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(54) **Thermal transfer recording medium**

(57) A thermal transfer recording medium has a release layer mainly formed of waxes on a base material, an ink layer containing a colouring material, and a transparent adhesive layer on the base material in this order. A polyester resin having a glass transition temperature (Tg) of 70°C to 80°C, is used as the binder resin of the adhesive layer, which prevents the ink being set off during preservation, and confers excellent heat sensitivity and a satisfactory abrasion resistance.

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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a thermal transfer recording medium used for a thermal transfer printer which adopts a heating means such as a thermal-head or a laser. Particularly, the present invention relates to the thermal transfer recording medium having an excellent fixing property to an image receiving sheet and a high performance concerning a transfer performance such as heat sensitivity.

[0002] There have been known heat fusion type transfer methods. On the heat fusion type transfer methods, a thermal transfer sheet is used for transferring a coloring material with a binder on an image receiving sheet such as papers or plastic sheets, by means of applying energy in accordance with an image-information, through a heating device such as a thermal-head. The thermal transfer sheet has a coloring material layer that is obtained by dispersing the coloring material such as pigments or dyes in the binder such as heat-melting waxes and resins, on a base material sheet such as plastic films.

[0003] Generally, there are many cases such that a transferred image through using the heat fusion type transfer methods has inferior a heat sensitivity when an abrasion resistance thereof is excellent, and the heat sensitivity thereof is excellent when the abrasion resistance thereof is inferior. One cause of these problems is, generally speaking, to improve the abrasion resistance through use of a binder resin having high molecular weight and high temperature of a glass-transition temperature (Tg) for the coloring material layer.

[0004] Further, since a coloring pigment such as carbon black is added to the coloring material layer, the heat sensitivity and the abrasion resistance increasingly become inferior. Therefore, the binder resin having excessive high molecular weight and excessive high temperature of a glass-transition temperature (Tg) has to use for the coloring material layer.

[0005] As stated above, in the thermal transfer recording medium used for the heat fusion type transfer methods, the abrasion resistance of a transferred image is excellent, and transferring the coloring material layer during heating for printing, is conducted sensitively by heating. That is, there is a problem that a thermal transfer recording medium having an excellent heat sensitivity and a satisfied property do not existed.

SUMMARY OF THE INVENTION

[0006] The present invention has been solved the above mentioned problem. An object of the present invention is to provide a thermal transfer recording medium having an excellent abrasion resistance and a superior heat sensitive property, and manufactured easily.

[0007] This object can be achieved according to the present invention by providing a thermal transfer recording medium comprising a release layer mainly formed of waxes and laminated on a base material, an ink layer containing a coloring material, and a transparent adhesive layer, wherein these layers are laminated in this order and the adhesive layer is formed of polyester resin having a glass transition temperature(Tg) of 70 to 80°C as a binder resin.

[0008] In the above mentioned thermal transfer recording medium, it is preferable that a number average molecular weight of the polyester resin is within the range of 2000 to 8000.

[0009] Further, in the thermal transfer recording medium according to the present invention, an amount of a coating of the adhesive layer is within the range of 0.1 g/m^2 to 0.5 g/m^2.

[0010] The action of the present invention will be explain as follows.

[0011] The thermal transfer recording medium according to the present invention, comprises a release layer mainly formed of waxes and laminating on a base material, an ink layer containing a coloring material, and a transparent adhesive layer. These layers are laminated in this order. And the adhesive layer is formed of polyester resin having a glass transition temperature(Tg) of 70 to 80°C as a binder resin.

[0012] When the polyester resin having a glass transition temperature (Tg) of less than 70°C, is used as the binder resin of the adhesive layer, there occurs a phenomenon such that an ink is set off to the back surface of the thermal transfer recording medium (blocking) during preserving the thermal transfer recording medium. The other hand, when polyester resin having a glass transition temperature (Tg) of more than 80°C, is used as the binder resin, a fixation is insufficient and the heat sensitivity is inferior.

[0013] However, in the present invention, since polyester resin having a glass transition temperature (Tg) of 70 to 80°C, is used as the binder resin of the adhesive layer, there can be obtained the thermal transfer recording medium which can prevent the phenomenon such that an ink is set off during preservation, and which has an excellent heat sensitivity and abrasion resistance.

[0014] As mentioned above, the thermal transfer recording medium according to the present invention, comprises a release layer mainly formed of waxes and laminated on a base material, an ink layer containing a coloring material, and a transparent adhesive layer. These layers are laminated in this order. And the adhesive layer is formed of polyester resin having a glass transition temperature (Tg) of 70 to 80°C as a binder resin. Accordingly, there can be obtained the thermal transfer recording medium that has an excellent abrasion resistance, preservative property, and heat sensitivity.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0015] The present invention will be explained in detail hereinafter with the preferred embodiments.

[0016] The thermal transfer recording medium according to the present invention comprises a release layer mainly formed of waxes and laminated on a base material, an ink layer containing a coloring material, and a transparent adhesive layer, in which these layers are laminated in this order, and the adhesive layer is formed of polyester resin having a glass transition temperature (Tg) of 70 to 80°C as a binder resin.

[0017] Further, in the thermal transfer recording medium according to the present invention, it is possible to form a back surface layer on the surface of the other side of the base material, for the purpose of preventing the fusible adhesion with a thermal head, and improving a sliding property.

[0018] According to such a formation, it is possible to provide the thermal transfer recording medium having more satisfactory heat sensitivity than conventional one.

[Base Material]

[0019] As to the base material used for the thermal transfer recording medium according to the present invention, a base material conventionally used for a thermal transfer recording medium can be utilized as it is. Further, the other base material may be utilized, and there is no limitation to utilize.

[0020] As preferable specific examples of the base material, there will be listed up the following materials: plastics having comparably excellent heat resistant property including polyester such as polyethylene terephthalate, polypropylene, cellophane, polycarbonate, cellulose acetate, triacetylcellulose, polyethylene, polyvinyl chloride, polystyrene, nylon, polyimide, polyvinylidene chloride, polyvinyl alcohol, fluororesin, chlorinated rubber, or ionomer; papers such as condenser paper or paraffin paper; nonwoven fabric and the like; or composite base material formed by the combination of two or more kinds of these materials.

[0021] The base material preferably has a thickness of, for example, 2 to 25 μm, however, it may be modified in accordance with the material so as to have a sufficient strength and thermal conductivity.

[Ink Layer]

[0022] In the thermal transfer recording medium according to the present invention, an ink layer is formed. The ink layer includes a coloring material and binder, and may include various additives such as a dispersant or an antistatic agent, as the occasion demands.

[0023] As the coloring material, an organic or inorganic pigment or dye, which has excellent property as a recording material, for example, the material to have a sufficient coloring density and not to brown by an exposure to light, heat, temperature and so on, is preferably utilized. Further, as the coloring material, in accordance with the demanded color tone, the material may be suitably selected from carbon black, an organic pigment, an inorganic pigment, and various dyes, and utilized.

[0024] A binder used for the ink layer is preferably formed of resin mainly. As specific examples of the binder, there will be listed up the following thermoplastic elastomers such as acrylic resin, cellulose resin, melamine resin, polyester resin, polyamide resin, polyolefine resin, acrylic resin, styrene resin, polyamide, ethylene-vinyl acetate copolymer, vinyl chloride-vinyl acetate copolymer, styrene-butadiene rubber. Particularly, the material conventionally used for a thermally-sensitive adhesive, and having relatively low softening point, for example, 50-150°C of softening point, is preferably utilized as the binder.

[0025] In the ink layer, a wax may be mixed with the ink layer unless a heat resistance is decline. Specific examples of the wax include microcrystalline wax, carnauba wax, paraffin wax, Fischer-Tropsch's wax, various low molecular polyethylene waxes, Japan tallow, bees wax, cetaceum, insect wax, wool wax, shellac wax, candelilla wax, petrolatum, polyester wax, partially modified wax, fatty acid ester, and fatty acid amide. In these waxes, it is preferable that the wax has the melting point at the temperature within the range of 50 to 85°C. When the temperature of the melting point is lower than 50°C, a problem concerning preservability may be generated. When the temperature of the melting point is higher than 85°C, a sensitivity for printing deteriorates.

[0026] Following steps can form the ink layer. First, coating solution for forming the ink coloring material layer is prepared by adjusting the component such as the above mentioned coloring materials and the binder, and, as the occasion demands, solvent component such as water or organic solvents. Next, the prepared coating solution is applied through a known applying method such as hot melt coating, hot lacquer coating, gravure direct coating, gravure reverse coating, knife coating, air coating, or roll coating and then drying the same. The ink layer usually has a thickness of 0.05 to 5 μm, preferably 0.2 to 1.5 μm in a dried state.

[0027] When a thickness of the ink layer in a dried state is less than 0.05 μm, the uniform ink layer can not be obtained because of a problem of a film forming property, and it causes a deterioration of paratripsis property concerning a printing object. And when a thickness of the ink layer in a dried state is more than 5μm, since high energy is necessary to print and transfer, the particular thermal transfer printer has to use for printing, and printing sensitivity becomes insufficiency.

[Release Layer]

[0028] In the present invention, a release layer is formed between the base material and the ink layer.

[0029] The release layer is a layer formed next to the base material. And the release layer is mainly formed of waxes having a melting point or a softening point of 70°C to 120°C. Since this layer is formed for improving a releasing property between the base material and the ink layer during heat applying, the release layer is preferably composed by a component such that the component becomes the liquid having a low viscosity through malting when the heat is applied by a thermal head. And it is preferable that the composition of the layer is adjusted such that the layer can cut easily at the area close to interface between a heating portion and a non-heating portion.

[0030] Specific examples of the wax using for the release layer include natural wax such as bees wax, cetaceum, Japan tallow, rice bran wax, carnauba wax, candelilla wax, or montan wax; synthetic wax such as paraffin wax, microcrystalline wax, oxidized wax, ozokerite, ceresin wax, ester wax, or polyethylene wax; higher saturated fatty acid such as margaric acid, lauric acid, myristic acid, palmitic acid, stearic acid, furoin acid, or behenic acid; higher saturated monohydric alcohol such as stearyl alcohol or behenyl alcohol; higher ester such as fatty acid ester of sorbitan; higher fatty acid amide such as stearic acid amide, or oleic acid amide.

[0031] It is possible to develop a closely contact property between a transferred material and a thermal transfer recording medium through that the release layer has elasticity. In order to achieve this object, rubbers such as isoprene rubber, butyl rubber or nitrile rubber may be added to the release layer. Further, in order to prevent the release layer falling, resins having a strong adhesive property may be added to the release layer. As the resin added to the release layer for achieving this purpose, ethylene-vinyl acetate copolymer or ethylene-ethylacrylate copolymer are preferably listed.

[0032] The release layer can form such that a coating solution for forming the release layer is applied through a known coating method such as hot melt coating, hot lacquer coating, gravure direct coating, gravure reverse coating, knife coating, air coating, or roll coating and then drying the same. The release layer usually has a thickness of 0.05 to 2 μm in a dried state.

[0033] When a thickness of the release layer in a dried state is less than 0.05 μm, the adhesive property between the base material and the ink layer becomes strong so that the release layer can not obtain a satisfactory releasing effect. And when a thickness of the ink layer in a dried state is more than 2 μm, it is not preferable because a transferring sensitivity becomes inferior.

[Adhesive Layer]

[0034] In the thermal transfer recording medium according to the present invention, a adhesive layer may be formed on the ink layer, as a result, there can be developed an adhesive property between an image receiving sheet and the ink layer to be transferred.

[0035] The adhesive layer adopted in the present invention is mainly formed of polyester resin having a glass transition temperature (Tg) of 70°C to 80°C as a binder resin. The following is an explanation concerning the polyester resin.

[0036] When the polyester resin having a glass transition temperature (Tg) of less than 70°C, is used as the binder resin of the adhesive layer, there occurs a phenomenon such that an ink is set off to a back surface of the thermal transfer recording medium (blocking) during preserving the thermal transfer recording medium. The other hand, when the polyester resin having a glass transition temperature (Tg) of more than 80°C, is used as the binder resin, a heat sensitivity is inferior because of an insufficient fixation to the image receiving sheet.

[0037] In the present invention, it is preferable that a number average molecular weight of the polyester resin using as the binder resin of the adhesive layer, is within the range of 2000 to 8000. When a number average molecular weight of the polyester resin is less than 2000, the fixation property to the image receiving sheet is inferior, as a result, a resistant property such as an abrasion resistance of an transferred image is inferior. When a number average molecular weight of the polyester resin is more than 8000, the heat sensitivity is inferior, as a result, a clear image can not be obtained.

[0038] These polyester resins may be synthesized by the conventional synthetic method such as a condensation polymerization of polyhydric alcohol and polybasic acid, a ring-opening polymerization of a cyclic ester such as lactones, or a condensation polymerization of dibasic acid and glycol.

[0039] A blocking preventive such as waxes, higher fatty acid amide, ester and base, fluororesin, or powder of inorganic material, can be added to the adhesive layer in order to prevent blocking when thus-obtained thermal transfer recording medium is wound like a roll.

[0040] Following steps can form the adhesive layer. First, coating solution for forming the adhesive layer is prepared by dissolving or dispersing the above mentioned material and additives, as the occasion demands, in a proper organic solvent or water. Next, the prepared coating solution is applied through a known coating method such as gravure direct coating, gravure reverse coating, knife coating, air coating, or roll coating.

[0041] An amount of a coating of the adhesive layer is preferable within the range of 0.1 g/m^2 to 0.5 g/m^2 as non-volatile matter. When an amount of the coating is less than 0.1 g/m^2, a resistant property such as an abrasion resistance of an transferred image is inferior. When an amount of the coating is more than 0.5 g/m^2, the heat sensitivity is inferior, as a result, a clear image can not be obtained.

[Back Surface Layer]

[0042] In the thermal transfer recording medium according to the present invention, as the occasion demands, a back surface layer may be formed on a back surface of the base material. The back surface layer is formed for the purpose of protecting the base material from high temperature through a thermal head during heat applying. That is, the back surface layer prevents the base material from being thermally fused to a thermal head and improves the sliding performance thereof. The back surface layer may be formed of a thermoplastic resin having a superior heat resistance or a thermosetting resin, and an ultraviolet setting resin or an electron beam setting resin may be used for the back surface layer.

[0043] The preferable resin to form the back surface layer is fluororesin, silicone resin, polyimide resin, epoxy resin, phenol resin, or melamine resin. These resins may be formed to membrane shape, and used for back surface layer. By virtue of arranging the back surface layer on the back surface of the base material, a heat resistance of the base material can be considerably improved, so that materials which are conventionally unsuitable for forming the base material, can be utilized for forming the base material.

[0044] The back surface layer is preferably used a material which is formed through adding a sliding agent, a surface active agent, inorganic particles, organic particles, a pigment, and so on, to the above mentioned binder resin.

[0045] Following steps can form the back surface layer. First, coating solution for forming the back surface layer is prepared by dissolving or dispersing the above mentioned material which is formed through adding a sliding agent, a surface active agent, inorganic particles, organic particles, a pigment, and so on, to the above mentioned binder resin, in a proper organic solvent. Next, the prepared coating solution is applied through a known coating method such as a gravure coating, a roll coating, or a wire bar, and then drying the same.

EXAMPLE

[0046] Hereunder, the thermal transfer recording medium according to the present invention will be more concretely explained by way of preferred examples executed. Units of "part(s)" described in the following examples mean, "weight part(s)" as non-volatile matter. Polyethylene terephthalate film having a thickness of 4.5 μm is used as a base material. The thermal transfer recording medium for Examples and Comparative Examples was formed as follows. An amount of a coating of the release layer was 0.6g/m^2 and it was not varied, and an amount of a coating of the ink layer was 0.4 g/m^2 and it was not also varied. The release layer and the ink layer were formed on the base material in this order, and the adhesive layer was formed on the ink layer and varied the composition.

[0047] The back surface layer was formed on the other surface of the base material through applying the coating solution for the back surface layer having the following composition and drying such that an amount of the coating became 0.3 g/m^2.

<u>The coating solution for the back surface layer</u>

[0048]

Styrene-acrylonitrile copolymer resin	11 parts
Linear saturated polyester resin	0.3 parts
Zinc stearyl phosphate	6 parts
Melamine resin particles	3 parts
Methyl ethyl ketone	80 parts

[Example 1]

[0049] The composition of the coating solution for the release layer, the ink layer, and the adhesive layer which was formed on one surface of the base material, are as follows. An amount of the coating for the adhesive layer was 0.3 g/m^2 as non-volatile matter. In this way, the thermal transfer recording medium of Example 1 was manufactured.

The coating solution for the release layer

[0050]

Carnauba wax	100 parts

The coating solution for the ink layer

[0051]

Carbon black Acrylic resin (Number average molecular weight: 20000) Vinyl chloride-vinyl acetate copolymer (Degree of polymerization: 400)	10 parts 10 parts 10 parts

The coating solution for the adhesive layer

[0052]

Polyester resin (Number average molecular weight: 8000, Tg: 77°C)	100 parts

[Example 2]

[0053] A thermal transfer recording medium of Example 2 was manufactured in the same manner as in Example 1 except that a coating solution for an adhesive layer having the following composition was used instead of the coating solution for the adhesive layer of Example 1.

The coating solution for the adhesive layer

[0054]

Polyester resin (Number average molecular weight: 2000, Tg: 70°C)	100 parts

[Comparative Example 1]

[0055] A thermal transfer recording medium of Comparative Example 1 was manufactured in the same manner as in Example 1 except that a coating solution for an adhesive layer having the following composition was used instead of the coating solution for the adhesive layer of Example 1.

The coating solution for the adhesive layer

[0056]

Polyester resin (Number average molecular weight: 15000, Tg: 67°C)	100 parts

[Comparative Example 2]

[0057] A thermal transfer recording medium of Comparative Example 2 was manufactured in the same manner as in Example 1 except that a coating solution for an adhesive layer having the following composition was used instead of the coating solution for the adhesive layer of Example 1.

The coating solution for the adhesive layer

[0058]

Polyester resin (Number average molecular weight: 2000, Tg: 68°C)	100 parts

[Comparative Example 3]

[0059] A thermal transfer recording medium of Comparative Example 3 was manufactured in the same manner as in Example 1 except that a coating solution for an adhesive layer having the following composition was used instead of the coating solution for the adhesive layer of Example 1, and an amount of a coating for an adhesive layer was 0.6 g/m^2 as non-volatile matter.

The coating solution for the adhesive layer

[0060]

Polyester resin (Number average molecular weight: 8000, Tg: 77°C)	100 parts

[Comparative Example 4]

[0061] A thermal transfer recording medium of Comparative Example 4 was manufactured in the same manner as in Example 1 except that a coating solution for an adhesive layer having the following composition was used instead of the coating solution for the adhesive layer of Example 1, and an amount of a coating for an adhesive layer was 0.05 g/m^2 as non-volatile matter.

The coating solution for the adhesive layer

[0062]

Polyester resin (Number average molecular weight: 8000, Tg: 77°C)	100 parts

[Comparative Example 5]

[0063] A thermal transfer recording medium of Comparative Example 5 was manufactured in the same manner as in Example 1 except that an adhesive layer was not formed.

[Evaluation]

[0064] The following tests for evaluation were conducted to the obtained thermal transfer recording medium by Example 1 and 2, and Comparative Example 1 to 5.

Printing Condition

[0065]

Thermal head: thin film partial glace thermal print head

Printing Energy: 0.7mJ/dot
Speed of printing: 40msec/line
Image receiving sheet: white PET

[0066] The evaluation was conducted concerning following properties.

1. Condition of Image Forming

[0067] The condition of the image forming was evaluated through visual observation of the image forming materials obtained under the above-mentioned printing condition.

◎: There is no void, scratchiness, and undesirable transfer, and an edge of the image is sharp.
○ : There is almost no void, scratchiness, and undesirable transfer.
Δ : There are some voids, scratchiness, and undesirable transfers.
× : There is completely no transfer.

2. Abrasion Resistance

[0068] The abrasion resistance was evaluated through a vibration tester under the condition of weighting 700g loads and rubbing 50 times.

◎: The image is not destroyed at all.
○ : The image is not generally destroyed.
Δ : The image is destroyed a little.
× : The image is destroyed completely.

3. Preservability

[0069] The preservability was evaluated as follows. The thermal transfer recording mediums were laminated and weighted 2kg loads. The laminated thermal transfer recording mediums were left at the temperature of 50°C and the humidity of 80% for 48 hours. After that, the thermal transfer recording mediums were evaluated through visual observation concerning the set off to a back surface of the thermal transfer recording medium.

◎: Completely no set off
○ : Almost no set off
Δ : About half set off
× : Completely set off

[Result of Evaluation]

[0070] Results of the evaluation concerning Examples and Comparative Examples were shown in following Table 1.

TABLE 1

	Condition of Image Forming	Abrasion Resistance	Preservability
Example 1	◎	◎	◎
Example 2	◎	◎	◎
Comparative Example 1	◎	◎	×
Comparative Example 2	◎	Δ	×
Comparative Example 3	○	◎	◎
Comparative Example 4	◎	○	◎
Comparative Example 5	○	×	◎

Claims

1. A thermal transfer recording medium formed by laminating, at least, a releasing layer mainly formed of waxes on a base material, an ink layer containing a colouring material, and a transparent adhesive layer on the base material in this order, characterised in that the adhesive layer is formed of polyester resin having a glass transition temperature (Tg) of 70 to 80°C as a binder resin.

2. A thermal transfer recording medium according to Claim 1, characterised in that a number average molecular weight of the polyester resin is within the range of 2000 to 8000.

3. A thermal transfer recording medium according to Claim 1, characterised in that the amount of the adhesive layer is within the range of 0.1 g/m^2 to 0.5 g/m^2.

4. A thermal transfer recording medium comprising at least a base material and a releasing layer, an ink layer, and an adhesive layer in this order on the base material, characterised in that the adhesive layer is formed of polyester resin having a glass transition temperature (Tg) of 70 to 80°C as a binder resin.