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(54) METHOD OF DRY TRANSFER PRINTING OF SYNTHETIC FIBROUS MATERIAL WITH DISPERSE DYE AND TRANSFER PAPER

(57) A transfer paper which comprises a transfer paper base and a disperse dye ink printed thereon or imparted thereto. The transfer paper is used in a dry transfer printing method in which the transfer paper is pressed against a synthetic fibrous material with heating to thereby transfer the dye (pattern) from the transfer paper to the fibrous material. The transfer paper is **characterized in that** the transfer paper base has a releasant layer comprising a synthetic resin soluble in organic solvents and an ink-receiving layer made from a mixture comprising a hydrophilic synthetic resin which softens or melts upon heating, a hydrophilic binder, and various aids, the ink-receiving layer being superposed on the releasant layer. With this transfer paper for dry transfer printing, a highly fine pattern can be printed with excellent reproducibility. Furthermore, the transfer paper enables quick delivery by so-called printing without platemaking. The method of dry transfer plating employs this transfer paper.

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Description

[TECHNICAL FIELD]

[0001] The present invention relates to a method of dry transfer printing on a synthetic fiber material using a disperse dye, and to a transfer paper.

[BACKGROUND ART]

[0002] For drawing a design fast and finely on a cloth with a dye, screen printing, roller printing, rotary screen printing, gravure printing, and transfer printing based on the cited printing techniques have conventionally been known, and also industrially employed. These plate printing techniques have, however, the following drawbacks.

i. The number of applicable colors is limited.
ii. Although printing with pattern frames of decomposed three primary colors can express a multicolor image, it is difficult to adjust the hue and density of the colors composed from the three primary colors.
iii. Reproducibility of the printing effect is prone to be degraded because of forming multiple layers.
Besides, problems of loss and waste of materials have been pointed out, such as the expensive plate making cost in the case of a small-lot production, and necessity of preparing a surplus amount of color paste than is actually necessary for the printing process.

[0003] As a new printing method that eliminates the foregoing problems, a plateless printing technique, performed through processing an image by a computer and printing the image with the inkjet system, is being spotlighted. The plateless printing is being developed in the transfer printing field in addition to direct printing on a cloth, and the practical use thereof is being launched. The transfer printing based on the plateless printing technique includes applying a dye ink (design) on a paper with an inkjet printer to create a transfer paper, and transferring the dye on the transfer paper to a natural or synthetic fiber material. This technique has, however, such drawback that when printing a dye ink in small dots with the inkjet printer on an uncolored transfer paper, uniformity in printing effect among the dots becomes insufficient, and that the dye solution oozes out thus destroying the delicacy.

[0004] In the field of the inkjet printer method utilizing the disperse dye, a direct printing process on a cloth and a sublimation transfer process that employs the transfer paper are now in practical use. A drawback of the direct printing process on a cloth is that, as stated in patent documents 1 (JP-A No.2005-264021, page 9, paragraphs 0047 to 0051) and 2 (JP-B No.H05-36545), a pretreatment of the cloth with a water-soluble metal salt, polycation compound, water-soluble polymer, surfactant, water repellent and so forth is indispensible for preventing blur. To be more detailed, blur or repelling of water ink printed on the cloth degrades sharpness of the design, and hence some kind of pretreatment has to be performed on the cloth to avoid such a problem, as stated in those patent documents.

[0005] The pretreatment has to be different depending on the type of the woven or knitted fabric (type of weaving or knitting, thickness and twisting type of thread, etc.), which leads not only to complication of the process and an increase in cost, but also to the need of preparing pretreatment facilities and special chemicals, thus resulting in degraded economical efficiency and stability of quality. Besides, it is difficult to apply the direct printing process to thick fabrics including a three-dimensional woven or knitted fabric or three-dimensional cloth such as velvet and a sewn fabric, as stated in a patent document 3 (JP-A No.2004-176203). Further, in the case of direct printing on the cloth the transfer paper cannot be stocked in advance, and therefore quick delivery may become difficult, in view of the printing speed of the inkjet printer.

[0006] Meanwhile, transfer printing utilizing a sublimation disperse dye is well known as a printing method that employs a transfer paper printed with the disperse dye ink. The sublimation transfer process has, while offering such advantage that the dye can be fixed simply by press-heating the transfer paper and washing is unnecessary, various drawbacks as cited below.

(1) Because of employing the disperse dye that has a high sublimation effect, bleeding is incurred around the pattern and sharpness of the design is degraded. In other words, sharpness and reproducibility of the design is not satisfactory.
(2) Because of the sublimation fixing process, sufficient color yield cannot be achieved in intense colors.
(3) Thermal stability, sublimation fastness and washing fastness are low because of lack in fastness of the sublimation disperse dye.
(4) Because of surface dyeing, a chalk mark is prone to appear.
(5) High-temperature treatment degrades the texture of the fabric.
These drawbacks are considered to be reasons for that the sublimation transfer printing method with the disperse dye has not yet been industrially adopted in earnest.

[0007] A patent document 4 discloses a method including superposing on a cloth a transfer paper constituted of four layers, namely a peeling agent layer, a thermoplastic resin layer, a water-soluble polymer layer, and an ink layer, transferring the ink layer, the water-soluble polymer layer, and the thermoplastic resin layer onto the cloth by heating, and fixing. However, the thermoplastic resin layer according to the patent document 4 is constituted of what is known as a hydrophobic resin, and applied in a form of a toluene solution (page 2, right column, 5th line of the patent document 4) and separated in a

form of a film in the rinse process (page 2, left column, 19th to 23rd lines of the patent document 4). Such hydrophobic resin has poor compatibility with the water disperse dye according to the present invention, and hence unsuitable to be employed in the dry transfer printing process using the disperse dye ink, which an object of the present invention. Besides, the hydrophobic resin is difficult to be removed by rinse, which leads to the disadvantage that the cloth texture is degraded.

[0008] Further, a patent document 5 describes a transfer paper having a release layer on a surface and an outer coating layer composed of a paste and an adhesive agent, which achieves 98 to 100% of transfer rate of the paste and the adhesive agent to the cloth through applying the coating layer of the transfer paper to the cloth and pressing them at 1 to 4 kg/cm^2. The patent document 5 provides the feature that the transfer of the paste and the adhesive agent is performed solely by pressing, without heating, because the ink receiving layer is predominantly composed of the paste, however the process that employs such coating layer is barely practical. To be more detailed, whereas the uncolored transfer paper to which the paste has been applied and the transfer paper that has been printed by inkjet printing are generally wound in a roll and preserved for a certain period of time before undergoing the transfer process, since the ink receiving layer is peeled off with a pressure as low as 1 to 4 kg/cm^2 the transfer takes place to the back of the paper upon winding several hundred meters of uncolored transfer paper with the paste/printed transfer paper in a roll, which makes it practically impossible to wind the uncolored transfer paper/transfer paper.

[0009] Further, a patent document 6 discloses a transfer printing method of a natural fiber material using a water-soluble dye, including employing a transfer paper made from an uncolored transfer paper provided with three layers, namely (1) a release agent composed of an organic solvent-soluble synthetic resin applied on a base paper, (2) a hydrophilic resin applied thereon, and (3) a hydrophilic paste further applied thereon; applying a water-soluble dye to such uncolored transfer paper with an inkjet printer or the like and then drying; closely superposing the transfer paper on the fiber material and heating them, thereby transferring the design on the transfer paper to the surface of the fiber material; and performing a fixing process.

[0010] However, the disperse dye ink to be employed in the present invention is more prone to aggregate than a water-soluble dye ink and hence prone to cause clogging of an inkjet nozzle, and therefore a large amount of organic solvent such as ethylene glycol or glycerin is employed for the purpose of prevention of drying (moisture retention) and of clogging. This worsens the absorption of the disperse dye ink into the uncolored transfer paper, and impedes obtaining a high-density print. Besides, the uncolored transfer paper of the three-layer structure referred to in the patent document 6 incurs the disadvantage of increased number of processes and insufficient achievement of transfer rate.

[0011] The terms related to the transfer paper may be used in the following meanings, in this specification.

(1) Transfer base paper : paper or film with a release agent applied thereto
(2) Uncolored transfer paper: the transfer base paper with the ink-receiving layer applied thereto
(3) Transfer paper: the uncolored transfer paper with the disperse dye ink printed or applied thereto

[Patent document 1] JP-A No.2005-264021
[Patent document 2] JP-B No.H05-36545
[Patent document 3] JP-A No.2004-176203
[Patent document 4] JP-B No.S43-14865
[Patent document 5] JP-A No.H06-270596
[Patent document 6] JP-A No.2006-207101

[SUMMARY OF THE INVENTION]

[PROBLEM TO BE SOLVED BY THE INVENTION]

[0012] An object of the present invention is to provide a transfer paper for dry transfer printing, to be used in a dry transfer printing method comprising press-heating the transfer paper on which a disperse dye ink is printed or applied, on a synthetic fiber material, thereby transferring a dye (design) from the transfer paper to the fiber material; the transfer paper being applicable to printing on a woven fabric, knitted fabric, or a nonwoven cloth made from a synthetic fiber material or a semi-synthetic fiber material such as polyester, triacetate, diacetate, polyamide or polyacrylic, or a composite fabric of the synthetic fiber material or semi-synthetic fiber material containing a natural fiber material such as a mixed spun fabric, combined weave or mixed weave fabric, capable of giving high delicacy and reproducibility to the printed design, and which allows executing quick delivery by what is known as plateless printing. The present invention further provides a dry transfer printing method that utilizes such transfer paper for dry transfer printing, and that achieves high delicacy and reproducibility of the design, a lower cost and ecological benefit.

[MEANS FOR SOLVING THE PROBLEM]

[0013] The present invention provides a transfer paper for dry transfer printing made by printing or applying a disperse dye ink on an uncolored transfer paper,
wherein the uncolored transfer paper comprises a release agent layer composed of an organic solvent-soluble synthetic resin, and an ink receiving layer composed of a mixture of a hydrophilic synthetic resin, hydrophilic paste, and various auxiliaries that soften or melt by heating, and the ink receiving layer is stacked over the release agent layer (claim 1).

[0014] The present invention also provides the transfer paper for dry transfer printing according to claim 1, where-

in a mixing ratio of the hydrophilic synthetic resin and the hydrophilic paste contained in the ink receiving layer is in a range of 1 to 50 parts by weight of hydrophilic paste against 100 parts by weight of hydrophilic synthetic resin (claim 2).

Also, the present invention provides the transfer paper for dry transfer printing according to claim 1 or 2, wherein the auxiliary serves as a pH adjuster (claim 3).

[0015] Also, the present invention provides the transfer paper for dry transfer printing according to claim 3, wherein the pH adjuster is selected from substances composed of an organic acid alone, a salt of organic acid or a salt of inorganic acid, and which are intrinsically acid or can be acidified by heating (claim 4).

[0016] Also, the present invention provides the transfer paper for dry transfer printing according to any one of claims 1 to 4, wherein the disperse dye ink is a non-sublimation type disperse dye ink (claim 5).

[0017] Also, the present invention provides the transfer paper for dry transfer printing according to any one of claims 1 to 5, wherein the auxiliary is one or a mixture of two or more selected from a pH adjuster, a surface tension reducer, a thickening agent, a moisture retainer, a foil transfer binder, a color depth agent, an antiseptic agent, an antifungal agent, an anti-static agent, a sequestering agent and a reduction inhibitor (claim 6).

Also, the present invention provides the transfer paper for dry transfer printing according to any one of claims 1 to 6, wherein the organic solvent-soluble synthetic resin used for the release agent layer is one or a mixture of two or more selected from a silicone resin, a fluorine resin, a polypropylene resin, a polyethylene resin, an acrylic resin, an alkyd resin, a polyamide resin, a phenol resin, a stearic acid resin and a polyester resin (claim 7).

[0018] Also, the present invention provides the transfer paper for dry transfer printing according to any one of claims 1 to 7 , wherein the hydrophilic synthetic resin that softens or melts by heating is one or a mixture of two or more selected from a water-soluble polyester resin, a water-soluble urethane resin, a water-soluble urethane-modified ether resin, a water-soluble polyvinylalcohol-modified resin, a water-soluble acrylic acid-based resin and a water-soluble polyethylene oxide resin (claim 8).

[0019] Also, the present invention provides the transfer paper for dry transfer printing according to any one of claims 1 to 8, wherein the hydrophilic paste is one or a mixture of two or more selected from a natural gum paste (etherized tamarind gum, etherized locust bean gum, etherized guargum, acacia arabica gum, etc.), a cellulose derivative paste (etherized carboxymethyl cellulose, hydroxyethyl cellulose, etc.), a modified starch paste (etherized starch, esterized starch), a water-soluble synthetic paste (polyacrylic acid salt, polyvinylalcohol, etc.), and a seaweed paste (sodium alginate) (claim 9).

[0020] Further, the present invention provides a method of dry transfer printing, comprising printing or applying a disperse dye ink on an uncolored transfer paper thereby forming a transfer paper; press-heating the transfer paper closely superposed on a synthetic fiber material thereby transferring the disperse dye ink to the synthetic fiber material; and performing a fixing process;

wherein the uncolored transfer paper comprises a release agent layer composed of an organic solvent-soluble synthetic resin, and an ink receiving layer, that soften or melt by heating, composed of a mixture of a hydrophilic synthetic resin, hydrophilic paste, and various auxiliaries, and the ink receiving layer is stacked over the release agent layer (claim 10).

[0021] Further, the present invention provides the method of dry transfer printing according to claim 10, wherein a mixing ratio of the hydrophilic synthetic resin and the hydrophilic paste contained in the ink receiving layer is in a range of 1 to 50 parts by weight of hydrophilic paste against 100 parts by weight of hydrophilic synthetic resin (claim 11).

[0022] Further, the present invention provides the method of dry transfer printing according to claim 10 or 11, wherein the auxiliary serves as a pH adjuster (claim 12).

Also, the present invention provides the method of dry transfer printing according to claim 12, wherein the pH adjuster is selected from substances composed of substances composed of an organic acid alone, a salt of organic acid or a salt of inorganic acid, and which are intrinsically acid or can be acidified by heating (claim 13).

[0023] Further, the present invention provides the method of dry transfer printing according to any one of claims 10 to 13, wherein the disperse dye ink is a non-sublimation type disperse dye ink (claim 14).

Also, the present invention provides the method of dry transfer printing according to any one of claims 10 to 14, wherein the fixing process is a wet fixing process (steaming process) (claim 15).

[0024] Further, the present invention provides the method of dry transfer printing according to claim 15, wherein the temperature of the wet fixing process (steaming process) is set in a range of 90 to 180°C (claim 16).

Further, the present invention also provides the method of dry transfer printing according to any one of claims 10 to 16, wherein the auxiliary is one or a mixture of two or more selected from a pH adjuster, a surface tension reducer, a thickening agent, a moisture retainer, a foil transfer binder, a color depth agent, an antiseptic agent, an anti-static agent, a sequestering agent and a reduction inhibitor (claim 17).

[0025] Further, the present invention provides the method of dry transfer printing according to any one of claims 10 to 17, wherein the organic solvent-soluble synthetic resin used for the release agent layer is one or a mixture of two or more selected from a silicone resin, a fluorine resin, a polypropylene resin, a polyethylene resin, an acrylic resin, an alkyd resin, a polyamide resin, a phenol resin, a stearic acid resin and a polyester resin (claim 18).

[0026] Further, the present invention provides the method of dry transfer printing according to any one of

claims 10 to 18, wherein the hydrophilic synthetic resin that softens or melts by heating is one or a mixture of two or more selected from a water-soluble polyester resin, a water-soluble urethane resin, a water-soluble urethane-modified ether resin, a water-soluble polyvinylalcohol-modified resin, a water-soluble acrylic acid-based resin and a water-soluble polyethylene oxide resin (claim 19).

[0027] Further, the present invention provides the method of dry transfer printing according to any one of claims 10 to 19, wherein the hydrophilic paste is one or a mixture of two or more selected from a natural gum paste (etherized tamarind gum, etherized locust bean gum, etherized guargum, acacia arabica gum, etc.), a cellulose derivative paste (etherized carboxymethyl cellulose, hydroxyethyl cellulose, etc.), a modified starch paste (etherized starch, esterized starch), a water-soluble synthetic paste (polyacrylic acid salt, polyvinylalcohol, etc.), and a seaweed paste (sodium alginate) (claim 20).

[0028] Further, the present invention provides the method of dry transfer printing according to any one of claims 10 to 20, wherein the synthetic fiber material is selected from a woven fabric, a knitted fabric or a non-woven cloth made from a synthetic fiber material or a semi-synthetic fiber material such as polyester, triacetate, diacetate, polyamide or polyacrylic, or a mixed spun fabric, a combined weave or a composite fabric of the synthetic fiber material or semi-synthetic fiber material containing a natural fiber material (claim 21).

Further, the present invention provides a synthetic fiber material subjected to a transfer printing under the dry transfer printing method according to claim 21 (claim 22).

[ADVANTAGEOUS EFFECT OF THE INVENTION]

[0029] The present invention provides various eminently beneficial effects from the viewpoint of cost, quality and ecological benefit, such as enabling quick delivery by the plateless printing and easy production of a sharp, high-density, high-quality and fast design, upgrading the texture of the synthetic fiber product obtained, eliminating the need to prepare surplus paste, and allowing utilization of existing general-purpose equipments. Also, the dry transfer printing method according to the present invention enables executing a small-lot production at a low cost, and yet obtaining a high-quality transfer-printed product. In particular, the present invention not only simplifies the printing technique which has so far been complicated thereby creating an advantage in the industrial production, but also provides a special effect that anybody can choose a favorite design and print the design clearly and fast on various synthetic fiber materials at any convenient place, and obtain excellent texture.

[0030] The present invention provides a dry transfer printing method for a synthetic fiber material that enables expressing a delicate printed design with high reproducibility, which has so far been considered to be quite difficult, and provides a novel technique established against many obstacles. For example, although two properties of the transfer paper, the preservation stability (the ink receiving layer is to be kept from being damaged or peeled off during the storage of the transfer paper) and the transfer performance to the cloth (transferring 100% of the ink receiving layer through the transfer process and cleanly releasing the paper from the cloth) are contradictory to each other, the technique according to the present invention harmonizes those contradictory properties, and besides allows directly printing on the uncolored transfer paper with an inkjet printer and utilizing the synthetic fiber material, the object of the transfer printing, without any pretreatment. Further, the present invention not only allows constructing an industrial manufacturing system capable of quickly and efficiently coping with the highly variety low-volume manufacturing and a wide variety of needs which have come to be an essential requirement, but also provides a high-quality and functional transfer paper with which people can easily enjoy printing at home, thus providing a method that is environment-friendly, economical and excellent in quality achievement (sharpness, fastness, texture, etc.), which greatly contributes to improvement in quality and added value of the printed fiber products.

[0031] The advantage of the present invention lies in providing the transfer paper that allows directly printing a design on the uncolored transfer paper with an inkjet printer, eliminating the need of the pretreatment of the cloth, industrially executing the dry transfer printing of the synthetic fiber by utilizing the equipments for dry transfer printing and steam fixing for the polyester fabric that are currently widely employed, and providing excellent printing performance with eminent texture, sharpness, and fastness, and in providing the dry transfer printing method that utilizes the transfer paper.

[BEST MODE FOR CARRYING OUT THE INVENTION]

[0032] The present invention provides, as already stated, a transfer paper employed for a dry transfer printing method comprising printing or applying a disperse dye ink on an uncolored transfer paper thereby forming the transfer paper, press-heating the transfer paper closely superposed on a synthetic fiber material thereby transferring the disperse dye ink to the synthetic fiber material, and performing a fixing process, wherein the uncolored transfer paper is provided with an organic solvent-soluble synthetic resin serving as a release agent layer, and a mixture of a hydrophilic synthetic resin, hydrophilic paste, and various auxiliaries that soften or melt by heating, serving as an ink receiving layer stacked over the release agent layer. In other words, the uncolored transfer paper is provided with the release agent layer composed of the organic solvent-soluble synthetic resin, and the ink receiving layer composed of the mixture of the hydrophilic synthetic resin, hydrophilic paste, and various auxiliaries that soften or melt by heating (such mixture may hereinafter be referred to as "ink receiving layer paste"), and

the ink receiving layer is stacked over the release agent layer (claim 1).

[0033] Thus, the transfer paper according to the present invention is formed through applying the ink receiving layer paste, which serves as the ink receiving layer, to a transfer base paper on which the organic solvent-soluble synthetic resin layer is formed as the release agent layer, drying to thereby form the uncolored transfer paper, and printing or applying the disperse dye ink on the uncolored transfer paper. Here, the amount of the ink receiving layer paste applied to the release agent is generally in a range of 15 g/m^2 to 80 g/m^2, and preferably 20 g/m^2 to 50 g/m^2. In the case where the amount is below 15 g/m^2 the transfer rate of the dye in the transfer process is prone to be insufficient. It is undesirable that the amount exceeds 80 g/m^2, because it takes longer for drying and productivity is lowered, and besides washing efficiency after the dye fixing process is degraded.

[0034] Features of the present invention include composing the ink receiving layer paste from various components and optimizing the mixing ratio thereof, so as to facilitate the disperse dye ink to be absorbed in the uncolored transfer paper and dried in the printing process of the disperse dye ink on the transfer paper, and to quickly fix and stabilize the design pattern without incurring blur, thus accomplishing the transfer paper that offers excellent transfer performance and peeling performance to the extent of achieving the transfer rate of generally 100%, and that also enables fast and delicate transfer with high reproducibility. In this process, an application condition that permits a large amount of hydrophilic paste to directly contact the release agent layer significantly degrades the transfer performance. The present inventors have discovered, as a solution of this issue, that the composition ratio of the hydrophilic synthetic resin and the hydrophilic paste in the ink receiving layer is the key, and that specifically it is preferable to employ the ink receiving layer paste containing 1 to 50 parts by weight of the hydrophilic paste, and more preferably 5 to 30 parts by weight, against 100 parts by weight of hydrophilic synthetic resin (claim 2).

[0035] Advantages of employing such ink receiving layer paste in the present invention include enabling executing the dry transfer printing process through forming the uncolored transfer paper simply by applying the ink receiving layer paste to the transfer base paper and drying, without the need of pretreatment on the synthetic fiber material to undergo the transfer printing, printing or applying the disperse dye ink on the uncolored transfer paper thereby forming the transfer paper, closely superposing the transfer paper on the synthetic fiber material, and performing the press-heating process and the fixing process, and thereby establishing a totally new transfer printing method that enables executing quick delivery by the plateless printing and easily producing a delicate and high-quality design, and that also achieves cost reduction and ecological compliance.

[0036] In particular, the present inventors have discovered, for the first time, that in the dry transfer printing method for the synthetic fiber material using the disperse dye ink according to the present invention it is critical that the ink receiving layer paste contains a pH adjuster, and that it is quite effective for achieving the object of the present invention (especially improvement of the transfer rate) to provide in the pH adjuster a so-called weak acid substance selected from substances composed of an organic acid alone, a salt of organic acid or a salt of inorganic acid, and which are intrinsically acid or can be acidified by heating (claim 3, claim 4), and have accomplished the present invention.

[0037] Specific examples of the weak acid substance selected from substances composed of an organic acid alone, a salt of organic acid or a salt of inorganic acid, and which are intrinsically acid or can be acidified by heating, include, in terms of the organic acid alone, aliphatic carboxylic acid such as aliphatic monocarboxylic acid (Cl-4 aliphatic monocarboxylic acid including formic acid, acetic acid, propionic acid, butyric acid, isobutyric acid, valeric acid, acrylic acid, and crotonic acid), halogenated aliphatic monocarboxylic acid (C1-4halogenated aliphatic monocarboxylic acid including monochloroacetic acid, dichloroacetic acid, trichloroacetic acid), aliphatic polyvalent carboxylic acid (aliphatic polyvalent carboxylic acid including malonic acid, succinic acid, adipic acid, maleic acid, especially C1-4 aliphatic polyvalent carboxylic acid), aliphatic hydroxy carboxylic acid (aliphatic hydroxy carboxylic acid including glycolic acid, lactic acid, glyceric acid, maleic acid, tartaric acid, citric acid, gluconic acid, especially Cl-4 aliphatic hydroxy carboxylic acid), alkoxy carboxylic acid (such as Cl-4 alkoxy carboxylic acid including methoxyacetic acid, ethoxyacetic acid), oxocarboxylic acid (such as Cl-4 oxocarboxylic acid including acetoacetic acid), further, alkyl sulfonic acid such as methane sulfonic acid or ethane sulfonic acid, aromatic sulfonic acid such as benzenesulfonic acid, xylenesulfonic acid, mesitylenesulfonic acid, sulfosalicylic acid, or P-toluene sulfonic acid, and aromatic carboxylic acid such as benzoic acid, cinnamic acid or salicylic acid.

Examples of the salt of organic acid or of inorganic acid include ammonium salts of organic acid such as oxalic acid, tartaric acid, maleic acid or citric acid, ammonium salts of inorganic acid such as hydrochloric acid, sulfuric acid, nitric acid or monobasic phosphate, and alkali metal salts of inorganic acid such as monobasic sodium phosphate, monobasic potassium phosphate or monobasic lithium phosphate. Among above, the ammonium salt of hydrochloric acid, sulfuric acid, or nitric acid is particularly preferably employed. A preferable amount of these weak acid substances to be added is generally 0.1 to 10%, and more preferably 0.3 to 5%, against the ink receiving layer paste.

[0038] The components to be predominantly contained in the ink receiving layer paste used in the present invention are the hydrophilic synthetic resin and the hydrophilic paste that soften or melt when subjected to pres-

sure or heat, to be easily peeled off from the release agent layer and transferred to the cloth, and can be easily washed off by water after the transfer and fixing process. It is desirable that the properties of the hydrophilic synthetic resin satisfy the following conditions.

[0039]

1. The resin can be uniformly adhered on the solvent type release agent layer, in other words can be uniformly applied without incurring repelling of water during the coating process.
2. The coated film is flexible and strong, so as to prevent a crack or peeling in a dynamic handling or storage of the transfer paper and the cloth.
3. Compatibility with the disperse dye is high, so as not to disturb fixation.
4. Drying is easy after the application, so as to prevent blocking (tack) and contact stain due to rubbing of the dye.
5. The resin softens or melts by the heat of the transfer process (in other words, the resin softens or melts at the heating temperature of the transfer process to be subsequently specified), and provides high transfer performance to the cloth and good peeling performance from the paper, under the heat and pressure.
6. Washing is easy after the dye fixing process, and the texture of the fiber is not degraded.
7. High compatibility with a surface tension reducer, which may be added for improving uniformity in adhesion to the release agent layer, and an anti-over-drying agent for resin, paste and the printing dye solution (necessary for adjusting water repelling performance, drying performance, viscosity stability and so on).

Employing the hydrophilic synthetic resin that satisfies these conditions allows achieving the object of the present invention.

Also, since the effect of the surface tension reducer differs depending on the type and mixing ratio of the chemicals and on the type of the water-soluble synthetic resin, it is desirable to confirm in advance an optimal combination.

[0040] It is preferable that the property of the hydrophilic paste satisfies the following conditions.

1. Compatibility with the hydrophilic synthetic resin is high.
2. Compatibility with the disperse dye is high, so as not to disturb fixation after the transfer.
3. The coated film is flexible and strong when dried, so as to prevent a crack or peeling in a dynamic handling of the transfer paper and the cloth.
4. The dye ink is quickly and uniformly absorbed and retained in the paste layer upon performing the ink-jet printing, and quickly dried so as to prevent a contact stain due to rubbing of the dye.
5. Easy peeling off from the release agent layer together with the hydrophilic synthetic resin through the heat-pressing process, for easy transfer to the cloth.
6. Easy removal by washing after the dye fixation process.

The hydrophilic paste basically does not soften or melt by the heat applied during the transfer process.

The hydrophilic paste is mixed for maintaining the sharpness of the design in the process of applying the disperse dye ink.

[0041] Further, it is preferable to add various auxiliaries to the ink receiving layer paste employed in the present invention, in addition to the hydrophilic synthetic resin and the hydrophilic paste. Examples of such auxiliaries to be added or mixed include, other than the pH adjuster, one or a combination of two or more selected from a surface tension reducer, a thickening agent, a moisture retainer, a foil transfer binder, a color depth agent, an antiseptic agent, an antifungal agent, an anti-static agent, a sequestering agent and a reduction inhibitor.

[0042] As the surface tension reducer, various types of aliphatic acids, alcohols, aldehydes, ethers, esters, amines, and tempels are effective. More specifically a nonion- and anion-based surfactant, methanol, ethanol, ethylether, triethanol amine, diethanol amine, acetone, chloroform, diethylhexyl sodium sulfosuccinate, polyether-modified polydimethylsiloxane can be cited as examples. Examples of commercial articles include Meisanol TR (anion-based surfactant: manufactured by Meisei Chemical Works, Ltd.), Ionet 300 (nonion-based surfactant: Sanyo Chemical Industries, Ltd.), and Plascoat RY-2 (fluorine-based 10% solution: manufactured by Goo Chemical Co., Ltd.), which are added in a ratio of 0.1 to 5% including the foregoing chemicals, against the ink receiving layer paste. These are effective for preventing a water repellent in the application process of the ink receiving layer paste.

[0043] Regarding the thickening agent, an acrylic -based synthetic paste is effective. Examples of the commercial articles include thickening agent - F (anion-based: manufactured by Sano Co. , Lid.), Hi-print LN-11R (anion-based: manufactured by Hayashi Chemical Industry Co., Ltd.), and Daishi-print ST (manufactured by Kyoto Seinori Co., Ltd.), which may be added in a ratio of 0.1 to 3% against the ink receiving layer paste.

Specific examples of the moisture-retaining agent include polyethylene glycol (MW200 to 600) and glycerin, which may be added in a ratio of 1 to 5% against the ink receiving layer paste.

[0044] Specific examples of the foil transfer binder include materials composed based on nylon powder, an acrylic-based resin and so on, which are effective for promoting the transfer of the hydrophilic synthetic resin.

[0045] Specific examples of the color depth agent include Mei-printer PE -11 (nonion-based active agent: manufactured by Meisei Chemical Works, Ltd.), IP Ther-

mos M-10A (polyvalent alcohol-based: manufactured by Ipposha Oil Industries Co., Ltd.), and Hi-acceler PE-71 (nonion-based active agent: manufactured by Senka Corporation), which are employed for further improving the dyeing rate.

[0046] Specific examples of the antiseptic agent and antifungal agent include Neo Shintol LB (antiseptic agent: manufactured by Shinto Fine Co., Ltd.), Neo Shintol TF-1 (antifungal agent: manufactured by Shinto Fine Co., Ltd.), Amolden FS-100 (antiseptic/antifungal agent of organic nitride sulfide compound: manufactured by Daiwa Chemical Industry Co., Ltd.), and Protectol N (parachloromethacresol-based antiseptic/antifungal agent: manufactured by Okamoto Senryo-ten), which are employed for maintaining the viscosity stability of the ink receiving layer paste (antiseptic agent), and preventing moulding on the applied ink receiving layer, during the storage period.

Specific examples of the reduction inhibitor include sodium chlorate and sodium metanitrobenzene sulfonate, which are employed for improving dyeing stability in the steaming process of the transfer cloth.

[0047] Examples of the transfer base paper employed in the present invention include a pulp paper made from a pulp such as a craft pulp or a ground pulp, or from recycled paper, the recycled paper, and a heat-resistant synthetic resin film such as a polyester film. From the viewpoint of work efficiency, it is preferable that the weight (grammage) is about 10 to 150 g/m^2, and the thickness is about 0.01 to 0.5 mm.

[0048] The release agent layer can be formed through dissolving the organic solvent-soluble synthetic resin, specifically the silicone resin, fluorine resin, polypropylene resin, polyethylene resin, acrylic resin, alkyd resin, polyamide resin, phenol resin, stearic acid resin, polyester resin or the like in the organic solvent such as ethyl acetate, toluene, xylene, methanol, ethanol, propyl alcohol or the like thus to form an organic solvent varnish, and applying the varnish to the foregoing transfer base paper and drying. It is preferable that the release agent layer is formed in a thickness of about 10 to 30 μm. As the transfer base paper, for example a commercially available polyethylene-laminated craft paper may be employed. Employing as the transfer base paper a film of the same composition as that of the release agent provides the advantage that the application of the release agent can be skipped and yet the transfer base paper can be utilized as it is as the transfer base paper with the release agent layer.

[0049] On the transfer base paper thus prepared the ink receiving layer is formed by applying thereto, in a thickness of about 10 to 60 μm, the ink receiving layer paste predominantly containing the hydrophilic synthetic resin that softens or melts by heating and the hydrophilic thickener, a type of hydrophilic paste, that does not impede the dyeing effect of the disperse dye on the fiber.

As specific examples of the hydrophilic synthetic resin, one or a combination of two or more selected from a water-soluble polyester resin (for example, Plascoat Z-850, Plascoat Z-221 and Plascoat Z-730, all manufactured by Goo Chemical Co., Ltd.), a water-soluble urethane resin, a water-soluble urethane-modified ether resin (for example, HA resin PE-1B: manufactured by Meisei Chemical Works, Lid.), a water-soluble polyvinyl alcohol-modified resin (for example, hot-melt resin, Exeval-based resin, HP polymer: manufactured by Kuraray Co., Ltd.), a water-soluble acrylic acid-based resin (for example, binder 812-A-1: manufactured by Sano Co., Ltd., and Acryset-based resin: manufactured by Nippon Shokubai Co., Ltd.), and a water-soluble polyethylene oxide resin (for example, Alkox E-30: manufactured by Meisei Chemical Works, Ltd.) can be mentioned.

As examples of the hydrophilic thickener, one or a combination of two or more selected from the hydrophilic paste including a natural gum paste (etherized tamarind gum, etherized locust bean gum, etherized guargum, acacia arabica gum, etc.), a cellulose derivative paste (etherized carboxymethyl cellulose, hydroxyethyl cellulose, etc.), a modified starch paste (etherized starch, esterized starch), a water-soluble synthetic paste (polyacrylic acid salt, polyvinylalcohol, etc.), and a seaweed paste (sodium alginate) can be mentioned.

To the hydrophilic paste, a mineral paste (specifically silica, diatomite, clay, talc, bentonite, acid clay and so on) may be added, for promoting the absorption of the dye ink into the ink receiving layer and improving the surface drying performance.

[0050] In the present invention, it is desirable to control the deposition amount of the ink receiving layer paste when applying the paste with a coating machine, because the thickness of the applied ink receiving layer affects the difficulty level of transfer performance to the cloth by the resin which softens or melts, as well as the removal efficiency by washing after the fixing process of the disperse dye.

Also, depending on the type of the hydrophilic synthetic resin, water may be repelled in the application process, resulting in insufficient uniformity in adhesion to the release agent. The water repelling condition differs depending on the type and solid content of the paste, and the type and added amount of the surface tension reducer (whether anion-based, nonion-based surfactant, or alcohol, etc.), and therefore it is preferable to adjust for individual cases according to the prescription. Also, to increase the viscosity of the ink receiving layer paste used in the coating process, the acrylic acid-based synthetic paste or the like may be optionally added, in a ratio of 0.5 to 3%.

[0051] As the disperse dye ink to be used for the transfer paper according to the present invention, a commercially available disperse dye ink may be employed as it is. Alternatively, a disperse dye ink prepared by the following process, according to JP-A No.H11-256084 and JP-A No.2003-246954, can be used.

1. A commercially available disperse dye powder or

liquid, or a color source such as a conc cake or press cake may be employed as the material.

2. The material is atomized and dispersed into a size of 1.0 μm to 0.1μm with a dispersing agent utilizing a sand mill or the like.

3. Then, filtering is conducted to remove a trace amount of impurities thereby obtaining the ink liquid.

4. To the ink liquid, a moisture retainer and anti-drying agent such as urea, polyethylene glycol, glycerin, diethylene glycol, or ethylene glycol, and also, if necessary, a surface tension adjuster, a defoaming/deairing agent, a viscosity adjuster, a pH adjuster, an antifungal agent and a sequestering agent are added and mixed.

5. Then, filtering is conducted to remove a trace amount of insoluble substance through a membrane filter of 1 to 2μm in pore diameter for prevention of nozzle clogging, followed by deairing.

[0052] More specifically, the following procedure may be taken to obtain the disperse dye ink. A mixture containing 15% of color component of C.I. Disperse Yellow 114, 15% of Demol C (formalin condensate of special aromatic sulfonic acid salt:

manufactured by Kao Corporation) to serve as the dispersing agent, and 70% of water is atomized by usual method utilizing zirconium beads of 0.3 mm in particle diameter, such that the dye particle diameter becomes 0.3μm. Then, water is added to 30% (% by weight, hereinafter the same unless otherwise noted) of dispersion solution from which the beads have been removed, 10% of glycerin, 2% of urea, and 2% of

polyether-modified polydimethylsiloxane (surface tension

adjuster) to make the total of 100%, and after adjusting pH to 7±0.5 the solution is filtered through a membrane filter of 1 μm, thus to obtain the disperse dye ink.

[0053] It is to be noted that, in the preparation method according to JP-A No.2005-264021 for example, the ink is intended for direct printing on the cloth, and hence the mixing ratio is slightly different from the case of the present invention focusing on printing on the uncolored transfer paper. Specifically, in the case of printing on the uncolored transfer paper the ink has to dry quickly. On the other hand, in the case of direct printing on the cloth, the ink intrudes inside the cloth (this may also incur blur). Therefore the ink may dry slowly and a large amount of water-soluble organic solvent such as ethylene glycol or glycerin is added.

[0054] Since the dry transfer printing method according to the present invention is not the sublimation transfer method, and hence the disperse dye does not have to be the sublimation type. On the contrary, the sublimation type disperse dye is not preferable because of low sublimation fastness. In other words, possibility of employing a high-fastness non-sublimation type disperse dye is one of the features of the present invention.

Accordingly, in the present invention, the non-sublimation type disperse dye, corresponding to B or C class or even lower of conventional dyes for the sublimation transfer printing, is preferably used.

[0055] Specific examples of the high-fastness non-sublimation type disperse dye preferably used in the present invention include C.I.Disperse Yellow 114(Kiwalon Polyester Yellow 6GF), C.I.Disperse Yellow 126 (Kiwalon Polyester Yellow 6GRF), C.I.Disperse Yellow 79(Kiwalon Polyester Yellow GLS), C.I.Disperse Yellow 163(Kiwalon Polyester Yellow BRF), C.I.Disperse Orange 73(Kiwalon Polyester Orange RF), C.I.Disperse Orange 62(Kiwalon Polyester Y.Brown RFL), C.I.Disperse Orange 30(Kiwalon Polyester Y.Brown 2RF), C.I.Disperse Orange 61(Kiwalon Polyester Y.Brown 3RF), C.I.Disperse Red 202(Foron Brill.Red S-RGL), C.I.Disperse Red 153(Kiwalon Polyester Scarlet D-GS), C.I.Disperse Red 152(Kiwalon Polyester Red D-BS), C.I.Disperse Red 167:1((Kiwalon Polyester Rubine 2GF), C.I.Disperse Red 145(Kiwalon Polyester Rubine D-3BF), C.I.Disperse Red 179(Kiwalon Polyester Rubine 2BF), C.I.Disperse Violet 77(Kiwalon Polyester Violet 4RF), C.I.Disperse Violet 63(Kiwalon Polyester Violet 3RF), C.I.Disperse Blue 257(Sumikaron Blue S-3RF), Kiwalon Polyester Blue KBSF, C.I.Disperse Blue 165(Kiwalon Polyester Blue 2BFL), C.I.Disperse Blue 165:1(Kiwalon Polyester Blue BGFL), C.I.Disperse Blue 73(Kiwalon Polyester Blue BGF), C.I.Dispersa Blue 149(Kiwalon Polyester Blue D-5G), C.I.Disperse Blue 60(Kiwalon Polyester T.Blue BG), Kiwalon Polyester T.Blue BG-LN, C.I.Disperse Blue 79(Kiwalon Polyester Navy 2GF), Kiwalon Polyester Navy R-80 Liquid, Kiwalon Polyester Black KGSF Liquid and Kiwalon Polyester Black T-62 Liquid.

The high-fastness non-sublimation type disperse dye refers to disperse dyes of such fastness that can be rated as class 3 or 4 or higher by gray scale rating of stain, with respect to stain made on PET white cloth through a sublimation fastness test (JIS L-0879, 1968), based on 1/1 depth according to Standard Color Depth (JIS L-0802).

[0056] Although the method performed by the ink-jet printer which is a high-tech equipment is mainly described here, in this specification, naturally, according to the present invention, the design or color can be applied to the uncolored transfer paper by any desired method such as machine printing, hand printing, hand drawing or gravure printing, upon adjusting the solvent, viscosity, or surface tension of the ink.

[0057] To the uncolored transfer paper obtained as above, in other words the uncolored transfer paper constituted of the transfer base paper (including the release agent layer) and the ink receiving layer, the disperse dye ink or the liquid thereof is printed or applied by inkjet printing or another method and then dried, so that the transfer paper is obtained. Then the transfer paper and

the synthetic fiber cloth are placed on each other, and press-heating is performed so as to transfer the design to the cloth. The heating temperature in this process is normally 100°C to 170°C, and preferably 110°C to 160°C. The pressure range is 1 to 5 kg/cm^2 and preferably 1.5 to 3 kg/cm^2. Thus, the method according to the present invention enables easily achieving the transfer rate of substantially 100%. That is, the ideal transfer rate of the dye from the transfer paper can be achieved.

[0058] Finally the dye fixing process is performed so as to fix the dye on the cloth, and washing (reduction clearing or soaping depending on the material) is performed to remove the hydrophilic synthetic resin and the hydrophilic paste utilized as the ink receiving layer, to thus obtain a printed cloth or printed product that offers excellent fiber texture.

[0059] To fix the disperse dye to the fiber after the transfer, the fixing conditions applied to the ordinary printing method using the disperse dye can be adopted as they are. However the present inventors have discovered that, in the dry transfer printing method using the disperse dye according to the present invention, a wet fixing process (steaming process) is especially effective in attaining high color strength and delicacy. Also, a preferable temperature range of the wet fixing process (steaming process) according to the present invention is 90 to 180°C.

[0060] More specifically, the wet fixing process (steaming process) according to the present invention may be arranged, for example, as a wet heating process at 100°C for 30 minutes in a normal-pressure steaming process, a wet heating process at 150 to 180°C for 5 to 10 minutes in a HT steaming process, and a wet heating process at 120 to 135°C for 20 to 40 minutes in a HP steaming process, thus to fix the dye to the fiber.

[0061] After the dye fixing process, the synthetic resin and paste used in the ink receiving layer and residual dye are removed by washing (reduction clearing or soaping depending on the material), so that a printed product of a clear design and excellent fiber texture can be obtained.

[0062] Examples of the synthetic fiber material applicable to the dry transfer printing method according to the present invention include woven fabrics, knitted fabrics, and nonwoven cloths solely made from a synthetic fiber material or a semi-synthetic fiber material such as polyester (for example, polyethylene terephthalate, polyalkylene terephthalate, polyester lactate), triacetate, diacetate, polyamide, polyacrylic, and a mixed spun fabric, a combined weave and a composite fabric of the synthetic fiber material or a semi-synthetic fiber material containing a natural fiber.

[0063] In this case, the cloth may be subjected to pretreatment with a chemical that contributes to upgrading the color yield of the dye or promotes the dyeing performance before the transfer process, if necessary. However the present invention provides a feature that the ink receiving layer is composed of a multitude of components in an optimized ratio, which allows omitting an unnecessary process such as the pretreatment of the cloth, and thereby enhancing competitiveness in cost.

[0064] The dry transfer printing method according to the present invention enables transferring substantially 100% of the ink receiving layer applied to the transfer base paper, and therefore the paper left after the transfer can be recycled as the transfer base paper. Also, since a far less amount of hydrophilic paste is remained compared with the conventional printing process, the method according to the present invention can be called an ecology-oriented and environment-friendly process, in combination with the reduced effluent load of the washing waste water of the cloth for the transfer.

[0065] The present inventors have perseveringly continued the research and experiments, to finally discover the solution of numerous difficult issues including the transfer performance, transfer paper stability, sharpness of the printed design, fixation performance, washing performance, the texture of the fiber and fastness, through sorting out the composition balance of multiple components based on the selection and optimization of various chemicals to be added to the composition of the ink-receiving layer forming paste, resulting in successfully establishing the transfer printing method that can employ the fast disperse dye of the non-sublimation type and that can omit the pre-treatment of the cloth. This method is a highly practical, peerless novel technique unknown so far which is not only industrially advantageous, but also applicable to home use.

[0066] Hereunder, the present invention will be described in further details with examples. However it should be understood that the present invention is not limited to these examples. All the percentage values in the examples represent the weight percentage.

Example 1

[0067] An organic solvent varnish (phenol resin 30%, ethylcellulose 3%, calcium carbonate 10%, clay 10%, ethylacetate 47%) was applied to a transfer pulp paper (weight 90 g/m^2, thickness 0.2 mm) with a coating machine and cured at 140°C for three minutes after drying, to thereby form the release agent layer. The thickness of the release agent layer was 30 μm.

[0068] Then an ink receiving layer paste, composed of 60% of Plascoat Z-850 (25% dispersion of water-soluble polyester resin: manufactured by Goo Chemical Co., Ltd.), 10% of FD algin BL (low-viscosity sodium alginate: manufactured by Furukawa Chemical Industry Co., Ltd.) in 10% paste, 20% of Solvitose C-5 (etherized starch: manufactured by Avebe U.A.) in 10% paste, 1% of thickening agent - F (acrylic-based synthetic paste: manufactured by Sano Co., Ltd.), 0.5% of ammonium sulfate, 0.5% of sodium chlorate, 0.2% of sodium hexametaphosphate, 0.1% of Neo Shintol LB (antiseptic agent: manufactured by Shinto Fine Co., Ltd.), 0.1% of Neo Shintol TF-1 (antifungal agent: manufactured by Shinto Fine Co.,

Ltd.), 1.5% of Meisanol TR (anion-based active agent: manufactured by Meisei Chemical Works, Lad.), and water that makes the total of 100%, was applied with a coating machine and dried, to thereby form the ink receiving layer. The amount of the ink receiving layer paste applied was 30 g/m^2. Thus, the dry uncolored transfer paper for the disperse dye was obtained.

[0069] A disperse dye ink liquid (containing C.I. Disperse Blue 257, color component 5%, ethylene glycol 2%, glycerin 10%, Demol C 5%, surface tension adjuster 2%, urea 3%, and water 73%) was printed in a design on the uncolored transfer paper made up as above, with an inkjet printer (on-demand piezo inkjet printer HYPER ECO: manufactured by Mutoh Industries, Ltd.) and dried, to thereby obtain the transfer paper for dry transfer printing with the disperse dye. The disperse dye used here is of a non-sublimation type corresponding to sublimation fastness class 4 to 5 according to JIS L-0802 (Standard Color Depth 1/1) by high-temperature dyeing (the same applies hereinafter).

[0070] Then the transfer paper was superposed over a polyester cloth, and the design was transferred to the polyester cloth by press-heating (130°C, 5 seconds, 2 kg/cm^2). The dye transfer rate from the transfer paper to the cloth was 100%. The polyester cloth was then subjected to the HT steam fixing process (170°C, 10 minutes), rinse and reduction clearing (80"C, 10 minutes: solution containing 38° Be caustic soda 2 g, hydrosulfite conc. 2g, and nonion-based active agent 1 g/L) and rinse and drying, followed by heat setting (160°C, 2 minutes) for adjusting the size. The transferred cloth thus obtained exhibited a delicate and clear design and soft texture, and also achieved sufficient fastness against sublimation, washing and perspiration to be accepted in the actual market. Also, addition of 15% of foil transfer binder predominantly composed of nylon powder to the ink receiving layer paste according to this example resulted in reduction of the transfer time to approx. 1/4.

Example 2

[0071] After forming a release agent layer on a transfer pulp paper (weight 90g/m^2, thickness 0.2mm) with the organic solvent varnish prepared in the example 1 and in the same process as the example 1, an ink receiving layer paste composed of 55% of HA resin PE-1B (25% viscous solution of water-soluble urethane-modified ether resin: manufactured by Meisei Chemical Works, Ltd.), 10% of clay powder (particle diameter 0.6 μm), 25% of Meiprogum NP-5-D (hydrolysate of guargum: manufactured by Sansho Co., Ltd.) in 10% paste, 1% of ammonium chloride, 2% of Resister L (metanitrobenzene sulfonic acid-based reduction inhibitor: manufactured by Senka Corporation), 0.3% of Tetoron 210(2-sodium salt of EDTA: manufactured by Meisei Chemical Works, Ltd.), 0.1% of Neo Shintol LB (antiseptic agent: manufactured by Shinto Fine Co., Ltd.), 1% of Plascoat RY-2(fluorine-based 10% solution: manufactured by Goo Chemical Co., Lid.), and water that makes the total of 100% was applied with the coating machine and dried, to thereby form the ink receiving layer. The amount of the ink receiving layer paste applied was 38 g/m^2. Thus, the dry uncolored transfer paper for the disperse dye was obtained.

[0072] A disperse dye ink liquid (containing C.I. Disperse Red 202, color component 7%, ethylene glycol 5%, glycerin 5%, Demol C 7%, surface tension adjuster 2%, urea 2%, and water 72%) was printed in a design on the uncolored transfer paper made up as above, with the inkjet printer (on-demand piezo inkjet printer HYPER ECO: manufactured by Mutoh Industries, Ltd.) and dried, to thereby obtain the transfer paper for dry transfer printing with the disperse dye. The sublimation fastness of the disperse dye used here corresponds to class 5 of the non-sublimation type.

[0073] Then the transfer paper was superposed over a polyester cloth, and the design was transferred to the polyester cloth by press-heating (130° C, 5 seconds, 2 kg/cm^2). The dye transfer rate from the transfer paper to the cloth was 100%. The polyester cloth was then subjected to the HT steam fixing process (130° C, 30 minutes), rinse and reduction clearing (80° C, 10 minutes: solution containing 38° Be caustic soda 2 g, Super-Reduc 16, a reductant manufactured by Senka Corporation, 4g, and nonion-based active agent 1 g/L) and rinse and drying, followed by heat setting (170°C, 20 seconds) for adjusting the size. The transferred cloth thus obtained exhibited a delicate design beyond a usual image of a printed cloth as that obtained in the example 1, as well as high uniformity in dyeing effect and moderate extent of penetration, with soft fiber texture and excellent fastness against light, sublimation, washing, perspiration, etc.

[0074] According to the same manner as this example, upon printing a design using the disperse dye ink composed of non-sublimation type three primary colors of yellow, red, and blue, for example C.I. Disperse Yellow 114 (Kiwalon Polyester Yellow 6GF), C.I. Disperse Red 202 (Foron Brill, Red S-RGL) and C.I. Disperse Blue 257 (Sumikaron Blue S-3RF) and also black (Kiwalon Polyester Black KGSF Liquid) with the foregoing inkjet printer, the design and the tones drawn on a personal computer were accurately and precisely expressed in full-color on the cloth subjected to the transfer and fixation, and also high reproducibility of the processing was achieved.

Example 3

[0075] To a craft paper with a polyethylene release agent applied thereto (weight 75g/m^2: manufactured by Mitsubishi Paper Mills Ltd.), an ink receiving layer paste composed of 10% of Alkox E-30 (polyethylene oxide-based water-soluble resin powder: manufactured by Meisei Chemical Works, Ltd.), 5% of binder TGF-218 (foil binder paste containing nylon powder: manufactured by Matsui Shikiso Chemical Co., Ltd.), 25% of Kiprogum PL-V (tamarind-based gum: manufactured by Nippon Starch

Chemical Co., Ltd.) in 10% paste, 1% of silicon dioxide powder, 0.5% of ammonium sulfate, 2% of MS powder (metanitrobenzene sulfonic acid-based reduction inhibitor: manufactured by Meisei Chemical Works, Ltd.), 0.3% of sodium hexametaphosphate, 0.1% of Neo Shintol LB (antiseptic agent: manufactured by Shinto Fine Co., Ltd.), 0.1% of Neo Shintol TF-1 (antifungal agent: manufactured by Shinto Fine Co. , Ltd.), 1.5% of Plascoat RY-2 (fluorine-based surface tension reducer 10% solution: manufactured by Goo Chemical Co., Ltd.), and water that makes the total of 100% was applied with the coating machine and dried, to thereby form the ink receiving layer. The amount of the ink receiving layer paste applied was 30 g/m^2. Thus, the dry uncolored transfer paper for the disperse dye was obtained.

[0076] A disperse dye ink liquid (containing C.I. Disperse Blue 257, color component 6%, diethylene glycol 2%, glycerin 8%, Demol C 6%, surface tension adjuster 2%, urea 2%, and water 74%) was printed in a design on the uncolored transfer paper made up as above, with the inkjet printer (on-demand piezo inkjet printer HYPER ECO: manufactured by Mutoh Industries, Ltd.) and dried, to thereby obtain the dry transfer paper for the disperse dye. Then the transfer paper was superposed over a polyester cloth, and the design was transferred to the polyester cloth by press-heating (140° C, 3 seconds, 2 kg/cm^2). The dye transfer rate from the transfer paper to the cloth was 100%.

[0077] The polyester cloth was then subjected to the HT steam fixing process (130°C, 30 minutes), rinse and reduction clearing (80°C, 10 minutes: solution containing 38° Be caustic soda 1 g, hydrosulfite conc. 1g, and nonion-based active agent 1 g/L) and rinse and drying, followed by heat setting (160°C, 90 seconds) for adjusting the size. The transferred cloth thus obtained exhibited clear and deep tones and a delicate design with soft texture, and thus proved to be of high quality.

Example 4

[0078] After forming a release agent layer on a transfer pulp paper (weight 90g/m^2, thickness 0.2mm) with the organic solvent varnish used in the example 1 and in the same process as the example 1, an ink receiving layer paste composed of 60% of Plascoat Z-221 (20% dispersion of water-soluble polyester resin: manufactured by Goo Chemical Co., Ltd.), 6% of Sunprint TME (hydrolysate of guargum: manufactured by Sansho Co. , Ltd.), 1% of ammonium chloride, 0.5% of sodium chlorate, 0.2% of sodium hexametaphosphate, 0.2% of FAS-300 (antiseptic agent: manufactured by Sano Co. , Ltd.), 1% of Meisanol TR (anion-based active agent: manufactured by Meisei Chemical Works, Ltd.), and water that makes the total of 100% was applied with the coating machine and dried. The amount of the ink receiving layer paste applied was 30 g/m^2. Thus, the dry uncolored transfer paper for the disperse dye was obtained.

[0079] Then a commercially obtained product (Kiwa JET-E Textile Magenta manufactured by Kiwa Chemical Industry Co., Ltd.) was employed as the disperse dye ink, and a design was printed on the uncolored transfer paper made up as above, with the inkjet printer (Epson PM-770C) and dried, to thereby obtain the dry transfer paper for the disperse dye. The transfer paper was then superposed over a polyester cloth, and the design was transferred to the polyester cloth by press-heating (130°C, 5 seconds, 2 kg/cm^2). The dye transfer rate from the transfer paper to the cloth was 100%.

[0080] The polyester cloth was then subjected to the HT steam fixing process (170°C, 8 minutes), rinse and soaping (80°C, 5 minutes: solution containing anion-based active agent 1 g/L and soda-ash 3 g/L), followed by rinse, to thereby obtain a transferred polyester cloth. The transferred polyester cloth thus obtained exhibited clear and deep tones and a delicate design with soft texture.

Example 5

[0081] To a craft paper with a polyethylene release agent applied thereto (weight 75g/m^2: manufactured by Mitsubishi Paper Mills Ltd.), an ink receiving layer paste composed of 30% of Plascoat Z-730 (water-soluble polyester resin 25% dispersion: manufactured by Goo Chemical Co., Ltd.), 30% of HA resin PE-1B (25% viscous solution of water-soluble urethane-modified ether resin: manufactured by Meisei Chemical Works, Ltd.), 15% of Serubesugamu 4450 (etherized CMC: manufactured by Daicel Chemical Industries, Ltd.) in 7% paste, 15% of Fujihekku BL-15 (hydroxyethyl cellulose: manufactured by Fuji Chemical Co., Ltd.) in 10% paste, 0.5% of ammonium sulfate, 0.5% of sodium chlorate, 0.2% of sodium hexametaphosphate, 0.1% of Neo Shintol LB (antiseptic agent: manufactured by Shinto Fine Co., Ltd.), 0.1% of Neo Shintol TF-1 (antifungal agent: manufactured by Shinto Fine Co. , Ltd.), 1.5% of Meisanol TR (anion-based active agent: manufactured by Meisei Chemical Works, Lid.), and water that makes the total of 100% was applied with the coating machine and dried, to thereby form the ink receiving layer. The amount of the ink receiving layer paste applied was 25 g/m^2. Thus, the dry uncolored transfer paper for the disperse dye was obtained.

[0082] Then a disperse dye ink liquid (containing C.I. Disperse Yellow 114, color component 8%, ethylene glycol 3%, glycerin 8%, Demol C 7%, surface tension adjuster 2%, urea 2%, and water 70%) was printed in a design on the uncolored transfer paper made up as above, with the inkjet printer (on-demand piezo inkjet printer HYPER ECO: manufactured by Mutoh Industries, Ltd.) and dried, to thereby obtain the dry transfer paper for the disperse dye. The sublimation fastness of the disperse dye employed here corresponds to class 5 of the non-sublimation type. The transfer paper was then superposed over a polyester/triacetate (70/30) composite cloth, and the design was transferred to the composite

cloth by press-heating (140° C, 3 seconds, 2 kg/cm^2). The dye transfer rate from the transfer paper to the cloth was 100%.

[0083] The composite cloth was then subjected to the HT steam fixing process (170°C, 10 minutes), rinse and reduction clearing (80°C, 10 minutes: solution containing soda-ash 2 g, hydrosulfite conc. 1g, and nonion-based active agent 1 g/L) and rinse and drying, followed by heat setting (160°C, 2 minutes) for adjusting the size. The transferred composite cloth thus obtained exhibited clear and deep tones and a delicate design with soft texture.

Example 6

[0084] After forming a release agent layer on a transfer pulp paper (weight 90g/m^2, thickness 0.2mm) with the organic solvent varnish used in the example 1 and in the same process as the example 1, an ink receiving layer paste composed of 55% of Plascoat Z-850 (25% dispersion of water-soluble polyester resin: manufactured by Goo Chemical Co., Ltd.), 15% of HAS binder TG-30 (tamarind gum: manufactured by Shikibo Ltd.) in 10% paste, 10% of Solvitose C-5 (etherized starch: manufactured by Avebe U.A.) in 10% paste, 1% of ammonium chloride, 2% of MS powder (metanitrobenzene sulfonic acid-based reduction inhibitor: manufactured by Meisei Chemical Works, Lid.), 0.2% of sodium hexametaphosphate, 0.1% of Neo Shintol LB (antiseptic agent: manufactured by Shinto Fine Co. , Lid.), 1% of Neo Shintol TF-1 (antifungal agent: manufactured by Shinto Fine Co., Ltd.), 1% of Plascoat RY-2 (fluorine-based surface tension reducer 10% solution: manufactured by Goo Chemical Co., Ltd.), and water that makes the total of 100% was applied with the coating machine and dried, to thereby form the ink receiving layer. The amount of the ink receiving layer paste applied was 35 g/m^2. Thus, the dry uncolored transfer paper for the disperse dye was obtained.

[0085] Then the disperse dye ink employed in the example 2 was printed in a design on the uncolored transfer paper made up as above, with the inkjet printer (on-demand piezo inkjet printer HYPER ECO: manufactured by Mutoh Industries, Ltd.) and dried, to thereby obtain the dry transfer paper for the disperse dye. The transfer paper was then superposed over a polyester cloth, and the design was transferred to the polyester cloth by press-heating (140°C, 4 seconds, 2 kg/cm^2). The dye transfer rate from the transfer paper to the cloth was 100%.

[0086] The polyester cloth was then subjected to the HT steam fixing process (175°C, 8 minutes), rinse and reduction clearing (80°C, 10 minutes: solution containing 38° Be caustic soda 2 g, hydrosulfite conc. 2g, and nonion-based active agent 1 g/L) and rinse and drying, followed by heat setting (1160°C, 2 minutes) for adjusting the size. The transferred cloth thus obtained exhibited clear and deep tones and a delicate design with soft texture.

Example 7

[0087] To a craft paper with a polyethylene release agent applied thereto (weight 75g/m^2: manufactured by Mitsubishi Paper Mills Ltd.), an ink receiving layer paste composed of 40% of Plascoat Z-730 (25% dispersion of water-soluble polyester resin: manufactured by Goo Chemical Co., Ltd.), 20% of Binder 812-A-1(50% dispersion of water-soluble acrylic acid-based resin: manufactured by Sano Co. , Ltd.), 15% of Serubesugamu 4450 (etherized CMC: manufactured by Daicel Chemical Industries, Ltd.) in 7% paste, 15% of Fujihekku BL-15 (hydroxyethyl cellulose: manufactured by Fuji Chemical Co. , Ltd.) in 10% paste, 0.5% of ammonium sulfate, 0.5% of sodium chlorate, 0.2% of sodium hexametaphosphate, 0.1% of Neo Shintol LB (antiseptic agent: manufactured by Shinto Fine Co., Ltd.), 0.1% of Neo Shintol TF-1 (antifungal agent: manufactured by Shinto Fine Co., Ltd.), 1.5% of Meisanol TR (anion-based active agent: manufactured by Meisei Chemical Works, Ltd.), and water that makes the total of 100% was applied with the coating machine and dried, to thereby form the ink receiving layer. The amount of the ink receiving layer paste applied was 35 g/m^2. Thus, the dry uncolored transfer paper for the disperse dye was obtained.

[0088] Then a disperse dye ink liquid (containing C.I. Disperse Yellow 114, color component 8%, ethylene glycol 3%, glycerin 8%, Demol C 7%, surface tension adjuster 2%, urea 2%, and water 70%) was printed in a design on the uncolored transfer paper made up as above, with the inkjet printer (on-demand piezo inkjet printer HYPER ECO: manufactured by Mutoh Industries, Ltd.) and dried, to thereby obtain the dry transfer paper for the disperse dye. The sublimation fastness of the disperse dye employed here corresponds to class 5 of the non-sublimation type. The transfer paper was then superposed over a polyester/triacetate (70/30) composite cloth, and the design was transferred to the composite cloth by press-heating (140°C, 3 seconds, 2 kg/cm^2). The dye transfer rate from the transfer paper to the cloth was 100%.

[0089] The composite cloth was then subjected to the HT steam fixing process (170°C, 10 minutes), rinse and reduction clearing (80°C, 10 minutes: solution containing soda-ash 2 g, hydrosulfite conc. 1g, and nonion-based active agent 1 g/L) and rinse and drying, followed by heat setting (160°C, 2 minutes) for adjusting the size. The transferred composite cloth thus obtained clear and deep tones and a delicate design with soft texture.

Claims

1. A transfer paper for dry transfer printing made by printing or applying a disperse dye ink on an uncolored transfer paper,
   wherein the uncolored transfer paper comprises a release agent layer composed of an organic solvent-

soluble synthetic resin, and an ink receiving layer composed of a mixture of a hydrophilic synthetic resin, hydrophilic paste, and various auxiliaries that soften or melt by heating, and the ink receiving layer is stacked over the release agent layer.

2. The transfer paper for dry transfer printing according to claim 1, wherein a mixing ratio of the hydrophilic synthetic resin and the hydrophilic paste contained in the ink receiving layer is in a range of 1 to 50 parts by weight of hydrophilic paste against 100 parts by weight of hydrophilic synthetic resin.

3. The transfer paper for dry transfer printing according to claim 1 or 2, wherein the auxiliary serves as a pH adjuster.

4. The transfer paper for dry transfer printing according to claim 3, wherein the pH adjuster is selected from substances composed of an organic acid alone, a salt of organic acid or a salt of inorganic acid, and which are intrinsically acid or can be acidified by heating.

5. The transfer paper for dry transfer printing according to any one of claims 1 to 4, wherein the disperse dye ink is a non-sublimation type disperse dye ink.

6. The transfer paper for dry transfer printing according to any one of claims 1 to 5, wherein the auxiliary is one or a mixture of two or more selected from a pH adjuster, a surface tension reducer, a thickening agent, a moisture retainer, a foil transfer binder, a color depth agent, an antiseptic agent, an antifungal agent, an anti-static agent, a sequestering agent and a reduction inhibitor.

7. The transfer paper for dry transfer printing according to any one of claims 1 to 6, wherein the organic solvent-soluble synthetic resin used for the release agent layer is one or a mixture of two or more selected from a silicone resin, a fluorine resin, a polypropylene resin, a polyethylene resin, an acrylic resin, an alkyd resin, a polyamide resin, a phenol resin, a stearic acid resin and a polyester resin.

8. The transfer paper for dry transfer printing according to any one of claims 1 to 7, wherein the hydrophilic synthetic resin that softens or melts by heating is one or a mixture of two or more selected from a water-soluble polyester resin, a water-soluble urethane resin, a water-soluble urethane-modified ether resin, a water-soluble polyvinylalcohol-modified resin, a water-soluble acrylic acid-based resin and a water-soluble polyethylene oxide resin.

9. The transfer paper for dry transfer printing according to any one of claims 1 to 8, wherein the hydrophilic paste is one or a mixture of two or more selected from a natural gum paste (etherized tamarind gum, etherized locust bean gum, etherized guargum, acacia arabica gum, etc.), a cellulose derivative paste (etherized carboxymethyl cellulose, hydroxyethyl cellulose, etc.), a modified starch paste (etherized starch, esterized starch), a water-soluble synthetic paste (polyacrylic acid salt, polyvinylalcohol, etc.), and a seaweed paste (sodium alginate).

10. A method of dry transfer printing, comprising printing or applying a disperse dye ink on an uncolored transfer paper thereby forming a transfer paper; press-heating the transfer paper closely superposed on a synthetic fiber material thereby transferring the disperse dye ink to the synthetic fiber material; and performing a fixing process;
wherein the uncolored transfer paper comprises a release agent layer composed of an organic solvent-soluble synthetic resin and an ink receiving layer, that soften or melt by heating, composed of a mixture of a hydrophilic synthetic resin, hydrophilic paste, and various auxiliaries, and the ink receiving layer is stacked over the release agent layer.

11. The method of dry transfer printing according to claim 10, wherein a mixing ratio of the hydrophilic synthetic resin and the hydrophilic paste contained in the ink receiving layer is in a range of 1 to 50 parts by weight of hydrophilic paste against 100 parts by weight of hydrophilic synthetic resin.

12. The method of dry transfer printing according to claim 10 or 11, wherein the auxiliary serves as a pH adjuster.

13. The method of dry transfer printing according to claim 12, wherein the pH adjuster is selected from substances composed of substances composed of an organic acid alone, a salt of organic acid or a salt of inorganic acid, and which are intrinsically acid or can be acidified by heating.

14. The method of dry transfer printing according to any one of claims 10 to 13, wherein the disperse dye ink is a non-sublimation type disperse dye ink.

15. The method of dry transfer printing according to any one of claims 10 to 14, wherein the fixing process is a wet fixing process (steaming process).

16. The method of dry transfer printing according to claim 15, wherein the temperature of the wet fixing process (steaming process) is set in a range of 90 to 180°.

17. The method of dry transfer printing according to any one of claims 10 to 16, wherein the auxiliary is one

or a mixture of two or more selected from a pH adjuster, a surface tension reducer, a thickening agent, a moisture retainer, a foil transfer binder, a color depth agent, an antiseptic agent, an anti-static agent, a sequestering agent and a reduction inhibitor.

18. The method of dry transfer printing according to any one of claims 10 to 17, wherein the organic solvent-soluble synthetic resin used for the release agent layer is one or a mixture of two or more selected from a silicone resin, a fluorine resin, a polypropylene resin, a polyethylene resin, an acrylic resin, an alkyd resin, a polyamide resin, a phenol resin, a stearic acid resin and a polyester resin.

19. The method of dry transfer printing according to any one of claims 10 to 18, wherein the hydrophilic synthetic resin that softens or melts by heating is one or a mixture of two or more selected from a water-soluble polyester resin, a water-soluble urethane resin, a water-soluble urethane-modified ether resin, a water-soluble polyvinylalcohol-modified resin, a water-soluble acrylic acid-based resin and a water-soluble polyethylene oxide resin.

20. The method of dry transfer printing according to any one of claims 10 to 19, wherein the hydrophilic paste is one or a mixture of two or more selected from a natural gum paste (etherized tamarind gum, etherized locust bean gum, etherized guargum, acacia arabica gum, etc.), a cellulose derivative paste (etherized carboxymethyl cellulose, hydroxyethyl cellulose, etc.), a modified starch paste (etherized starch, esterized starch), a water-soluble synthetic paste (polyacrylic acid salt, polyvinylalcohol, etc.), and a seaweed paste (sodium alginate).

21. The method of dry transfer printing according to any one of claims 10 to 20, wherein the synthetic fiber material is selected from a woven fabric, a knitted fabric or a nonwoven cloth made from a synthetic fiber material or a semi-synthetic fiber material such as polyester, triacetate, diacetate, polyamide or polyacrylic, or a mixed spun fabric, a combined weave or a composite fabric of the synthetic fiber material or semi-synthetic fiber material containing a natural fiber material.

22. A synthetic fiber material subjected to a transfer printing under the dry transfer printing method according to claim 21.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2008/055919

A. CLASSIFICATION OF SUBJECT MATTER
D06P5/00(2006.01)i, *B32B27/00*(2006.01)i, *B41J2/01*(2006.01)i, *B41M5/00*(2006.01)i, *B41M5/50*(2006.01)i, *B41M5/52*(2006.01)i, *B44C1/17*(2006.01)i, *D06P1/16*(2006.01)i, *D21H27/00*(2006.01)i
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
D06P5/00, B32B27/00, B41J2/01, B41M5/00, B41M5/50, B41M5/52, B44C1/17, D06P1/16, D21H27/00

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	1996-2008
Kokai Jitsuyo Shinan Koho	1971-2008	Toroku Jitsuyo Shinan Koho	1994-2008

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.
A	JP 2006-207101 A (Art Inc.), 10 August, 2006 (10.08.06), (Family: none)	1-22
A	JP 43-14865 B1 (Fukui Seiren Kako Kabushiki Kaisha), 22 June, 1968 (22.06.68), & CA 859017 A	1-22
A	JP 6-270596 A (Kanebo, Ltd.), 27 September, 1994 (27.09.94), (Family: none)	1-22
A	JP 8-100380 A (Canon Inc.), 16 April, 1996 (16.04.96), (Family: none)	1-22

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

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"&" document member of the same patent family

Date of the actual completion of the international search 09 May, 2008 (09.05.08)	Date of mailing of the international search report 27 May, 2008 (27.05.08)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2008/055919

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 53-126377 A (Toppan Printing Co., Ltd.), 04 November, 1978 (04.11.78), (Family: none)	1-22
P,A	WO 2007/111302 A1 (Art Inc.), 04 October, 2007 (04.10.07), (Family: none)	1-22

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2005264021 A **[0004] [0011] [0053]**
- JP H0536545 B **[0004] [0011]**
- JP 2004176203 A **[0005] [0011]**
- JP S4314865 B **[0011]**
- JP H06270596 A **[0011]**
- JP 2006207101 A **[0011]**
- JP H11256084 A **[0051]**
- JP 2003246954 A **[0051]**