of 72°C. Table 1 shows characteristics of the fiber.

(2) A random web was fabricated from the thus-produced PVA-based fiber (100 parts by mass). An aqueous solution containing the same PVA as forming the fiber (5 mass%) and a surfactant (BEROL-48, linear-chain alkylbenzenesulfonate) was foamed by use of a handy mixer, to thereby form a binder solution. The fabricated web was impregnated with the binder solution, followed by drying at 70°C, to thereby produce nonwoven fabric. As shown in Table 2, the nonwoven fabric was found to have a bending resistance of 118 mm, which means high softness and operability, and a 10% modulus strength as high as 27.8 (N/50-mm width).

(3) The nonwoven fabric produced in (2) above was embroidered with an embroidery yarn made of a commercial colored polyester fiber. The nonwoven fabric provided embroidery patterns free of skips and non-uniformity. Thus, the nonwoven fabric was suitable for chemical lace base fabric. The base fabric after embroidering exhibited a water dissolution temperature B of base fabric of 74°C and a B-A of 2.0°C. Even when a commercial colored polyester embroidery yarn, which readily causes dye transfer, was employed, removal of dye from the embroidery yarn and re-coloring were not observed after removal of base fabric through dissolution. Thus, embroidered fabric having a vividly colored, high-end pattern was produced.

Example 2

[0055] The procedure of Example 1 including spinning was repeated, except that PVA (degree of polymerization : 1,750, degree of saponification: 96 mol%) was used, to thereby produce a PVA-based crimped fiber having a fiber fineness of 85,000 dtex, a fiber strength of 6.2 cN/dtex, and a water dissolution temperature A of 65°C. Table 1 shows characteristics of the fiber. Under the same conditions as employed in Example 1, nonwoven fabric was produced from the fiber. As shown in Table 2, the nonwoven fabric was found to have a bending resistance of 86 mm, which means high softness and and a 10% modulus strength as as 1.9.4 (N/50-mm width). The thus-produced nonwoven fabric was embroidered with the same embroidery yarn as employed in Example 1. The nonwoven fabric provided embroidery patterns free of skips and non-uniformity. Thus, the nonwoven fabric was suitable for chemical lace fabric. The base fabric embroidering exhibited a water dissolution temperature B of base fabric of 68.5°C and a B-A of 3.5°C. Therefore, removal of dye from the embroidery yarn and re-coloring were not observed after removal of base fabric through dissolution, and embroidered fabric having a vividly colored, high-end pattern was produced.

Example 3

[0056]

(1) PVA (degree of polymerization : 1,750, degree of saponification : 98,5 mol%) was fed to water, and the mixture was stirred at 90°C and 240 rpm for 10 hours under nitrogen flow so as to dissolve the polymer, whereby a spinning liquid having a polymer concentration of 17 mass% was produced. The thus-produced spinning liquid was wet-spun through a spinneret (holes: 15,000, hole size: 0.16 mm) into an acidic solidification bath formed of an aqueous saturated sodium sulfate solution (at 40°C) so as to perform solidification. Subsequently, the thus-formed threads were wet-stretched at a roller draft of 3.0 while they were heated, followed by washing with water and drying at 130°C. The obtained threads were dry-stretched at 170°C and a draw ratio of 2.0, followed by crimping and cutting, to thereby produce a PVA-based crimped fiber. The fiber was found to have a fiber size of 33,000 dtex, a fiber strength of 3.1 cN/dtex, and a water dissolution temperature A of 76°C. Table 1 shows characteristics of the fiber.

(2) Under the same conditions as employed in Example 1, nonwoven fabric was produced from the fiber. As shown in Table 2, the nonwoven fabric was found to have a bending resistance of 139 mm, which means high softness and operability, and a 10% modulus strength as high as 35.3 (N/50-mm width).

(3) The nonwoven fabric produced in (2) above was embroidered with the same embroidery yarn as employed in Example 1. The nonwoven fabric provided embroidery patterns free of and non-uniformity. Thus, the nonwoven fabric was suitable for chemical lace base fabric. The base fabric after embroidering exhibited a water dissolution temperature B of base fabric of 78°C and a B·A of 2.0°C. Therefore, removal of dye from the embroidery yarn and re-coloring were not observed after removal of base fabric through dissolution, and embroidered fabric having a

vividly colored, high-end pattern was produced.

Comparative Example 1

[0057] A random, web similar to that of Example 1 was produced to serve as a nonwoven fabric source. The random web was impregnated with an aqueous solution containing the same PVA as forming the fiber (1 mass%), followed by wring liquid from the web and drying at 70°C, to thereby produce nonwoven fabric. As shown in Table 2, the nonwoven fabric was found to have a 10% modulus strength as high as 54.8 (N/50-mm width). However, the bending resistance was as excessively high as 162 mm, which means hard sensation. During embroidering of the nonwoven fabric with the same embroidery yarn as employed in Example 1, mal-operability such as breakage of needles was observed. Thus, the nonwoven fabric was found to be unsuited for chemical lace base fabric.

Comparative Example 2

[0058] A random web similar to that of Example 1 was produced to serve as a nonwoven fabric source. The random web was impregnated with an aqueous foamed solution containing the same PVA as forming the fiber (1 mass%), followed by drying at 70°C, to thereby produce nonwoven fabric. As shown in Table 2, the nonwoven fabric was found to have a 10% modulus strength as low as 7.8 (N/50-mm width). When the nonwoven fabric was embroidered with the same embroidery yarn as employed in Example 1, skips and non-uniformity in embroidery motifs were provided. Thus, the nonwoven fabric was found to be unsuited for chemical lace base fabric.

Comparative Example 3

[0059] A random web similar to that of Example 1 was produced to serve as a nonwoven fabric source. The web was embossed through passage between a heated embossing roller and a steel roller under the following embossing conditions (percent emboss area: 12%, temperature: 195°C, line pressure: 329 N/cm, and process speed: 5 m/min), to thereby produce nonwoven fabric. As shown in Table 2, the nonwoven fabric exhibited satisfactory embroidering performance. However, the embroidered base fabric was found to have a water dissolution temperature of 86.5°C and a B-A of 14.5°C, and dye removal and re-coloring occurred during removal of the base fabric through dissolution preformed after embroidering. Thus, the nonwoven fabric was found to be unsuited for chemical lace base fabric.

Table 1

	Ex. 1 Comp. Exs. 1 to 3	Ex.2	Ex.3
Fiber strength (cN/detx)	7.2	6.2	3.1
Elongation (%)	10.6	14.3	19.5
Water dissolution temp. A (°C)	72	65	76

Table 2

	Ex. 1	Ex.2	Ex.3	Comp. Ex. 1	Comp. Ex. 2	Comp. Ex. 3
Weight per unit area (g/m^2)	40.2	39.7	40.3	40.4	40.0	39.8
Thickness (mm)	0.16	0.16	0.17	0.16	0.17	0.35
Foamy resin coating amount (mass%/PVA)	8.3	7.6	8.5	27.9	1.6	0
10% Modulus strength (N/50-mm width) in the widthwise direction	27.8	19.4	35.3	54.8	7.8	28.0
Bending resistance (mm)	118	86	139 39	162	81	62
Water dissolution temp. B (°C)	74.0	68.5	78.0	76.0	74.0	86.5
B-A (°C)	2.0	3.5	2.0	4.0	2.0	14.5
Embroidering performance	good	Good	Good	1*	2*	3*

(continued)

	Ex. 1	Ex.2	Ex.3	Comp. Ex. 1	Comp. Ex. 2	Comp. Ex. 3
General evaluation	good	Good	Good	bad	bad	bad
1*: Hard poor operability 2*: Skips and non-uniformity in embroidery motifs 3*: Dye removal and stains						

INDUSTRIAL APPLICABILITY

[0060] The present invention enables to provide a chemical lace base fabric which is soft and easy to handle, which has high dimensional stability and low dissolution temperature, which prevents skips and non-uniformity in embroidery motifs, and which is produced at low cost, and a method for producing the chemical lace base fabric.

Claims

1. Abase fabric for producing chemical lace comprising dyed embroidery yarn and nonwoven fabric formed of a water-soluble poly (vinyl alcohol)-based fiber random web, which base fabric satisfies the following conditions:

   (1) a binder to be adhered onto the nonwoven fabric assumes a foamy aqueous solution containing a poly (vinyl alcohol)-based resin, and the binder is adhered onto the nonwoven fabric in an amount of 2 to 20 mass% with respect to the total mass of the nonwoven fabric;
   (2) the nonwoven fabric has a 10% modulus strength in the widthwise direction of 15 to 80 N/50-mm width; and
   (3) the nonwoven fabric has a bending resistance of 40 to 150 mm.

2. The base fabric for producing chemical lace as described in claim 1, wherein the water dissolution temperature (A°C) of the water-soluble vinyl alcohol-based fiber forming the nonwoven fabric and the water dissolution temperature (B°C) of the nonwoven fabric formed of a poly (vinyl alcohol)-based fiber random web satisfy the relationship: $B-A \leq 5°C$.

3. The base fabric for producing chemical lace as described in claim 1 or 2, wherein the poly (vinyl alcohol)-based fiber forming the nonwoven fabric has a water dissolution temperature of 50 to 80°C.

4. A method for producing the base fabric for producing chemical lace as recited in any one of claims 1 to 3, the method comprising adhering a foamy aqueous solution containing a poly (vinyl alcohol)-based resin onto base fabric comprising dyed embroidery yarn and nonwoven fabric formed of a water-soluble poly (vinyl alcohol)-based fiber random web and, subsequently, heat-drying the base fabric.

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
D06Q1/02(2006.01), ***D04H1/42***(2006.01), ***D04H1/58***(2006.01)

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)
D06Q1/00-1/14, D04H1/00-18/00

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

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2006
Kokai Jitsuyo Shinan Koho	1971-2006	Toroku Jitsuyo Shinan Koho	1994-2006

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y A	JP 64-45791 U (Japan Vilene Co., Ltd.), 20 March, 1989 (20.03.89), Claim 1; page 5, lines 16 to 20; examples (Family: none)	1,3,4 2
Y	JP 7-54257 A (Kuraray Co., Ltd.), 28 February, 1995 (28.02.95), Claim 1; Par. No. [0006]; examples 1 to 4 (Family: none)	1-4

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
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"&" document member of the same patent family

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INTERNATIONAL SEARCH REPORT

International application No.
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Y A	JP 6-2259 A (Kanebo, Ltd.), 11 January, 1994 (11.01.94), Claim 1; Par. Nos. [0010], [0011]; examples (Family: none)	1,3 2,4
A	JP 5-66088 U (Japan Vilene Co., Ltd.), 31 August, 1993 (31.08.93), Claim 1; example 2 (Family: none)	1-4
P,A	JP 2006-63459 A (Kuraray Co., Ltd.), 09 March, 2006 (09.03.06), Claims 1, 2; Par. Nos. [0021], [0029] (Family: none)	1-4

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- JP 2003129383 A **[0007]**
- JP 7054257 A **[0008]**
- JP 1018182 A **[0009]**