EUROPEAN PATENT SPECIFICATION

(54) Light-heat converting type heat mode recording

Wärmeeempfindliches Aufzeichnungsverfahren des leicht in Wärme umwandelnden Typs
Procédé thermique d’enregistrement avec conversion de la lumière en chaleur

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(56) References cited:
EP-A- 0 529 537
EP-A- 0 529 537

• PATENT ABSTRACTS OF JAPAN vol. 12, no. 346
  (DAI NIPPON PRINTING CO LTD) 10 May 1988
• PATENT ABSTRACTS OF JAPAN vol. 12, no. 478
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Description

[0001] The present invention relates to a light-heat converting type heat mode recording process that forms images by utilizing light. More particularly, it is concerned with a material, and a recording process, capable of forming highly detailed and/or full-color images by a digital dry process.

[0002] A conventional thermal transfer recording is a method in which a thermal transfer ink sheet comprising a substrate and provided thereon a thermomelting colorant layer or a colorant layer containing a sublimation dye is put face-to-face to a recording medium, and a heat source controlled by electrical signals given from a thermal head, an electrifying head or the like is brought into pressure contact with them from the side of the ink sheet to record an image by transfer. The thermal transfer recording has the features that it is noiseless, can be maintenance-free, is low in cost, can provide color images with ease and capable of performing digital recording, and is utilized in many fields of printers, recorders, facsimile systems and computer terminals.

[0003] Meanwhile, in recent years, in the field of medical treatment, printing and so forth, it is sought to provide recording processes feasible for what is called digital recording that can achieve a higher resolution and can process images at high speed.


[0005] In thermal transfer recording making use of a laser as heat source, resolution can be made higher by making the laser spot narrower. In the case when the recording is performed using a laser, it is common to carry out scanning recording. The scanning recording, however, has the disadvantage that its recording speed is lower than the recording speed achievable by the batch exposure making use of a masking material or the recording process making use of a line head. In order to increase the recording speed, it becomes necessary to increase the scanning speed.

[0006] Methods for scanning laser beams include what is called plane scanning, in which primary scanning of laser beams is carried out using a polygonal mirror or galvanic mirror and an f-th lens in combination and a secondary scanning is carried out while moving a recording medium, and cylindrical scanning, in which primary scanning is carried out while rotating a drum and secondary scanning is carried out by moving a laser beam. The cylindrical scanning is suited for heat mode recording because of its less energy loss in optical systems and capability of high-density recording. In this case, it is easy to increase scanning speed by increasing the rotational speed of the drum, but it is difficult to attain a close contact between a thermal transfer material and a recording material, which is necessary for the transfer. In the thermal transfer recording making use of a thermal head, it is possible to attain a close contact between a thermal transfer material and a recording material by virtue of the pressure acting between a platen and a thermal head heating element. In the cylindrical scanning, however, such a method can not be taken. JP-A-112665/1986 discloses that laser exposure is carried out while applying a pressure by means of a transparent pressing member. When, however, the drum is rotated at a high speed to carry out high-speed recording, it becomes difficult to apply a uniform pressure, tending to cause fogging due to contact uneveness or pressure transfer.

[0007] Meanwhile, a thermal transfer recording material comprising a support and having thereon an intermediate layer and an ink layer is proposed for the purpose of improving the contact between a recording material and an image receiving material, or for other reasons. For example, JP-A-225795/1985 discloses that a rubber type resin layer with a Young's modulus of $1.0 \times 10^8$ Nm$^{-2}$ at 50°C is provided in a thickness of 5 µm or less between a support and a thermomelting colorant layer, whereby good printing can be carried out using a thermal head on sheets of paper including those with high smoothness and those with low smoothness.

[0008] JP-A-36698/1982 also discloses a thermal transfer sheet in which a resin layer comprised of polyvinyl butyral or epoxy, for improving adhesion between a support and an ink layer, is provided in a thickness of from 1 to 3 µm as an intermediate layer to make cohesive failure readily take place in the ink layer so that the sheet can be used many times.

[0009] JP-A-138984/1982 further discloses a technique in which an adhesive layer comprised of a thermomelting polyamide and carbon black is provided in a thickness of 6 µm as an intermediate layer so that only ink components can be permeated in and transferred to a recording paper without separation of an ink layer from the ink ribbon and pratting can be repeatedly carried out. JP-A-116193/1983 discloses a technique which concerns with a manufacturing process in which an intermediate layer that is a similar layer comprised of a thermomelting polyamide and carbon black is coated and dried followed by heating and then an ink layer is provided, which makes it possible to obtain an ink ribbon that can achieve a high printing density without causing separation of the ink layer from the support even when the intermediate layer has a smaller thickness. JP-A-109897/1985 discloses a technique in which a 1 to 2 µm thick intermediate layer and a 2 to 4 µm thick ink layer are provided on a 3 to 5 µm thick PET film, where a rubber type latex or a synthetic rubber material is used in the intermediate layer, so that good printing can be performed even on a recording paper with a smoothness of from 100 to 300 seconds.

[0010] All of these techniques are clearly different from the technique for obtaining a good contact performance under
a contact pressure (1.0 kg/cm² at maximum) as weak as that in pressure reducing as intended in the present invention, and hence their constitution is also different from the constitution of the present invention.

[0011] JP-A-144394/1986, JP-A-258793/1986, JP-A-279582/1986, JP-A-151393/1987, JP-A-5885/1989, JP-A-26497/1989 and so forth also disclose techniques concerning an image receiving medium having a cushioning layer between a support and an image receiving material. These, however, all relate to thermal transfer of a sublimation dye and also the heating is carried out by a thermal head. In addition, they are techniques applicable in instances in which an image once having been formed on an image receiving material is not required to be further transferred to a final recording medium. Hence, the techniques disclosed in these publications are different from the technique of the present invention.

[0012] JP-A-63104 881 discloses a thermal-recording material having a light-absorbing photothermal converting layer capable of absorbing light is being thermally deformed and that heat is generated between a base and a thermal transfer ink layer.

[0013] An object of the present invention is to provide a light-heat converting type heat mode recording material that can well achieve close contact by vacuum contact, promises excellent transport performance and enables high-speed recording with a good transfer performance, and also provides a light-heat converting type heat mode image receiving material and a light-heat converting type heat mode recording process.

[0014] Another object of the present invention is to provide, in a laser thermal transfer recording system, a sheet contacting method that can achieve contact between a recording sheet and an image receiving sheet in short time and can obtain a good transferred image, and a recording sheet and an image receiving sheet which are preferably used in such a recording system.

[0015] These objects are achieved by a process having the features of claim 1.

[0016] Furthermore, these objects are achieved by a system having the features of claim 19.

[0017] Further features and improvements of the invention are subject matter of the respective dependent claims.

[0018] The above object of the present invention can be achieved in particular by the following constitution.

(a) A light-heat converting type heat mode recording system used in heat mode recording carried out by putting a light-heat converting type heat mode recording material and a light-heat converting type heat mode image receiving material together in such a manner that the former's surface having an ink layer is put face-to-face to the latter's image receiving surface, and exposing them to light corresponding with image information to transfer the ink layer to the image receiving surface; wherein said light-heat converting type heat mode recording material comprises a support and provided thereon an intermediate layer and an ink layer.

(b) A light-heat converting type heat mode image receiving system used in light-heat converting type heat mode recording carried out by bringing a light-heat converting type heat mode recording material into contact with a light-heat converting type heat mode image receiving material, or putting them adjacently to each other, so as for the former's surface having an ink layer to face the latter's surface having an image receiving layer, and, in that state, exposing them to light corresponding with image information to carry out recording; wherein said light-heat converting type heat mode image receiving material comprises a support and provided thereon a deformable layer.

(c) A light-heat converting type heat mode recording process comprising the steps of putting a light-heat converting type heat mode image receiving material and a light-heat converting type heat mode recording material together so as for the former's deformable layer side surface to face the latter's ink layer surface, exposing them to light corresponding with image information, from the back of the light-heat converting type heat mode recording material or light-heat converting type heat mode image receiving material to transfer the ink layer corresponding with the image information, to the image receiving surface of the light-heat converting type heat mode image receiving material, and thereafter putting the light-heat converting type heat mode image receiving material having supported the ink layer thereon and a final recording medium together so as for the former's image receiving surface to face the latter's recording surface, to further transfer the ink layer on the image receiving surface to the surface of a final recording medium while applying heat and/or pressure.

[0019] In preferred embodiments, which are more effective for achieving the present invention, the above intermediate layer of the light-heat converting type heat mode image receiving layer has an elasticity modulus of 250 kg/mm² or less at 25°C, the intermediate layer thereof has a glass transition temperature of 80°C or below, the intermediate layer thereof has a penetration as defined below of 15 or more, and the intermediate layer thereof has a layer thickness of 5 μm or more.

[0020] The penetration is measured by an apparatus shown in Fig. 7 and a method both similar to those applied for measuring the penetration degree of petroleum asphalt. In the method a metal needle having specified dimensions shown in Figs. 8a and 8b is used. To the surface of a block of the material for cushion layer, the needle is perpendicularly touched at the point of it with no loading. Then a load of 100 gram is added to the needle. After standing for 5 minutes, sinking distance of the needle caused by the loading is measured by a dial gauge equipped with the needle. During
the measurement, the temperature of the sample is maintained at 25°C. The penetration degree is expressed by a value of ten times of the sinking distance by mm, for instance, the penetration is expressed as 1 when the sinking distance is 0.1 mm. Concerning the detail of measuring apparatus, JIS K 2530 and JIS K 2808 can be referred.

In other preferred embodiments, which are also more effective for achieving the present invention, the above deformable layer of the light-heat converting type heat mode image receiving material has an elasticity modulus of 200 kg/mm² or less at 25°C, the deformable layer thereof has a viscosity of 10,000 cp or less at 200°C, the deformable layer thereof has a glass transition temperature of 80°C or below, the deformable layer thereof has a penetration as defined of 15 or more, and the deformable layer and/or the image receiving layer contain(s) a colorant capable of absorbing heat radiation.

The above objects of the present invention can also be achieved by the following.

(1) A sheet contacting method comprising bringing a recording sheet into contact with an image receiving sheet, wherein the two sheets are exposed to light while bringing them into vacuum contact by means of a suction pump.
(2) An image receiving sheet comprising a thermoplastic layer or elastic layer capable of being deformed by application of heat, having a light-heat converting agent capable of converting light into heat.

In the drawings

Fig. 1 schematically illustrates the vacuum contacting method by pressure reducing of the present invention,
Fig. 2 schematically illustrates how the light-heat converting type heat mode image receiving material and recording material are wound around a drum type pressure reducing device,
Fig. 3 cross-sectionally illustrates the basic structure of the drum type pressure reducing device,
Fig. 4 cross-sectionally illustrates how the image receiving material and recording material are brought into contact with each other using a flat plate type pressure reducing device,
Fig. 5 illustrates the whole construction showing the drum type pressure reducing device and the surroundings of the pressure reducing device,
Fig. 6 cross-sectionally illustrates an example of the layer structure of the light-heat converting type heat mode recording material and image receiving material of the present invention,
Fig. 7 shows a testing instrument for penetration,
Fig. 8a shows a metal needle for the testing instrument of Fig. 7 and Fig. 8b shows another metal needle for the testing instrument of Fig. 7.

In Fig. 1 to Fig. 6, reference numerals denote as follows:

1: pressure roll;
2: pressure reducing openings, where 2-1 denotes a state they are open, and 2-2 a state they are closed;
3: heat mode recording material, where 3-1 denotes a yellow recording material, 3-2 a magenta recording material, 3-3 a cyan recording material, and 3-4 a black recording material;
4: heat mode image receiving material;
5: heat mode recording material supply means;
6: heat mode image receiving material supply means;
7: pressure reducing device holding portion;
8: optical writing means;
9: housing;
10: pressure reducing valves;
11 and 21: supports;
12: an intermediate layer;
22, cushion layer;
13, light-heat converting layer;
14: ink layer;
15 and 24: back coat layers (optional);
23, image receiving layer;
31: image receiving sheet;
32: ink sheet;
33: drum;
34: hole for pressure reducing; and
35: direction of pressure reducing.
[0025] The present invention will be described below in detail. In the following description, the light-heat converting type heat mode image receiving material, recording material and recording process are often respectively abridged "the heat mode image receiving material, recording material and recording process" and further "the image receiving material, recording material and recording process".

[0026] In general, when the recording material and the image receiving material are brought into contact by vacuum contact, it is difficult for them to be brought into perfectly close contact. Hence, when exposed to light to carry out printing, poor transfer due to poor contact tends to occur.

[0027] Studies made by the present inventors have revealed that use of a recording material comprising a support that can have sufficient cushioning properties attributable to heat energy converted when exposed to light and an ink layer formed thereon makes it possible to obtain good transferred images free from blank areas even when no perfect contact is achieved between the recording material and the image receiving material. This is considered due to the support having cushioning properties attributable to heat generated when exposed to light, which contributes the achievement of close contact necessary for the transfer.

[0028] However, such a support that can have sufficient cushioning properties attributable to heat energy converted when exposed to light can be a material having an insufficient rigidity and at the same time having not a good lubricity, making it difficult to be automatically transported through the inside of a recording apparatus. In order to improve transport performance, one may contemplate to make the layer thickness of the support larger. In the support having sufficient cushioning properties, however, it is difficult to achieve the rigidity for attaining the transport performance, by only making the thickness larger. Now, as a result of studies, it has been made clear that in the contact by vacuum contact it is preferable for the recording material to have a support having a rigidity so that it can have a rigidity and also to have an intermediate layer with cushioning properties so that it can have cushioning properties.

[0029] It is also preferable for this intermediate layer with cushioning properties to be deformable in such a way that any foreign matter can be embedded on the occasion that the foreign matter has been caught between the recording material and the image receiving material when they are put together. This makes it possible to prevent any faulty images from occurring at that part even when the foreign matter is present.

[0030] Employment of such construction has been found to enable achievement of both the contact performance necessary for the transfer during exposure (to shorten the pressure reducing time for achieving the contact performance) and the transport performance. Thus the present invention has been accomplished.

[0031] In the meantime, studies made by the present inventors have also revealed that use of the image receiving material having an image receiving layer formed on the support having a sufficient elasticity brings about an improvement in contact performance between the recording material and the image receiving material and makes it possible to obtain good images free from blank areas. This can be considered due to the support having a deformability, which contributes the achievement of the close contact necessary for the transfer. However, in the material in which the support itself is deformable in this way, the support may have an insufficient strength and dimensional stability and it has been difficult to form images in a high precision.

[0032] Further studies now made by them have revealed that an image receiving material provided with a suitable deformable layer to have a deformability can bring about an improvement in contact performance. In the case when the image receiving material and a transfer material such as art paper, coated paper or woodfree paper are put together to further transfer the image formed on the former, to the latter while applying heat and/or pressure, to obtain a final image, no sufficient contact can be achieved because of undulation on the surface of the paper to which the image is being further transferred, causing blank areas or break-off in the transferred image, unless the image receiving material has no deformable layer. Thus, it has been made clear that the image can be transferred to the final recording medium when the deformable layer of the image receiving material is made to have a sufficiently large thickness.

[0033] The deformable layer of the image receiving material may preferably have a good adhesion, and be deformable to such an extent that it can well follow up the undulation of the final recording medium such as art paper, coated paper or woodfree paper when the image is further transferred thereto.

[0034] This deformable layer may also preferably be so formed that any foreign matter can be embedded on the occasion that the foreign matter has been caught between the recording material and the image receiving material when they are put together. This makes it possible to prevent any faulty images from occurring at that part even when the foreign matter is present.

[0035] The image receiving material is also required to have a certain degree of rigidity so that materials can be automatically transported through the inside of apparatus and can be automatically wound up to a holding member that holds the recording material and the image receiving material. For this purpose, it is preferable for the support itself of the image receiving material to have a rigidity, as in the case of the recording material.

[0036] As a result of the studies thus made, it has been made clear that the satisfaction of any of the above requirements enables achievement of the object of the present invention.

[0037] A typical process of light-heat converting type heat mode recording will be described below with reference to the accompanying drawings.
As a contacting method, as shown in Fig. 1, the image receiving layer surface of an image receiving material and the ink layer surface of a recording material having a larger length and breadth than the image receiving material are put face-to-face and superposed on a pressure reducing device having minute openings, and the pressure is reduced through the minute openings to attract the recording material at its part extending over the external boundary of the image receiving material so that the image receiving material and the recording material are brought into contact with each other. Alternatively, in reverse the ink layer surface of a recording material and the image receiving layer surface of an image receiving material having a larger length and breadth than the recording material are put face-to-face, and the pressure is reduced through the minute openings to attract the image receiving material extending over the external boundary of the recording material so that the recording material and the image receiving material are brought into contact.

This contacting method makes it easy to automate both the transport and the winding-up of the recording material and image receiving material and makes it possible to carry out heat mode recording by exposing them to light after the contacting has been completed. The pressure reducing device may be of a drum type as shown in Fig. 2 or a flat plate type as shown in Fig. 3. In instances in which high-speed recording is required, the cylindrical scanning making use of the drum type pressure reducing device is better than the plane scanning making use of the flat-plate type pressure reducing device and a polygonal mirror or galvanic mirror, because of a smaller loss of optical systems.

Using such a pressure reducing device, the ink layer surface of the recording material and the image receiving layer surface of the image receiving material are brought into contact or put them adjacent to each other (this state is called a contact state), in the state of which they are exposed to light corresponding with image information, to carry out thermal transfer recording.

Fig. 4 shows the pressure reducing device used in the present invention and the surroundings of the pressure reducing device.

Here is illustrated an instance in which the pressure reducing device is of a drum type. There is no change in the basic construction also when it is of a flat plate type. For example, in an instance in which a recording material and an image receiving material each having the structure as shown in Fig. 5 are brought into contact by winding them around the pressure reducing device, the image receiving material is first wound around it and secured thereto by reducing the pressure in the state that pressure reducing valves are closed. Next, the recording material is wound around on it. At this time, it is wound around while the pressure reducing valves are successively opened. This makes it easy to shorten the pressure reducing time and obtain the state of close contact. It is more effective to open the pressure reducing valves while pressing the materials by means of a squeegee roll.

The recording material and image receiving material used in the present invention will be described below.

The recording material of the present invention has a basic structure wherein an intermediate layer and an ink layer are laminated to a support and at the same time has the function of converting light of imagewise exposure into heat.

The support may be any of those having a rigidity, having a good dimensional stability and durable to heat at the time of image formation. Stated specifically, films or sheets as disclosed in JP-A-193886/1988, left lower column, lines 12-18 can be used. When images are formed by exposure to laser light from the recording material side, the support of the recording material should be transparent. When images are formed by exposure to laser light from the image receiving material side, the support of the recording material need not be transparent. The support may preferably have a layer thickness of from 6 to 200 μm, and more preferably from 25 to 100 μm.

As intermediate layer of the present invention, it is preferable to use those having an elasticity modulus of 1 kg/mm² or more to 250 kg/mm² or less, and more preferably from 2 kg/mm² to more than 150 kg/mm² or less, and a Tg of -100°C or above to 80°C or below, and more preferably -80°C or above to 40°C or below.

The intermediate layer with cushioning properties has a penetration of 15 or more to 500 or less, and preferably 30 or more to 300 or less.

Materials having such properties may be those selected from the following, to which, however, the materials are by no means limited. They may specifically include natural rubber, acrylate rubber, butyl rubber, nitrile rubber, butadiene rubber, isoprene rubber, styrene-butadiene rubber, chloroprene rubber, urethane rubber, silicone rubber, acrylic rubber, fluororubber, neoprene rubber, chlorosulfonated polyethylene, epichlorohydrin, EPDM (ethylene-propylene-diene rubber), elastomers such as urethane elastomer, polyethylene, polypropylene, polybutadiene, polybutene, impact-resistant ABS resin, polyurethane, ABS resin, acetate, cellulose acetate, amide resin, polytetrafluoroethylene, nitrocellulose, polystyrene, epoxy resin, phenol-formaldehyde resin, polyester, impact-resistant acrylic resin, a styrene-butadiene copolymer, an ethylene/vinyl acetate copolymer, an acrylonitrile/butadiene copolymer, a vinyl chloride/vinyl acetate copolymer, polyvinyl acetate, plasticizer-containing vinyl chloride resin, vinylidene chloride resin, polyvinyl chloride, and polyvinylidene chloride, among which resins having a low elasticity modulus are available.

As the intermediate layer with cushioning properties, a shape memory resin such as styrene type hybrid polymers wherein polynorbornene or polyybutadiene units and polystyrene units have been complexed can be used.

The intermediate layer that meets the preferable requirements of the present invention cannot necessarily
be defined on the basis of the types of component materials. Those having preferable properties in component materials themselves may further include the following: An ethylene/vinyl acetate copolymer, an ethylene/ethyl acrylate copolymer, polybutadiene resins, a styrene/butadiene copolymer (SBR), a styrene/ethylene/butadiene copolymer (SEBS), an acrylonitrile/butadiene copolymer (NBR), polyisoprene resins (IR), a styrene/isoprene copolymer (SIS), acrylate copolymers, polyester resins, polyurethane resins, butyl rubber, and polynorbornene.

[0051] Of these, those having a relatively low molecular weight can readily meet the requirements of the present invention, but can not necessarily be limited in relation to component materials.

[0052] Even component materials other than the foregoing can provide preferable properties to the intermediate layer by adding various additives.

[0053] Such additives may include low-melting substances such as waxes. Specifically stated, they may include phthalates, adipates, glycolates, fatty acid esters, phosphates and chlorinated paraffins. It is also possible to add various additives disclosed in "Practical Handbook of Plastic and Rubber Additives", Kagaku Kogyosha Co. (published 1970).

[0054] Any of these additives may be added in an amount so selected as to be necessary for achieving the properties of the present invention in combination with the basic intermediate layer component material, without any particular limitations, but, in general, preferably in an amount of not more than 10% by weight, and more preferably not more than 5% by weight, based on the weight of the intermediate layer component material.

[0055] As a method for forming the intermediate layer, a composition prepared by dissolving the above component in a solvent or dispersing them in the form of a latex may be coated by blade coating, roll coating, bar coating, curtain coating, gravure coating or the like. Hot-melt extrusion lamination, cushioning film lamination, etc. may also be used.

[0056] The intermediate layer is required to have a layer thickness of 5 μm or more so that it can be well brought into close contact with the image receiving material, and more preferably 10 μm or more. In order for the intermediate layer to be deformable in such a way that any foreign matter can be embedded to prevent faulty images on the occasion that the foreign matter has been caught between the recording material and the image receiving material, the intermediate layer may still more preferably have a layer thickness of 20 μm or more.

[0057] In the light-heat converting type heat mode recording (hereinafter also "heat mode recording"), the energy loss due to heat conduction from the ink layer to the support side can be decreased by making exposure time shorter. In the heat mode recording, the heat energy imparted to layers other than the ink layer is smaller than that in usual thermal transfer recording wherein a thermal head is used and the ink layer is heated by the heat conduction from the support side. Hence, it is considered necessary for the intermediate layer to have sufficient cushioning properties on account of the heat energy produced in the ink layer at the time of exposure. This slight quantity of heat brings about a lowering of elasticity modulus or a softening by heat, and hence the resin constituting the intermediate layer may preferably have a Tg of 80°C or below, and more preferably 40°C or below. In order for the foreign matter caught between the recording material and the image receiving material to be embedded, the intermediate layer may preferably have cushioning properties at room temperature, and a Tg of 20°C or below, and still more preferably 0°C or below.

[0058] In order for the energy of a light source for the heat mode recording to be absorbed in the ink layer without loss, the transmittance of light through the support and intermediate layer with respect to wavelength of the light source may preferably be not less than 70%, and more preferably not less than 80%. For this purpose, it is necessary to use a support and an intermediate layer each having a good transparency and also to decrease reflection at the back coat side of the support and at the interface between the support and the intermediate layer.

[0059] As a method for decreasing the reflection at the interface between the support and the intermediate layer, the intermediate layer may be made to have a refractive index smaller by at least 0.1 than that of the support, so that the light energy loss due to interfacial reflection can be greatly decreased.

[0060] The ink layer may be a transfer layer comprising a colorant, a light-heat converting agent and a binder, or may have a double-layer structure comprised of a transfer layer comprising a colorant layer and a binder and a non-transferring light-heat converting layer comprising a light-heat converting agent and a binder.

[0061] First, the embodiment in which the ink layer is a transfer layer capable of causing light-heat conversion will be described.

[0062] The colorant mentioned above may include pigments as exemplified by inorganic pigments and organic pigments, and dyes.

[0063] The inorganic pigments may include titanium oxide, carbon black, zinc oxide, Prussian blue, cadmium sulfide, iron oxide, and chromates of lead, zinc, barium and calcium.

[0064] The organic pigments may include pigments of an azo type, a thioindigo type, an anthraquinone type, an anthanthrone type and a triphenodioxazine type, vat dye pigments, phthalocyanine pigments (as exemplified by copper phthalocyanine) and derivatives thereof, and quinacridone pigments. The organic dyes may include acid dyes, direct dyes, disperse dyes, oil-soluble dyes, metal-containing oil-soluble dyes, and sublimation dyes.

[0065] When an image formed is used as a color proof, pigments as exemplified by Lyonol Blue FG-7330, Lyonol Yellow No. 1206, No. 1406G and Lyonol Red 6BFG-4219X (all available from Toyo Ink Mfg. Co., Ltd.) can be used.
[0066] There are no particular limitations on the content of the colorant in the ink layer. The colorant may usually be in a content ranging from 5 to 70% by weight, and preferably from 10 to 60% by weight.

[0067] As the light-heat converting agent, any conventionally known agents can be used. Since in a preferred embodiment of the present invention the heat is generated by exposure to semiconductor laser light, a near infrared absorbent showing an absorption peak at a wavelength band of from 700 to 3,000 nm and having no or small absorption in the visible region is preferable when color images are formed. Carbon black or the like having an absorption in the regions of from the visible region to the infrared region is preferable when monochromatic images are formed.

[0068] As the near infrared absorbent, organic compounds such as dyes of a cyanine type, a polymethine type, an azulenium type, a squarilium type, a thiopyrylium type, a naphthaquinone type and an anthraquinone type, and organic metal complexes of a phthalocyanine type, an azo type and a thioamide type are preferably used, specifically including the compounds disclosed in Japanese Patent O.P.I. Publication No. 20842/1977. The light-heat converting agent may be the colorant itself of the ink layer. It is by no means limited to those described above, and various substances can be used.

[0069] These may be used alone or in combination of two or more kinds.

[0070] The binder in the ink layer may include thermomelting substances, thermosoftening substances and thermoplastic resins. The thermomelting substances are usually solid or semi-solid substances having a melting point within the range of from 40 to 150°C, measured using Yanagimoto MJP-2 Type. They may specifically include waxes as exemplified by vegetable waxes such as carnauba wax, Japan wax, auricul wax and esparto wax; animal waxes such as bees wax, insect wax, shellac wax and sparmaceti; petroleum waxes such as paraffin wax, microcrystalline wax, polyethylene wax, ester wax and acid wax; and mineral waxes such as montan wax, ozokerite and ceresine. Besides these waxes, they may also include higher fatty acids such as palmitic acid, stearic acid, margaric acid and behenic acid; higher alcohols such as palmital alcohol, stearyl alcohol, behenyl alcohol, marganyl alcohol, myricyl alcohol and eicosanol; higher fatty acid esters such as ceryl palmitate, myricyl palmitate, ceryl stearate and myricyl stearate; amides such as acetamide, propionic acid amide, palmitic acid amide, stearic acid amide and amide wax; and higher amines such as stearylamine, behenylamine and palmitilamine.

[0071] The thermoplastic resins may include polymeric compounds as exemplified by resins such as ethylene co-polymer, propylene resins, polyester resins, polyyurethane resins, polyolefin resins, acrylic resins, a styrene(acrylate copolymer, styrene resins, a styrene/maleic acid copolymer, vinyl chloride resins, cellulose resins, rosin resins, polyvinyl alcohol resins, polyvinyl acetals, rosin resins and petroleum resins; elastomers such as natural rubber, styrene-butadiene rubber, isoprene rubber, chloroprene rubber and diethylene copolymers; rosin derivatives such as ester gum, rosins, maleic acid resin, rosin phenol resin and hydrogenated rosin; and aromatic hydrocarbon resins such as phenol resin, terpene resin and cyclopentadiene resin.

[0072] The above thermomelting substances and thermoplastic resins may be appropriately selected so that a thermal transfer layer having the desired thermosoftening point or thermomelting point can be formed.

[0073] Next, the embodiment in which the ink layer has the double-layer structure comprised of a transferring colorant layer and a light-heat converting layer will be described. The double-layer structure comprised of a colorant layer and a light-heat converting layer makes it possible to use a light-heat converting agent having an absorption in the visible region and is advantageous for color reproduction especially when color images are produced.

[0074] As the light-heat converting agent in the light-heat converting layer, those listed for the ink layer capable of causing light-heat conversion can be used. The light-heat converting layer has an absorption of at least 0.25, and preferably 0.5 or more, with respect to the wavelength of a light source in the near infrared region of 700 to 1,000 nm. Use of an infrared absorbing dye, which has a large coefficient of absorption per unit weight compared with the pigment such as carbon black, can allow to make the layer thickness of the light-heat converting layer smaller, so that the sensitivity can be made higher. Thus, its use is preferred.

[0075] As the light-heat converting layer, it is possible to use resins having a high glass transition point and a high thermal conductivity, as exemplified by gelatin and resins such as polyvinyl pyrrolidone, polyester, polyparabanic acid, polymethyl methacrylate, polycarbonate, polystyrene, ethyl cellulose, nitrocellulose, methyl cellulose, hydroxpropyl cellulose, polyvinyl alcohol, polyvinyl chloride, polyaamide, polynamide, polylether imide, polylsulfone, polystyrene, and aramid.

[0076] This light-heat converting layer may preferably have a layer thickness of from 0.1 to 3 μm. The content of the light-heat converting agent in the light-heat converting layer may be so determined as to give a light absorbance of 0.25 or more at the wavelength of a light source used in image recording.

[0077] This light-heat converting layer may otherwise be formed as a deposited film, which may include deposited films of carbon black or metal black such as aluminum, chromium, nickel, antimony, tellurium, bismuth or selenium as disclosed in Japanese Patent O.P.I. Publication No. 20842/1977. The light-heat converting agent may be the colorant itself of the ink layer. It is by no means limited to those described above, and various substances can be used.

[0078] The image receiving material will be described below.

[0079] The image receiving material receives the ink layer imagewise separated from the recording material de-
scribed above, to form an image. The image receiving material of the present invention comprises a support and provided thereon a deformable layer and an image receiving layer.

[0080] The image receiving material should have an appropriate thermal strength and also have an excellent dimensional stability so that images can be properly formed.

[0081] As the support for the image receiving material, the same supports as those described for the recording material can be used. It may preferably have a layer thickness of from 25 to 200 μm, and more preferably from 25 to 100 μm.

[0082] The deformable layer may preferably have an elasticity modulus of 1 kg/mm² or more to 200 kg/mm² or less at 25°C, and more preferably 2 kg/mm² or more to 100 kg/mm² or less. The deformable layer may preferably have a melt viscosity of 10 cp or more to 10,000 cp or less at 200°C, and more preferably 20 cp or more to 5,000 cp or less. The deformable layer may preferably have a glass transition temperature of -100°C or above to 80°C or below, and more preferably -80°C or above to 40°C or below. The deformable layer may have a penetration of 15 or more to 500 or less, and more preferably 30 or more to 300 or less. The deformable layer may be made of the same component material as that of the cushioning layer of the recording material.

[0083] Preferable properties of the deformable layer of the present invention can not necessarily be defined on the basis of the types of component materials. Those having preferable properties in component materials themselves may include the following: An ethylene/vinyl acetate copolymer, an ethylene/ethyl acrylate copolymer, polybutadiene resins, a styrene/butadiene copolymer (SBR), a styrene/ethylene/butadiene copolymer (SEBS), an acrylonitrile/buta diene copolymer (NBR), polyisoprene resins (IR), a styrene/isoprene copolymer (SIS), acrylate copolymers, polyester resins, polyurethane resins, butyl rubber, and polyisobutylene.

[0084] Of these, those having a relatively low molecular weight can readily meet the requirements of the present invention, but can not necessarily be limited in relation to component materials.

[0085] Even component materials other than the foregoing can provide preferable properties to the deformable layer by adding various additives.

[0086] Such additives may include low-melting substances such as waxes. Specifically stated, they may include phthalates, adipates, glycolates, fatty acid esters, phosphates and chlorinated paraffins. It is also possible to add various additives disclosed in "Practical Handbook of Plastic and Rubber Additives", Kagaku Kogyosha Co. (published 1970).

[0087] Any of these additives may be added in an amount so selected as to be necessary for achieving the properties of the present invention in combination with the basic deformable layer component material, without any particular limitations, but, in general, preferably in an amount of not more than 10% by weight, and more preferably not more than 5% by weight, based on the weight of the deformable layer component material.

[0088] As a method for forming the deformable layer, a composition prepared by dissolving the above component in a solvent or dispersing them in the form of a latex may be coated by blade coating, roll coating, curtain coating, gravure coating or the like. Hot-melt extrusion lamination, cushioning film lamination, etc. may also be used.

[0089] The deformable layer may preferably have a layer thickness of not less than 10 μm, and more preferably not less than 20 μm. In the case when the ink layer is further transferred to other recording material, the deformable layer may more preferably have a layer thickness of not less than 30 μm. If the layer thickness of the deformable layer is less than 10 μm, blank areas or break-off may occur when further transferred to a final recording material.

[0090] The image receiving layer comprises a binder and various additives or matting agent optionally added. In some instances, it is formed only of a binder.

[0091] The image receiving layer binder having a good transfer performance may include adhesives such as a polyvinyl acetate emulsion type adhesive, a chloroprene type adhesive and an epoxy resin type adhesive, pressure-sensitive adhesives such as natural rubber and resins of a chloroprene type, a butyl rubber type, a polyacrylate type, a nitryl rubber type, a polysulfide type, a silicone rubber type, a rosin type and a petroleum type, reclaimed rubber, vinyl chloride resins, SBR, polybutadiene resin, polyisoprene, polyvinyl butyral resin, polyvinyl ether, ionomer resin, styrene resin, styrene-acrylic resin, and acrylic resin.

[0092] In the case when the image having been formed on the image receiving material is further transferred to other recording medium while applying heat and/or pressure, a resin having a relatively small polarity (having a small SP value) is particularly preferred for the image receiving layer. Such a resin is exemplified by polyethylene, polypropylene, an ethylene/vinyl chloride copolymer, an ethylene/acylate copolymer, thylene-vinyl acetate resins (EVA), vinyl chloride graft EVA resins, vinyl chloride resins and various types of modified olefins.

[0093] The image receiving layer may usually have a layer thickness of from 0.5 to 10 μm. This does not necessarily apply to the case when the deformable layer is used as the image receiving layer.

[0094] As an exposure method, it is possible to use a method in which exposure is carried out from the support side of the recording material in the state that the recording material and the image receiving material are bought into close contact, and a method in which exposure is carried out through the image receiving material.

[0095] In the case when the exposure is carried out from the support side of the recording material, a colorant capable
of absorbing heat radiation may be added to the image receiving material and/or the deformable layer so that the light having not been completely absorbed in the recording material can be absorbed in the image receiving material and/or the deformable layer, to effectively utilize the heat. This is effective for improving transfer performance.

[0096] In the latter case, in order for the energy of a light source to be absorbed in the ink layer without loss, the thickness of the light-heat converting layer may preferably be not less than 70%, and more preferably not less than 80%. For this purpose, it is necessary to use a support and an intermediate layer each having a good transparency and also to decrease reflection at the back coat side of the support and at the interface between the support and the deformable layer. As a method for decreasing the reflection at the interface between the support and the deformable layer, the deformable layer may be made to have a refractive index smaller by at least 0.1 than that of the support, so that the light energy loss due to interfacial reflection can be greatly decreased.

[0097] The material having a deformability may cause a decrease in lubricity as a result of deformation, often resulting in a poor lubricity between the image receiving material and the ink layer. As a result, it may become difficult to achieve contact in a large area, and may become difficult to automatically transport the materials in a recording apparatus. In such a case, as a countermeasure to be taken, an image receiving layer with a good lubricity may be provided as an upper layer of the deformable layer.

[0098] In order to obtain the image receiving layer with a good lubricity, (i) a matting agent may be added and (ii) an component material with a good lubricity may be used.

(i) The addition of fine particles (a matting agent) to the image receiving material is effective for improving the lubricity of the recording material and image receiving material. However, addition of the matting agent in an excessively large amount may give formation of a gap between the recording material and the image receiving material, resulting in a poor transfer performance. The amount of the matting agent added depends on its particle diameter and the layer thickness of the image receiving layer. For example, in the case of a matting agent of 0.8 to 1.5 μm in particle diameter, it may be added in an amount of from 15 to 150 mg/m²; in the case of a matting agent of 2.0 to 3.5 μm in particle diameter, from 15 to 150 mg/m²; and in the case of a matting agent of 5 μm in particle diameter, not more than 10 mg/m².

(ii) The component with a good lubricity may include polyethylene resin, polypropylene resin, silicone resin and Teflon resin.

[0099] The ink sheet and image receiving sheet used in laser thermal transfer recording will be described below.

[0100] The ink sheet has a basic structure wherein at least a thermomelting ink layer is laminated to a support and at the same time has the function of converting light of imagewise exposure into heat. In some instances, a backing layer may be provided on the surface of the support on its side opposite to the side on which the thermomelting ink layer is provided, or a release layer may be provided between the support and the ink layer. A cushioning layer may also be provided between the support and the thermomelting ink layer, in the case of which the release layer may be provided between the cushioning layer and the ink layer.

[0101] The function of converting light of imagewise exposure into heat can be achieved, for example, by incorporating a light-heat converting agent into the ink layer or by providing adjacent to the ink layer a light-heat converting layer containing a light-heat converting agent.

[0102] The support may be any of those having a good dimensional stability and durable to heat at the time of image formation. Stated specifically, films or sheets as disclosed in JP-A-193886/1988, left lower column, lines 12-18 can be used. When images are formed by exposure to laser light from the ink sheet side, the support of the ink sheet should be transparent. When images are formed by exposure to laser light from the image receiving sheet side, the support of the ink sheet need not be transparent.

[0103] There are no particular limitations on the thickness of the support. It may preferably be from 2 to 300 μm, and more preferably from 5 to 200 μm.

[0104] On the back of the support (the surface on the side opposite to the surface provided with the ink layer), a backing layer may be provided in order to impart running stability, thermal resistance and the function of antistatic. The backing layer can be formed, for example, by coating the surface of the support with a backing layer coating composition prepared by dissolving a resin such as nitrocellulose in a solvent or dissolving or dispersing a binder resin and fine particles of 20 to 30 μm in a solvent.

[0105] The light-heat converting layer may be provided adjoiningly to the ink layer. As previously mentioned, the light-heat converting agent may be incorporated into the ink layer. This light-heat converting layer need not particularly be provided.

[0106] The image receiving sheet will be described below.

[0107] The image receiving sheet receives the ink layer imagewise separated from the ink sheet described above, to form an image. Usually the image receiving sheet has a support and an image receiving layer, or may also be formed
of the support itself.

[0108] To the image receiving sheet, the ink layer melted by heat is transferred, and hence the image receiving sheet should have an appropriate thermal strength and also have an excellent dimensional stability so that images can be properly formed.

[0109] The image receiving sheet has a good smoothness or has been appropriately roughed on its surface coming into touch with the opposing medium when images are formed. Stated more specifically, when the ink sheet has been roughed by a matting agent or the like on its surface of the ink layer, the surface coming into touch with the ink layer of the image receiving sheet should have a good smoothness. When on the other hand the ink layer of the ink sheet has not been surface-roughed, the surface coming into touch with the ink layer of the image receiving sheet should have been roughed. Both the surfaces at which the ink layer and the image receiving sheet come into touch with each other may have been roughed. The surface-roughing is effective for shortening the time required for vacuum contact and, in particular, for reducing pressure at the center area of the sheet. As a standard for the surface-roughing, it can be achieved by providing a matting agent of 1 to 20 \( \mu m \) in particle diameter to the surface coming into touch with the sheet. This, however, does not necessarily apply to the case where the contact for transfer may become faulty.

[0110] The image receiving layer may be formed of a binder, various additives optionally added and the above substance for imparting cushioning properties.

[0111] The binder may include adhesives such as an ethylene/vinyl chloride copolymer type adhesive, a polyvinyl acetate emulsion type adhesive, a chloroprene type adhesive and an epoxy resin type adhesive, pressure-sensitive adhesives such as natural rubber and resins of a chloroprene type, a butyl rubber type, a polybutadiene rubber type, a polyacrylate type, a nitrile rubber type, a polysulfide type, a silicone rubber type and a rosin type, vinyl chloride resins, petroleum resins and ionomer resin, reclaimed rubber, SBR, polyisoprene, and polyvinyl ether.

[0112] The cushioning layer that may be provided between the support and the image receiving layer corresponds to the cushioning layer described in regard to the ink layer of the recording material previously described.

[0113] There are no particular limitations on the thickness of the support in the ink sheet having the support, the cushioning layer and the image receiving layer, and on the thickness of the support in the ink sheet formed of only the support. The thickness of the cushioning layer corresponds to the thickness of the cushioning layer in the ink sheet. The image receiving sheet may usually have a thickness of from 0.1 to 20 \( \mu m \), which, however, does not necessarily apply to the case where the cushioning layer is used as the image receiving layer.

EXAMPLES

[0114] The present invention will be described below in detail by giving Examples. Embodiments of the present invention are by no means limited to these. Examples 1 to 4 relate to the recording material of the present invention, and Examples 5 and 6 to the image receiving material of the present invention.

Example 1

Preparation of recording material:

[0115] Using transparent PET with an elasticity modulus of 450 kg/mm\(^2\) and a thickness of 75 \( \mu m \) (polyethylene terephthalate; T-100, available from Diafoil Hoechst Ltd.) as a support, the following intermediate layer was formed thereon in a thickness of 30 \( \mu m \). As upper layers thereof, a light-heat converting layer and an ink layer were successively provided by coating. Heat mode recording materials were thus prepared. The elasticity modulus was measured using BYBRON DDV-2, manufactured by Orienteck Co., under conditions of applying a strain of 0.02\% at 11 Hz. Measurement temperatures were set in the range of from -100 to 100 \(^\circ\)C, and a storage elasticity modulus at 25 \(^\circ\)C measured when temperature was raised at a rate of 2 \(^\circ\)C/min was regarded as the value of elasticity modulus. With regard to samples that could not be formed into films, a 5 to 10 \( \mu m \) thick layer was formed on a 14 \( \mu m \) thick PET base, and its elasticity modulus was calculated by subtracting that of the PET base later.

<table>
<thead>
<tr>
<th>Intermediate layer component</th>
<th>Storage elasticity modulus (kg/mm(^2))</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Styrene butadiene (JSR0617, available from Japan Synthetic Rubber Co., Ltd.)</td>
<td>30</td>
</tr>
<tr>
<td>b. Urethane resin (CROWN BOND U-06, available from Takamatsu Yushi K.K.)</td>
<td>20</td>
</tr>
<tr>
<td>c. Ethylene-acrylic acid resin (HITECK S-3125, available from Toho Chemical Industry Co., Ltd.)</td>
<td>20</td>
</tr>
<tr>
<td>d. Acrylic resin (BR-102, available from Mitsubishi Rayon Co., Ltd.)</td>
<td>130</td>
</tr>
</tbody>
</table>
- Light-heat converting layer -

[0116] On the intermediate layer, a coating solution with the following composition was coated by wire bar coating, followed by drying.

<table>
<thead>
<tr>
<th>Light-heat converting layer coating solution</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyvinyl alcohol (GL-05, available from Nihon Gosei Kako Co., Ltd.)</td>
<td>7 parts</td>
</tr>
<tr>
<td>IR absorbing dye IR-1</td>
<td>3 parts</td>
</tr>
<tr>
<td>Distilled water</td>
<td>90 parts</td>
</tr>
</tbody>
</table>

IR-1

![Chemical structure of IR-1]

\[ \lambda_{\text{max}} \text{ 740 nm (MeOH)} \]

- Ink layer -

[0117] On the light-heat converting layer, a coating solution with the following composition was coated by wire bar coating, followed by drying.

<table>
<thead>
<tr>
<th>Ink layer coating solution</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Styrene-acrylic resin (HIMER SBM-100, available from Sanyo Kasei Kogyo Co.)</td>
<td>7.4 parts</td>
</tr>
<tr>
<td>Ethylene-vinyl acetate copolymer (EV-40Y, available from Mitsui Du Pont Polychemicals Co., Ltd.)</td>
<td>0.5 part</td>
</tr>
<tr>
<td>Cyan pigment dispersion (available from Mikuni Color Works Ltd.)</td>
<td>2.5 parts</td>
</tr>
<tr>
<td>Silicone resin fine particles (TOSPEARL 108, available from Toshiba Silicone Co., Ltd.)</td>
<td>0.3 part</td>
</tr>
<tr>
<td>DOP (dioctyl phthalate)</td>
<td>0.3 part</td>
</tr>
<tr>
<td>MEK (methyl ethyl ketone)</td>
<td>90 parts</td>
</tr>
</tbody>
</table>

Preparation of heat mode recording material:

[0118] On the same PET support as used in the recording material, a coating solution with the following composition was coated by wire bar coating, followed by drying. Layer thickness: 1.0 μm.

<table>
<thead>
<tr>
<th>Image receiving layer coating solution</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethylene-vinyl acetate copolymer (AD37P295, available from Toyo Morton Co.)</td>
<td>10 parts</td>
</tr>
<tr>
<td>Water</td>
<td>90 parts</td>
</tr>
</tbody>
</table>

[0119] Using the above four kinds of recording materials having different intermediate layer components and the above image receiving material, heat mode transfer was carried out in the following way to evaluate the effect of the intermediate layer.

[0120] Oppositely to an optical system comprising a semiconductor laser with a wavelength of 830 nm, set to give a power of 30 mW on the exposure surface and a 1/e2 spot diameter of 10 μm, the recording material and the image receiving material, which were brought into vacuum contact with each other at 400 Torr against the drum type pressure reducing device, were rotated at a linear velocity of 95 cm/second to carry out transfer of a 1 dot line image and a halftone image.

[0121] Any irregularity in dot quality of halftone dots in the transferred image was observed. In the samples of the
present invention, showing a good contact performance, transfer free from any break-off or slim image of halftone dots and with clear contours was performed.

Example 2

[0122] On the same PET support as used in Example 1, the following intermediate layer was formed in a thickness of 30 μm. As upper layers thereof, the same light-heat converting layer and ink layer as those in Example 1 were successively provided by coating. Ink sheets were thus prepared. The glass transition temperature (Tg) was measured using the same apparatus and under the same conditions as those in Example 1. The temperature at which loss elasticity modulus showed a peak was regarded as the Tg.

<table>
<thead>
<tr>
<th>Intermediate layer component</th>
<th>Tg (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>e. EVA (EVAFLEX 550, available from Mitsui Du Pont Co.)</td>
<td>-35</td>
</tr>
<tr>
<td>f. EVA (A709, available from Mitsui Du Pont Co.)</td>
<td>-40</td>
</tr>
<tr>
<td>g. 1,2-Polybutadiene (RB820, available from Japan Synthetic Rubber Co., Ltd.)</td>
<td>-12</td>
</tr>
<tr>
<td>h. Ethylene-acrylic acid resin (HITECK S-3125, available from Toho Chemical Industry Co., Ltd.)</td>
<td>19</td>
</tr>
<tr>
<td>i. Polyester resin (BYRON 200, available from Toyobo Co., Ltd.)</td>
<td>67</td>
</tr>
<tr>
<td>j. Polymethyl methacrylate resin</td>
<td>105</td>
</tr>
</tbody>
</table>

[0123] Heat mode recording was also carried out on the recording materials of Example 2 in the same manner as in Example 1.

[0124] Results obtained are shown below.

<table>
<thead>
<tr>
<th>Intermediate layer component</th>
<th>Transferred line width average value (μm)</th>
<th>Irregularity in halftone dot shape</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>8.5</td>
<td>None</td>
<td>Y</td>
</tr>
<tr>
<td>b.</td>
<td>10.5</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>c.</td>
<td>9.5</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>d.</td>
<td>9.5</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>e.</td>
<td>11.5</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>f.</td>
<td>10.5</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>g.</td>
<td>10.5</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>h.</td>
<td>9.0</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>i.</td>
<td>11.5</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>j.</td>
<td>5.2</td>
<td>Seen</td>
<td>X</td>
</tr>
</tbody>
</table>

X: Comparative Example, Y: Present Invention

[0125] In the instance in which the component material j was used in the intermediate layer, microscopic observation confirmed that the average area was only 38% with respect to exposure of 50% halftone dots and the halftone dot shape was clearly different from the square exposure pattern.

Example 3

[0126] Recording materials were prepared in the same manner as in Example 1 except that polyester resin (BYRON 200, ditto) and EVA resin (EVAFLEX 555, ditto) were used as intermediate layer components and the layer thickness of the intermediate layer was varied as shown below. Heat mode recording was similarly carried out.

[0127] Results obtained are shown below.

<table>
<thead>
<tr>
<th>Intermediate layer component</th>
<th>Layer thickness (μm)</th>
<th>Transferred line width average value (μm)</th>
<th>Irregularity in halftone dot shape</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>2.0</td>
<td>Seen</td>
</tr>
<tr>
<td>BYRON 200</td>
<td>2</td>
<td>3.0</td>
<td>&quot;</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>3.5</td>
<td>&quot;</td>
</tr>
</tbody>
</table>
Example 4

[0128] Recording materials were prepared in the same manner as in Example 1 except that the following components were used as intermediate layer components. Heat mode recording was carried out similarly. The rate of penetration was measured according to JIS K2530-1976. The intermediate layers were all formed in a thickness of 30 µm. Results obtained are shown below.

<table>
<thead>
<tr>
<th>Intermediate layer component</th>
<th>Layer thickness (µm)</th>
<th>Transferred line width average value (µm)</th>
<th>Irregularity in halftone dot shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;</td>
<td>6</td>
<td>8.0</td>
<td>None</td>
</tr>
<tr>
<td>&quot;</td>
<td>10</td>
<td>9</td>
<td>&quot;</td>
</tr>
<tr>
<td>&quot;</td>
<td>20</td>
<td>10.5</td>
<td>&quot;</td>
</tr>
<tr>
<td>&quot;</td>
<td>35</td>
<td>11.0</td>
<td>&quot;</td>
</tr>
<tr>
<td>&quot;</td>
<td>50</td>
<td>12.0</td>
<td>&quot;</td>
</tr>
<tr>
<td>EVAFLEx 550</td>
<td>2</td>
<td>1.5</td>
<td>Seen</td>
</tr>
<tr>
<td>&quot;</td>
<td>4</td>
<td>2.5</td>
<td>&quot;</td>
</tr>
<tr>
<td>&quot;</td>
<td>6</td>
<td>7.5</td>
<td>None</td>
</tr>
<tr>
<td>&quot;</td>
<td>10</td>
<td>9.0</td>
<td>&quot;</td>
</tr>
<tr>
<td>&quot;</td>
<td>20</td>
<td>9.5</td>
<td>&quot;</td>
</tr>
<tr>
<td>&quot;</td>
<td>30</td>
<td>11.0</td>
<td>&quot;</td>
</tr>
<tr>
<td>&quot;</td>
<td>50</td>
<td>11.5</td>
<td>&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intermediate layer component</th>
<th>Type of component</th>
<th>Penetration</th>
<th>Foreign matter size (µm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. EVAFLEx EV47X</td>
<td>EVA</td>
<td>40</td>
<td>A A A A A</td>
</tr>
<tr>
<td>2. EVAFLEx A709</td>
<td>EVA</td>
<td>45</td>
<td>A A A A A</td>
</tr>
<tr>
<td>3. EVAFLEx A704</td>
<td>EVA</td>
<td>21</td>
<td>A A A A B</td>
</tr>
<tr>
<td>4. BYRONAL BX1055</td>
<td>Polyester</td>
<td>57</td>
<td>A A A A B</td>
</tr>
<tr>
<td>5. KALIFLEX TR1117S</td>
<td>SIS</td>
<td>54</td>
<td>A A A A B</td>
</tr>
<tr>
<td>6. KRATON D1320X</td>
<td>SIS</td>
<td>81</td>
<td>A A A A B</td>
</tr>
<tr>
<td>7. EVAFLEx P1007</td>
<td>EVA</td>
<td>7</td>
<td>B B C C**</td>
</tr>
<tr>
<td>8. EVAFLEx EV550</td>
<td>EVA</td>
<td>10</td>
<td>B B C C**</td>
</tr>
</tbody>
</table>

EVAFLEx: Available from Mitsui Du Pont Chemicals Co., Ltd.
BYRONAL: Available from Toyobo Co., Ltd.
KALIFLEX, KRATON: Available from Shell Chemical Co.
* Evaluation was made according to the following criterions.
A: Faulty images occur by less than three times the size of foreign matter.
B: Faulty images occur by less than three to five times the size of foreign matter.
C: Faulty images occur by more than five times the size of foreign matter.
** Comparative Example
Example 5

Preparation of recording material:

On a 100 µm thick PET (polyethylene terephthalate) support, the following, light-heat converting layer and ink layer were successively provided by coating to produce a recording material. The amounts of components in each layer are all indicated as part(s) by weight.

- Light-heat converting layer -

A coating solution with the following composition was prepared and coated by wire bar coating, followed by drying. The layer was formed in a thickness of 0.3 µm and made to have a light absorbance of 0.9 at 830 nm.

| Water-soluble light-heat converting material | 3.50 parts |
| GL-50 (polyvinyl alcohol; available from Nihon Gosei Kako Co., Ltd.) | 3.43 parts |
| FT248 (aqueous surface active agent; available from BASF Corp.) | 0.07 part |
| Water | 93 parts |

- Ink layer -

A solution with the following composition was dispersed to prepare a coating solution, which was then coated on the above light-heat converting layer by wire bar coating, followed by drying. The layer was formed in a thickness of 0.4 µm and adjusted to have a green density of 0.65 using Sakura Densitometer.

<table>
<thead>
<tr>
<th>Deformable layer component</th>
<th>Elasticity modulus (kg/mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11) EVAFLEX 150 (ethylene-vinyl acetate resin with a vinyl acetate content of 14%; available from Mitsui Du Pont Polychemicals Co.)</td>
<td>2</td>
</tr>
<tr>
<td>12) JSR-RB830 (polybutadiene resin; available from Japan Synthetic Rubber Co., Ltd.)</td>
<td>10</td>
</tr>
</tbody>
</table>
(b) Deformable layers were provided by coating, using the following components having different melt viscosities (at 200°C). Layer thickness: 30 μm. The melt viscosity was measured using a flow tester manufactured by Shimadzu Corporation under conditions of an orifice diameter of 1 mm, an orifice length of 10 mm, a load of 10 kg/cm² and 200°C.

<table>
<thead>
<tr>
<th>Deformable layer component</th>
<th>Elasticity modulus (kg/mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>13) EVAFLEx 560 (ethylene-vinyl acetate resin with a vinyl acetate content of 14%; available from Mitsui Du Pont Polymers Co.)</td>
<td>10</td>
</tr>
<tr>
<td>14) CROWN BOND U-60 (Urethane resin; available from Takamatsu Yushi KK.)</td>
<td>20</td>
</tr>
<tr>
<td>15) HITECK S-3125 (ethylene-acrylic acid resin; available from Toho Chemical Industry Co., Ltd.)</td>
<td>20</td>
</tr>
<tr>
<td>16) JSR0617 (styrene-butadiene resin; available from Japan Synthetic Rubber Co., Ltd.)</td>
<td>30</td>
</tr>
<tr>
<td>17) DIANAL BR-102 (acrylic resin; available from Mitsubishi Rayon Co., Ltd.)</td>
<td>130</td>
</tr>
<tr>
<td>18) STYRON 666 (styrene resin; available from Asahi Chemical Industry Co., Ltd.)</td>
<td>330</td>
</tr>
<tr>
<td>19) STYRYL 767 (styrene-acrylonitrile resin; available from Asahi Chemical Industry Co., Ltd.)</td>
<td>350</td>
</tr>
</tbody>
</table>

(c) Deformable layers were provided by coating, using the following components having different glass transition temperatures. Layer thickness: 30 μm. The glass transition temperature was measured using BYBRON DDV-2, manufactured by Orientek Co., under conditions of applying a strain of 0.02% at 11 Hz. Measurement temperatures were set in the range of from -100 to 100°C, and a peak temperature of a storage elasticity modulus at 25°C measured when temperature was raised at a rate of 2°C/min was regarded as the glass transition temperature.

<table>
<thead>
<tr>
<th>Deformable layer component</th>
<th>Melt viscosity (cp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20) BYRON GV100 (polyester resin (available from Toyobo Co., Ltd.)</td>
<td>60</td>
</tr>
<tr>
<td>21) BYRON 500 (polyester resin (available from Toyobo Co., Ltd.)</td>
<td>700</td>
</tr>
<tr>
<td>22) BYRON 300 (polyester resin (available from Toyobo Co., Ltd.)</td>
<td>800</td>
</tr>
<tr>
<td>23) BYRON 200 (polyester resin (available from Toyobo Co., Ltd.)</td>
<td>3,000</td>
</tr>
<tr>
<td>24) EP-4969-1W (high melt viscosity ethylene-vinyl acetate resin available from Mitsui Du Pont Polymers Co.)</td>
<td>11,000</td>
</tr>
<tr>
<td>25) EP-4969-2W (high melt viscosity ethylene-vinyl acetate resin available from Mitsui Du Pont Polymers Co.)</td>
<td>20,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Deformable layer component</th>
<th>Glass transition temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>26) EVAFLEx A709 (ethylene-ethyl acrylate resin with an ethyl acrylate content of 35%; available from Mitsui Du Pont Polymers Co.)</td>
<td>-40</td>
</tr>
<tr>
<td>27) EVAFLEx 55030 (ethylene-vinyl acetate resin with a vinyl acetate content of 14%; available from Mitsui Du Pont Polymers Co.)</td>
<td>-35</td>
</tr>
<tr>
<td>28) JSR-RB820 (polybutadiene resin; available from Japan Synthetic Rubber Co., Ltd.)</td>
<td>-12</td>
</tr>
<tr>
<td>29) BYRON 500 (polyester resin; available from Toyobo Co., Ltd.)</td>
<td>4</td>
</tr>
<tr>
<td>30) HITECK S-3125 (ethylene-acrylic acid resin; available from Toho Chemical Industry Co., Ltd.)</td>
<td>19</td>
</tr>
<tr>
<td>31) DIANAL BR-102 (acrylic resin; available from Mitsubishi Rayon Co., Ltd.)</td>
<td>20</td>
</tr>
<tr>
<td>32) BYRON 103 (polyester resin; available from Toyobo Co., Ltd.)</td>
<td>47</td>
</tr>
<tr>
<td>33) BYRON 200 (polyester resin; available from Toyobo Co., Ltd.)</td>
<td>67</td>
</tr>
</tbody>
</table>
Evaluation method:

Opposingly to an optical system capable of concentrating light of a semiconductor laser with a wavelength of 830 nm and set to give a power of 30 mW on the exposure surface and a 1/e² spot diameter of 10 μm, the light-heat converting type heat mode recording material and image receiving material, which were brought into vacuum contact with each other at 400 Torr against the drum, were rotated at a linear velocity of 95 cm/second to carry out transfer. As the pattern of exposure, a line pattern formed by continuous emission of light from the laser and a halftone dot pattern formed by connecting a halftone dot image forming machine separately made ready for use. In samples showing a good contact performance, recorded line width was thick and halftone dots were transferred in a shape faithful to the original shape.

The ink layer imagewise transferred to the image receiving material, after its transmission density at solid areas on the image receiving material had been measured, was further transferred to art paper by passing the image receiving material through rubber rolls of a laminator set to operate under conditions of 3 kg/cm² and 150°C, putting face-to-face the surface of the image receiving layer of the image receiving material and the art paper. Thereafter, transmission density of the ink remaining on the image receiving material and the shape of halftone dots on the art paper were observed. Results obtained are shown below.

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Transferred line width</th>
<th>Halftone dot shape</th>
<th>Solid area density</th>
<th>Halftone dot shape</th>
<th>Solid area density</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 (Y)</td>
<td>11</td>
<td>Good</td>
<td>0.62</td>
<td>Good</td>
<td>0.01</td>
</tr>
<tr>
<td>12 (*)</td>
<td>10</td>
<td>Good</td>
<td>0.64</td>
<td>Good</td>
<td>0.02</td>
</tr>
<tr>
<td>13 (*)</td>
<td>11</td>
<td>Good</td>
<td>0.61</td>
<td>Good</td>
<td>0.01</td>
</tr>
<tr>
<td>14 (*)</td>
<td>10</td>
<td>Good</td>
<td>0.60</td>
<td>Good</td>
<td>0.01</td>
</tr>
<tr>
<td>15 (*)</td>
<td>9</td>
<td>Good</td>
<td>0.60</td>
<td>Good</td>
<td>0.01</td>
</tr>
<tr>
<td>16 (*)</td>
<td>8</td>
<td>Good</td>
<td>0.59</td>
<td>Good</td>
<td>0.02</td>
</tr>
<tr>
<td>17 (*)</td>
<td>6</td>
<td>Good</td>
<td>0.55</td>
<td>Good</td>
<td>0.03</td>
</tr>
<tr>
<td>18 (X)</td>
<td>2-3</td>
<td>Poor</td>
<td>0.21</td>
<td>Poor</td>
<td>0.07</td>
</tr>
<tr>
<td>19 (*)</td>
<td>2-3</td>
<td>Poor</td>
<td>0.18</td>
<td>Poor</td>
<td>0.10</td>
</tr>
<tr>
<td>20 (Y)</td>
<td>10</td>
<td>Good</td>
<td>0.62</td>
<td>Good</td>
<td>0.01</td>
</tr>
<tr>
<td>21 (*)</td>
<td>11</td>
<td>Good</td>
<td>0.63</td>
<td>Good</td>
<td>0.01</td>
</tr>
<tr>
<td>22 (*)</td>
<td>10</td>
<td>Good</td>
<td>0.61</td>
<td>Good</td>
<td>0.01</td>
</tr>
<tr>
<td>23 (*)</td>
<td>10</td>
<td>Good</td>
<td>0.60</td>
<td>Good</td>
<td>0.02</td>
</tr>
<tr>
<td>24 (X)</td>
<td>1-2</td>
<td>Poor</td>
<td>0.19</td>
<td>Poor</td>
<td>0.05</td>
</tr>
<tr>
<td>25 (*)</td>
<td>2-3</td>
<td>Poor</td>
<td>0.15</td>
<td>Poor</td>
<td>0.04</td>
</tr>
<tr>
<td>26 (Y)</td>
<td>10</td>
<td>Good</td>
<td>0.61</td>
<td>Good</td>
<td>0.01</td>
</tr>
<tr>
<td>27 (*)</td>
<td>10</td>
<td>Good</td>
<td>0.61</td>
<td>Good</td>
<td>0.01</td>
</tr>
<tr>
<td>28 (*)</td>
<td>11</td>
<td>Good</td>
<td>0.62</td>
<td>Good</td>
<td>0.02</td>
</tr>
<tr>
<td>29 (*)</td>
<td>10</td>
<td>Good</td>
<td>0.60</td>
<td>Good</td>
<td>0.01</td>
</tr>
<tr>
<td>30 (*)</td>
<td>10</td>
<td>Good</td>
<td>0.61</td>
<td>Good</td>
<td>0.02</td>
</tr>
<tr>
<td>31 (Y)</td>
<td>10</td>
<td>Good</td>
<td>0.60</td>
<td>Good</td>
<td>0.01</td>
</tr>
<tr>
<td>32 (*)</td>
<td>9</td>
<td>Good</td>
<td>0.59</td>
<td>Good</td>
<td>0.03</td>
</tr>
</tbody>
</table>

Deformable layer component | Glass transition temperature (°C)
--- | ---
34) DIANAL BR-75 (acrylic resin; available from Mitsubishi Rayon Co., Ltd.) | 90
35) DIANAL BR-50 (acrylic resin; available from Mitsubishi Rayon Co., Ltd.) | 100
36) DIANAL BR-88 (acrylic resin; available from Mitsubishi Rayon Co., Ltd.) | 105
Example 6

A recording material was prepared in the same manner as in Example 5. Heat mode recording was carried out using this recording material and an image receiving material prepared to have a deformable layer varied as shown below. The penetration of the deformable layer was measured in the same manner as in Example 4. Deformable layers were all made to have a layer thickness of 30 μm. Results obtained are shown below.

### Example 6

#### Preparation of ink sheet:

On a base comprised of a 75 μm thick transparent PET (T-100; polyethylene terephthalate available from Diafoil Hoechst Ltd.) having been laminate-coated with EVA (P1407C, available form Mitsui Du Pont Polychemicals Co., Ltd.) in a thickness of 30 μm, a cushioning layer coating solution, a subbing layer coating solution, a light-heat converting layer coating solution and an ink layer coating solution each having the following composition were successively coated to form an ink sheet. In order to attain surface precision of the laminate coating, a 25 μm thick PET film...
was laminated to the base, and the base was used after the 25 \mu m thick PET film was peeled therefrom before the light-heat converting layer was formed. Upon the coating of the following cushioning layer coating solution, the surface precision was 0.2 \mu m in surface roughness Ra when the standard length was 2.5 mm and the cut-off value was 0.08 mm, and was 2.4 \mu m in Rmax when the standard length was 2.5 mm and the cut-off value was 8 mm.

**[0139]** In Examples, "part(s)" refers to part(s) by weight of component solid content. (Solvents are as such.)

<table>
<thead>
<tr>
<th>Cushioning layer coating solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyester (BYRON 200, available from Toyobo Co., Ltd.)</td>
</tr>
<tr>
<td>Ethyl acetate</td>
</tr>
<tr>
<td>Toluene</td>
</tr>
</tbody>
</table>

Coated so as to give a dried coating thickness of 5 \mu m.

<table>
<thead>
<tr>
<th>Subbing layer coating solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyester (PLUS COAT Z-446, available from Goo Chemical Col., Ltd.)</td>
</tr>
<tr>
<td>Ethanol</td>
</tr>
<tr>
<td>Water</td>
</tr>
</tbody>
</table>

Coated so as to give a dried coating thickness of 0.15 \mu m.

<table>
<thead>
<tr>
<th>Light-heat converting layer coating solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVA (CS06, polyvinyl alcohol available from Kuraray Co., Ltd.)</td>
</tr>
<tr>
<td>IR absorbing dye IR-1</td>
</tr>
<tr>
<td>Surface active agent (FT248, available from BASF Corp.)</td>
</tr>
<tr>
<td>Water</td>
</tr>
</tbody>
</table>

Coated so as to give a light absorbance of 1.0 at 830 nm. The dried layer thickness was about 0.25 \mu m.

<table>
<thead>
<tr>
<th>Ink layer coating solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magenta pigment MEK dispersion</td>
</tr>
<tr>
<td>Styrene-acrylate resin (SUPRAPAL WS, available from BASF Corp.)</td>
</tr>
<tr>
<td>EVA (EV40Y, available from Mitsui Du Pont Polychemicals)</td>
</tr>
<tr>
<td>DOP (dioclyl phthalate)</td>
</tr>
<tr>
<td>Fine particles (TOSPEARL 108, available from Toshiba Silicone Co., Ltd.)</td>
</tr>
<tr>
<td>Surface active agent (S-382, available from Asahi Glass Co., Ltd.)</td>
</tr>
<tr>
<td>MEK (methyl ethyl ketone)</td>
</tr>
<tr>
<td>Cyclohexanone</td>
</tr>
</tbody>
</table>

Coated so as to give a dried coating thickness of 0.4 \mu m.

Preparation of image receiving sheet:

**[0140]** On a base with a cushioning layer as used in the ink sheet (a base provided by coating with two cushioning layers), an image receiving layer was formed by coating polyester resin (PESRESIN S230, available from Takamatsu Yushi K.K.) so as to give a dried coating thickness of 1 \mu m.

Thermal transfer:

**[0141]** The ink layer of the above ink sheet and the image receiving layer of the image receiving sheet were put face-to-face and wound around the drum, which were then brought into vacuum contact at 200 Torr; followed by exposure to semiconductor laser light with an oscillation wavelength of 830 nm from the back of the ink sheet under conditions of 33 mW and 1/e² of 6 \mu m on the exposure surface. At sensitivity 200 mJ/mm², it was possible to perform transfer without uneven line width.
Example 8

Preparation of ink sheet:

On Nisshinbo synthetic paper (PEACH COAT WE110, available from Nisshinbo Industries, Inc.), a cushioning layer coating solution, a light-heat converting layer coating solution and an ink layer coating solution each having the following composition were successively coated to form an ink sheet.

Upon the coating of the cushioning layer coating solution on PEACH COAT WE110, the surface precision was 0.2 μm in surface roughness Ra when the standard length was 2.5 mm and the cut-off value was 0.08 mm, and was 1.2 μm in Rmax when the standard length was 2.5 mm and the cut-off value was 8 mm.

In Examples, "part(s)" refers to part(s) by weight of component solid content. (Solvents are as such.)

Coated so as to give a dried coating thickness of 5 μm.

The light-heat converting layer and the ink layer were formed in the same manner as in Example 7.

As an image receiving sheet, the same sheet as in Example 7 was used.

Thermal transfer:

Carried out in the same manner as in Example 7 except that exposure was applied from the back of the image receiving sheet. At sensitivity 200 mJ/mm², it was possible to perform transfer without uneven line width.

Example 9

Preparation of image receiving sheet:

On Nisshinbo synthetic paper (PEACH COAT WE110, available from Nisshinbo Industries, Inc.), a cushioning layer coating solution and an image receiving layer coating solution shown below were successively coated to form an image receiving sheet. In Examples, "part(s)" refers to part(s) by weight of component solid content.

Coated so as to give a dried coating thickness of 2 μm.

The surface precision was 0.2 μm in surface roughness Ra when the standard length was 2.5 mm and the cut-off value was 0.08 mm, and was 1.2 μm in Rmax when the standard length was 2.5 mm and the cut-off value was 8 mm.

Thermal transfer:

Carried out in the same manner as in Example 7. As a result, at sensitivity 180 mJ/mm², it was possible to perform transfer without uneven line width. The image thus obtained was put face-to-face to printing paper (Mitsubishi...
ingrain art paper), and further transferred thereto at a laminate temperature of 150°C. As a result, it was possible to transfer the ink on the image receiving layer by 100% together with the image receiving layer in the state of interfacial separation.

Comparative Example 1

Preparation of ink sheet:

[0151] On a base comprised of a 75 µm thick transparent PET (T-100; polyethylene terephthalate available from Diafoil Hoechst Ltd.) having been laminate-coated with EVA (P1407C, available from Mitsui Du Pont Polychemicals Co., Ltd.) in a thickness of 30 µm, the subbing layer coating solution, the light-heat converting layer coating solution and the ink layer coating solution each having the composition as shown in Example 7 were successively coated to form an ink sheet. In order to attain surface precision of the laminate coating, a 25 µm thick PET film was laminated to the base, and the base was used after the 25 µm thick PET film was peeled therefrom before the light-heat converting layer was formed. The surface precision on the surface of the laminate coating was 0.8 µm in surface roughness Ra when the standard length was 2.5 mm and the cut-off value was 0.08 mm, and was 3.5 µm in Rmax when the standard length was 2.5 mm and the cut-off value was 8 mm.

Thermal transfer:

[0152] Using the above ink sheet and the image receiving sheet prepared in Example 7, exposure was carried out in the same manner as in Example 7. As a result, uneveness occurred in line width and irregularity was seen in sensitivity. Solid transfer was also carried out by scanning exposure, whereupon uneven density due to laminate non-uniformity was caused when the rotational speed of the drum was increased.

Example 10

Preparation of ink sheet:

[0153] On a base comprised of a 75 µm thick transparent PET (T-100; polyethylene terephthalate available from Diafoil Hoechst Ltd.), a cushioning layer coating solution, a intermediate layer coating solution, a light-heat converting layer coating solution and an ink layer coating solution each having the following composition were successively coated to form an ink sheet. The solutions were coated by wire bar coating. In the following, "part(s)" refers to part(s) by weight of component solid content. (Solvents are as such.)

<table>
<thead>
<tr>
<th>Cushioning layer coating solution</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyester (BYRON 200, available from Toyobo Co., Ltd.)</td>
<td>30 parts</td>
</tr>
<tr>
<td>Surface active agent (FC-431, available from Sumitomo 3M Limited.)</td>
<td>0.3 part</td>
</tr>
<tr>
<td>Ethyl acetate</td>
<td>56 parts</td>
</tr>
<tr>
<td>Toluene</td>
<td>14 parts</td>
</tr>
</tbody>
</table>

Coated so as to give a dried coating thickness of 5 µm.

<table>
<thead>
<tr>
<th>Intermediate layer coating solution</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyester (PLUS COAT Z-446, available from Goo Chemical Co., Ltd.)</td>
<td>5 parts</td>
</tr>
<tr>
<td>Ethanol</td>
<td>50 parts</td>
</tr>
<tr>
<td>Water</td>
<td>50 parts</td>
</tr>
</tbody>
</table>

Coated so as to give a dried coating thickness of 0.15 µm.

<table>
<thead>
<tr>
<th>Light-heat converting layer coating solution</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gelatin</td>
<td>64 parts</td>
</tr>
<tr>
<td>Saponin</td>
<td>3 parts</td>
</tr>
<tr>
<td>Citric acid</td>
<td>0.5 part</td>
</tr>
</tbody>
</table>
Light-heat converting layer coating solution

<table>
<thead>
<tr>
<th>Component</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glyoxal (hardening agent)</td>
<td>0.3 part</td>
</tr>
<tr>
<td>Sodium acetate</td>
<td>3 parts</td>
</tr>
<tr>
<td>IR absorbing dye IR-1</td>
<td>30 parts</td>
</tr>
<tr>
<td>Water</td>
<td>93.0 parts</td>
</tr>
</tbody>
</table>

IR-1

\[
\text{CH}_3 \text{CH}_3 \\
\text{N} - (\text{CH}=\text{CH})_3 \text{CH} = \text{N} \\
(\text{CH}_2)_3 \text{SO}_3^- \\
(\text{CH}_2)_3 \text{SO}_3 \text{Na}
\]

\[\lambda_{\text{max}} \text{ 740 nm (MeOH)}\]

This solution was coated so as to give a light absorbance of 1.0 at 830 nm. The dried layer thickness was about 0.25 μm.

Ink layer coating solution

<table>
<thead>
<tr>
<th>Component</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magenta pigment MEK dispersion</td>
<td>40 parts</td>
</tr>
<tr>
<td>Styrene-acrylate resin (SBM100, available from Sanyo Kasei Co.)</td>
<td>48 parts</td>
</tr>
<tr>
<td>EVA (EV40Y, available from Mitsui Du Pont Polymers Co., Ltd.)</td>
<td>5 parts</td>
</tr>
<tr>
<td>DOP (dioctyl phthalate)</td>
<td>3 parts</td>
</tr>
<tr>
<td>Fine particles (TOSPEARL 108, available from Toshiba Silicone Co., Ltd.)</td>
<td>3 parts</td>
</tr>
<tr>
<td>Surface active agent (S-382, available from Asahi Glass Co., Ltd.)</td>
<td>1 part</td>
</tr>
<tr>
<td>MEK (methyl ethyl ketone)</td>
<td>1,900 parts</td>
</tr>
<tr>
<td>Cyclohexanone</td>
<td>100 parts</td>
</tr>
</tbody>
</table>

Coated so as to give a dried coating thickness of 0.4 μm.

Preparation of image receiving sheet:

On a base comprised of a 75 μm thick transparent PET (T-100; ditto) having been laminate-coated with EVA (P1407C, ditto) in a thickness of 30 μm, an image receiving layer coating solution with the following composition was coated so as to give a dried coating thickness of 1 μm. An image receiving sheet was thus prepared.

Image receiving layer coating solution

<table>
<thead>
<tr>
<th>Component</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Styrene-acrylate resin (SBM100, available from Sanyo Kasei Co.)</td>
<td>92 parts</td>
</tr>
<tr>
<td>EVA (EV40Y, available from Mitsui Du Pont Polymers Co., Ltd.)</td>
<td>5 parts</td>
</tr>
<tr>
<td>Fine particles (TOSPEARL 108, available from Toshiba Silicone Co., Ltd.)</td>
<td>3 parts</td>
</tr>
<tr>
<td>MEK (methyl ethyl ketone)</td>
<td>700 parts</td>
</tr>
<tr>
<td>Cyclohexanone</td>
<td>200 parts</td>
</tr>
</tbody>
</table>

Thermal transfer:

The ink layer of the above ink sheet and the image receiving layer of the image receiving sheet were put face-to-face and the sheets were wound around the drum, which were then brought into vacuum contact at 200 Torr, followed by exposure to semiconductor laser light with an oscillation wavelength of 830 nm under conditions of 33 mW and \(1/e^2\).
of 6 μm on the exposure surface. Then the ink sheet was peeled from the image receiving sheet. As a result, at sensitivity 200 mJ/cm², it was possible to perform transfer. This image was free from adhesion of the light-heat converting layer and entirely free from color turbidity. This image was further transferred to art paper at a laminate temperature of 150°C. As a result, it was possible to transfer it together with the image receiving layer.

Comparative Example 2

Example 10 was repeated except that the intermediate layer was not provided. As a result, there was little change in sensitivity, but, because of non-uniformity of the image receiving layer cushioning layer, portions showing a poor contact performance with respect to the ink sheet and portions having a strong laser light intensity (the beam center) caused scattering of the light-heat converting layer to cause color turbidity. When the ink sheet was peeled from the image receiving layer, it was non-uniformly separated, so that the light-heat converting layer was separated from the cushioning layer to cause color turbidity.

Claims

1. Light-heat converting type heat mode recording process using a recording material (3) and an image receiving material (4), the recording material (3) comprising a support having thereon a light-heat converting layer (13) and an ink layer (14) in this order, and the image receiving material (4) comprising a support having thereon an image receiving layer (23), the process comprising the steps of:

   (a) contacting the surface of the ink layer (14) with the surface of the image receiving layer (23),
   (b) exposing the recording material (3) to light corresponding with image information,
   (c) transferring a portion of the ink layer (14) corresponding to the image information as an ink image from the recording material (3) to the image receiving layer (23) of the image receiving material (4),

wherein at least one of the recording material (3) and the image receiving material (4) comprises a deformable layer (22), and the deformable layer is different from the light-heat converting layer.

2. The process of claim 1, characterized in that the ink image is transferred from the image receiving material (4) to a final recording medium by applying heat or pressure.

3. The process of claim 1 or 2, characterized in that the contacting is carried out by reducing the pressure between both materials by means of a suction pump.

4. The process of one of claims 1 to 3, characterized in that at least one of the ink layer (14) and the image receiving layer (23) contains a matting agent.

5. The process of one of claims 1 to 4, characterized in that at least one of the ink layer (14) and the image receiving layer (23) contains a matting agent having a particle diameter of 1 to 20 μm.

6. The process of one of claims 1 to 5, characterized in that the deformable layer (22) has a glass transition temperature of 80°C or below.

7. The process of one of claims 1 to 6, characterized in that the deformable layer (22) has a penetration of 15 or more.

8. The process of one of claims 1 to 7, characterized in that the deformable layer of the recording sheet has an elasticity modulus of 250 kg/mm² or less at 25°C.

9. The process of one of claims 1 to 8, characterized in that the deformable layer of the recording material has a layer thickness of at least 5 μm or 10 μm or 20 μm.

10. The process of one of claims 1 to 9, characterized in that the deformable layer (22) of the image receiving material has an elasticity modulus of 200 kg/mm² or less at 25°C.

11. The process of one of claims 1 to 10, characterized in that the deformable layer (22) of the image receiving material has a viscosity of 10000 cp. or less at 20°C.
12. The process of one of claims 1 to 11, characterized in that a colorant capable of absorbing heat is contained in
the ink layer.

13. The process of one of claims 1 to 12, characterized in that the recording material (3) is to be exposed to light from
its rear side.

14. The process of one of claims 1 to 13, characterized in that a colour proofing final recording medium is produced.

15. The process of one of claims 1 to 14, characterized in that the binder in the ink layer includes thermomelting
substance or thermosoftening substance or thermoplastic resin.

16. The process of one of claims 1 to 15, characterized in that the deformable layer has a glass transition temperature
of -100°C to 80°C.

17. The process of one of claims 1 to 16, characterized in that the recording material (3) comprises the deformable
layer, and that the transmittance of light through the support and the deformable layer of the recording material
with respect to the wavelength of the exposing light is not less than 70%.

18. The process of one of claims 1 to 17, characterized in that the recording material (3) comprises the deformable
layer, and that the deformable layer of the recording material has a refractive index smaller by at least 0.1 than
the refractive index of the support of the recording material.

19. Light-heat converting type heat mode recording system, comprising a recording material (3) and an image receiving
material (4), the recording material (3) having a support (15) and thereon a light-heat converting layer (13) and an
ink layer (14) in this order, and the image receiving material (4) having a support (24) and an image receiving layer
(23) thereon, wherein at least one of the recording material and the image receiving material comprises a deform-
able layer (22), and the deformable layer is different from the light-heat converting layer.

20. The recording system of claim 19, characterized in that the ink of the ink layer (14) is a heat-meltable ink transference
to a final recording medium by applying heat or pressure.

21. The recording system of claim 20 or 21, characterized in that at least one of the ink layer (14) and the image
receiving layer (23) contains a matting agent on its surface.

22. The recording system of claim 21, characterized in that the matting agent comprises of particles having a diameter
of 1 to 20 μm.

23. The recording system of one of claims 19 to 22, characterized in that the deformable layer (22) has a glass transition
temperature of 80°C or below.

24. The recording system of one of claims 19 to 23, characterized in that the deformable layer (22) has a penetration
of 15 or more.

25. The recording system of one of claims 19 to 24, characterized in that the deformable layer of the recording material
(3) has an elasticity modulus of 250 kg/mm² or less at 25°C.

26. The recording system of one of claims 19 to 25, characterized in that the deformable layer of the recording material
(3) has a layer thickness of at least 5 μm or 10 μm or 20 μm.

27. The recording system of one of claims 19 to 26, characterized in that the deformable layer (22) of the image
receiving material (4) has an elasticity modulus of 200 kg/mm² or less at 25°C.

28. The recording system of one of claims 19 to 27, characterized in that the deformable layer (22) of the image
receiving material (4) has a viscosity of 10000 cp. or less at 20°C.

29. The recording system of one of claims 19 to 28, characterized in that the ink layer (14) of the recording material
(3) contains a colorant which is capable of absorbing heat.
30. The recording system of one of claims 19 to 29, characterized in that the recording material (3) comprises the support (15), an intermediate layer (11), the deformable layer (22), the light-heat converting layer (13) and the ink layer (14) in that order.

31. The recording system of one of claims 19 to 30, characterized in that the image receiving material (4) comprises the support (24), an intermediate layer (21), the deformable layer (22) and the image receiving layer (23) in that order.

32. The recording system of one of claims 19 to 31, characterized in that the binder in the ink layer includes thermomelting substance or thermosoftening substance or thermoplastic resin.

33. The recording system of one of claims 19 to 32, characterized in that the recording material (3) comprises the deformable layer and that the transmittance of light through the support and the deformable layer of the recording material with respect to the wavelength of the exposing light is not less than 70%.

34. The recording system of one of claims 19 to 33, characterized in that the recording material (3) comprises the deformable layer and that the deformable layer of the recording material has a refractive index smaller by at least 0.1 than the refractive index of the support of the recording material.

Patentansprüche

1. Licht in Wärme umwandelndes, wärmemäßiges Aufzeichnungsverfahren unter Verwendung eines Aufzeichnungsmaterials (3) und eines Bildaufnahmematerials (4), wobei das Aufzeichnungsmaterial (3) eine Unterlage aufweist, auf welcher eine Licht in Wärme umwandelnde Schicht (13) und eine Farbschicht (14) in dieser Reihenfolge angeordnet sind, und das Bildaufnahmematerial (4) eine Unterlage mit einer darauf angeordneten Bildaufnahmeschicht (23) aufweist, wobei das Verfahren die Schritte umfaßt:

   a) Zusammenfügen der Fläche der Farbschicht (14) und der Fläche der Bildaufnahmeschicht (23),
   b) Bestrahlung des Aufzeichnungsmaterials (3) mit Licht entsprechend den Bildinformationen,
   c) Übertragung eines Bereiches der Farbschicht (14) entsprechend den Bildinformationen als ein Druckbild von dem Aufzeichnungsmaterial (3) auf die Bildaufnahmeschicht (23) des Bildaufnahmematerials (4),

wobei wenigstens eines des Aufzeichnungsmaterials (3) und des Bildaufnahmematerials (4) eine verformbare Schicht (22) aufweist, und die verformbare Schicht sich von der Licht in Wärme umwandelnden Schicht unterscheidet.


3. Verfahren gemäß Anspruch 1 oder 2, dadurch gekennzeichnet, daß das Zusammenfügen durch Verminderung des Druckes zwischen beiden Materialien mittels einer Saugpumpe durchgeführt wird.

4. Verfahren gemäß einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß wenigstens eine der Farbschicht (14) oder der Bildaufnahmeschicht (23) ein Mattierungsmittel enthält.

5. Verfahren gemäß einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß wenigstens eine der Farbschicht (14) und der Bildaufnahmeschicht (23) ein Mattierungsmittel mit einem Partikeldurchmesser von 1 bis 20 μm enthält.

6. Verfahren gemäß einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß die verformbare Schicht (22) eine Einfriertemperatur von 80° C oder niedriger aufweist.

7. Verfahren gemäß einem der Ansprüche 1 bis 6, dadurch gekennzeichnet, daß die verformbare Schicht (22) eine Eindringtiefe von 15 oder mehr aufweist.

8. Verfahren gemäß einem der Ansprüche 1 bis 7, dadurch gekennzeichnet, daß die verformbare Schicht des Aufzeichnungsblattes ein Elastizitätsmodul von 250 kg/mm² oder weniger bei 25°C aufweist.
9. Verfahren gemäß einem der Ansprüche 1 bis 8, dadurch gekennzeichnet, daß die verformbare Schicht des Aufzeichnungsmaterials eine Schichtdicke von wenigstens 5 μm oder 10 μm oder 20 μm aufweist.

10. Verfahren gemäß einem der Ansprüche 1 bis 9, dadurch gekennzeichnet, daß die verformbare Schicht (22) des Bildaufnahmematerials ein Elastizitätsmodul von 200 kg/mm² oder weniger bei 25°C aufweist.

11. Verfahren gemäß einem der Ansprüche 1 bis 10, dadurch gekennzeichnet, daß die verformbare Schicht (22) des Bildaufnahmematerials eine Viskosität von 10000 cp oder weniger bei 20°C aufweist.

12. Verfahren gemäß einem der Ansprüche 1 bis 11, dadurch gekennzeichnet, daß ein Färbemittel, welches in der Lage ist Wärme zu absorbieren, in der Farbschicht enthalten ist.

13. Verfahren gemäß einem der Ansprüche 1 bis 12, dadurch gekennzeichnet, daß das Aufzeichnungsmaterial (3) von seiner Rückseite mit Licht zu bestrahlen ist.

14. Verfahren gemäß einem der Ansprüche 1 bis 13, dadurch gekennzeichnet, daß ein Farbanduck-Endaufzeichnungsmedium hergestellt wird.

15. Verfahren gemäß einem der Ansprüche 1 bis 14, dadurch gekennzeichnet, daß das Bindeflüssigkeitsmaterial in der Farbschicht wärmeschmelzende Substanzen oder wärmeaufweichende Substanzen oder thermoplastische Harze enthält.

16. Verfahren gemäß einem der Ansprüche 1 bis 15, dadurch gekennzeichnet, daß die verformbare Schicht eine Einfriertemperatur von -100°C bis 80°C aufweist.

17. Verfahren gemäß einem der Ansprüche 1 bis 16, dadurch gekennzeichnet, daß das Aufzeichnungsmaterial (3) die verformbare Schicht aufweist, und daß die Lichtübertragung durch die Unterlage und die verformbare Schicht des Aufzeichnungsmaterials bezüglich der Wellenlänge des Bestrah lungslichtes nicht weniger als 70% beträgt.

18. Verfahren gemäß einem der Ansprüche 1 bis 17, dadurch gekennzeichnet, daß das Aufzeichnungsmaterial (3) die verformbare Schicht aufweist, und daß die verformbare Schicht des Aufzeichnungsmaterials einen um wenigstens 0,1 kleineren Brechungsindex als der Brechungsindex der Unterlage des Aufzeichnungsmaterials aufweist.

19. Licht in Wärme umwandelndes, wärmemäßiges Aufzeichnungssystem mit einem Aufzeichnungsmaterial (3) und einem Bildaufnahmematerial (4), wobei das Aufzeichnungsmaterial (3) eine Unterlage (15) aufweist, auf welcher eine Licht in Wärme umwandelnde Schicht (13) und eine Farbschicht (14) in dieser Reihenfolge darauf angeordnet sind, und das Bildaufnahmematerial (4) eine Unterlage (24) mit einer darauf angeordneten Bildaufnahmeschicht (23) aufweist, wobei wenigstens eines des Aufzeichnungsmaterials und des Bildaufnahmematerials eine verformbare Schicht (22) aufweist, und die verformbare Schicht sich von der Licht in Wärme umwandelnden Schicht unterscheidet.

20. Aufzeichnungssystem gemäß Anspruch 19, dadurch gekennzeichnet, daß die Druckfarbe der Farbschicht (14) eine wärmeschmelzende Farbe ist, die durch Anwendung von Wärme oder Druck auf ein Endaufzeichnungsmedium übertragbar ist.

21. Aufzeichnungssystem gemäß Anspruch 19 oder 20, dadurch gekennzeichnet, daß wenigstens eine der Farbschicht (14) und der Bildaufnahmeschicht (23) ein Mattierungsmittel auf ihrer Oberfläche enthält.

22. Aufzeichnungssystem gemäß Anspruch 21, dadurch gekennzeichnet, daß das Mattierungsmittel aus Partikeln mit einem Durchmesser von 1 bis 20 μm besteht.

23. Aufzeichnungssystem gemäß einem der Ansprüche 19 bis 22, dadurch gekennzeichnet, daß die verformbare Schicht (22) eine Einfriertemperatur von 80°C oder weniger aufweist.


25. Aufzeichnungssystem gemäß einem der Ansprüche 19 bis 24, dadurch gekennzeichnet, daß die verformbare Schicht des Aufzeichnungsmaterials (3) ein Elastizitätsmodul von 250 kg/mm² oder weniger bei 25°C aufweist.
26. Aufzeichnungssystem gemäß einem der Ansprüche 19 bis 25, dadurch gekennzeichnet, daß die verformbare Schicht des Aufzeichnungsmaterials (3) eine Schichtdicke von wenigstens 5 μm oder 10 μm oder 20 μm aufweist.

27. Aufzeichnungssystem gemäß einem der Ansprüche 19 bis 26, dadurch gekennzeichnet, daß die verformbare Schicht (22) des Bildaufnahmematerials (4) ein Elastizitätsmodul von 200 kg/mm² oder weniger bei 25°C aufweist.

28. Aufzeichnungssystem gemäß einem der Ansprüche 19 bis 27, dadurch gekennzeichnet, daß die verformbare Schicht (22) des Bildaufnahmematerials (4) eine Viskosität von 10000 cp oder weniger bei 20°C aufweist.

29. Aufzeichnungssystem gemäß einem der Ansprüche 19 bis 28, dadurch gekennzeichnet, daß die Farbschicht (14) des Aufzeichnungsmaterials (3) ein Färbemittel enthält, welches in der Lage ist Wärme zu absorbieren.

30. Aufzeichnungssystem gemäß einem der Ansprüche 19 bis 29, dadurch gekennzeichnet, daß das Aufzeichnungsmaterial (3) die Unterlage (15), eine Zwischenschicht (11), die verformbare Schicht (22), die Licht in Wärme umwandelnde Schicht (13) und die Farbschicht (14) in dieser Reihenfolge aufweist.

31. Aufzeichnungssystem gemäß einem der Ansprüche 19 bis 30, dadurch gekennzeichnet, daß das Bildaufnahmematerial (4) die Unterlage (24), eine Zwischenschicht (21), die verformbare Schicht (22) und die Bildaufnahmeschicht (23) in dieser Reihenfolge aufweist.

32. Aufzeichnungssystem gemäß einem der Ansprüche 19 bis 31, dadurch gekennzeichnet, daß das Bindemittel in der Farbschicht wärmeschmelzende Substanzen oder wärmeaufweichende Substanzen oder thermoplastische Harze enthält.

33. Aufzeichnungssystem gemäß einem der Ansprüche 19 bis 32, dadurch gekennzeichnet, daß das Aufzeichnungsmaterial (3) die verformbare Schicht aufweist, und daß die Lichtübertragung durch die Unterlage und die verformbare Schicht des Aufzeichnungsmaterials bezüglich der Wellenlänge des Bestrahlungslichtes nicht weniger als 70% beträgt.

34. Aufzeichnungssystem gemäß einem der Ansprüche 19 bis 33, dadurch gekennzeichnet, daß das Aufzeichnungsmaterial (3) die verformbare Schicht aufweist, und daß die verformbare Schicht des Aufzeichnungsmaterials einen um wenigstens 0,1 kleineren Brechungsindex als der Brechungsindex der Unterlage des Aufzeichnungsmaterials aufweist.

Revendications

1. Procédé thermique d'enregistrement avec conversion de la lumière en chaleur utilisant une matière d'enregistrement (3) et une matière de réception d'image (4), la matière d'enregistrement (3) comprenant un support, sur lequel une couche de conversion de la lumière en chaleur (13) et une couche d'encre (14) sont disposées dans cet ordre, et la matière de réception d'image (4) comprenant un support, sur lequel une couche de réception d'image (23) est disposée, le procédé comprenant les étapes de:

   a) contacter la surface de la couche d'encre (14) avec la surface de la couche de réception d'image (23),
   b) exposer la matière d'enregistrement (3) à la lumière correspondant aux informations d'image,
   c) transférer une partie de la couche d'encre (14) correspondant aux informations d'image comme une image d'encre de la matière d'enregistrement (3) à la couche de réception d'image (23) de la matière de réception d'image,

   dans lequel au moins l'une de la matière d'enregistrement (3) et de la matière de réception d'image (4) comprend une couche déformable (22), et la couche déformable est différente de la couche de conversion de la lumière en chaleur.

2. Procédé selon la revendication 1, caractérisé en ce que l'image d'encre est transférée de la matière de réception d'image (4) à un moyen final d'enregistrement en appliquant de la chaleur ou de la pression.

3. Procédé selon la revendication 1 ou 2, caractérisé en ce que la mise en contact est réalisée par réduction de pression entre les deux matières par moyen d'une pompe aspirante.
4. Procédé selon l'une des revendications 1 à 3, caractérisé en ce qu'au moins l'une de la couche d'encre (14) et de la couche de réception d'image (23) contient un agent de mise au mat.

5. Procédé selon l'une des revendications 1 à 4, caractérisé en ce qu'au moins l'une de la couche d'encre (14) et de la couche de réception d'image (23) contient un agent de mise au mat comprenant un diamètre de particle de 1 à 10 µm.

6. Procédé selon l'une des revendications 1 à 5, caractérisé en ce que la couche déformable (22) a une température de solidification de 80°C ou moins.

7. Procédé selon l'une des revendications 1 à 6, caractérisé en ce que la couche déformable (22) a une pénétration de 15 ou plus.

8. Procédé selon l'une des revendications 1 à 7, caractérisé en ce que la couche déformable de la feuille d'enregistrement a un module d'élasticité de 250 kg/mm² ou moins à 25°C.

9. Procédé selon l'une des revendications 1 à 8, caractérisé en ce que la couche déformable de la matière d'enregistrement a une épaisseur de couche d'au moins 5 µm ou 10 µm ou 20 µm.

10. Procédé selon l'une des revendications 1 à 9, caractérisé en ce que la couche déformable (22) de la matière de réception d'image a une module d'élasticité de 200 kg/mm² ou moins à 25°C.

11. Procédé selon l'une des revendications 1 à 10, caractérisé en ce que la couche déformable (22) de la matière de réception d'image a une viscosité de 1000 cp ou moins à 20°C.

12. Procédé selon l'une des revendications 1 à 11, caractérisé en ce qu'un colorant, qui est capable d'absorber de la chaleur, est contenu dans la couche d'encre.

13. Procédé selon l'une des revendications 1 à 12, caractérisé en ce que la matière d'enregistrement (3) doit être exposée à la lumière à partir de sa face arrière.

14. Procédé selon l'une des revendications 1 à 13, caractérisé en ce qu'un moyen final d'enregistrement d'épreuve en couleurs est fabriqué.

15. Procédé selon l'une des revendications 1 à 14, caractérisé en ce que l'agent liant dans la couche d'encre comprend des substances thermofondantes ou des substances thermoamollantes ou des résines thermoplastiques.

16. Procédé selon l'une des revendications 1 à 15, caractérisé en ce que la couche déformable a une température de solidification de -100°C à 80°C.

17. Procédé selon l'une des revendications 1 à 16, caractérisé en ce que la matière d'enregistrement (3) coud la couche déformable, et que la transmission de lumière à travers du support et de la couche déformable de la matière d'enregistrement par rapport à la longueur d'onde de la lumière exposante ne reste pas au-dessous de 70%.

18. Procédé selon l'une des revendications 1 à 17, caractérisé en ce que la matière d'enregistrement (3) comprend la couche déformable, et que la couche déformable de la matière d'enregistrement a un indice de réfraction qui est plus petit d'au moins 0,1 que l'indice de réfraction du support de la matière d'enregistrement.

19. Système d'enregistrement thermique avec conversion de la lumière en chaleur comprenant une matière d'enregistrement (3) et une matière de réception d'image (4), la matière d'enregistrement (3) comprenant un support (15), sur lequel une couche de conversion de la lumière en chaleur (13) et une couche d'encre (14) sont disposées dans cet ordre, et la matière de réception d'image (4) comprenant un support (24), sur lequel une couche de réception d'image (23) est disposée, dans lequel au moins l'une de la matière d'enregistrement (3) et de la matière de réception d'image (4) comprend une couche déformable (22), et la couche déformable est différente de la couche de conversion de la lumière en chaleur.

20. Système d'enregistrement selon la revendication 19, caractérisé en ce que l'encre de la couche d'encre est une encre fondante à chaud et transférable à un moyen final d'enregistrement en appliquant de la chaleur ou de la
21. Système d'enregistrement selon la revendication 19 ou 20, caractérisé en ce qu'au moins l'une de la couche d'encre (14) et de la couche de réception d'image (23) contient un agent de mise au mat sur sa surface.

22. Système d'enregistrement selon la revendication 21, caractérisé en ce que l'agent de mis au mat comprend des particules d'un diamètre de 1 à 20 μm.

23. Système d'enregistrement selon l'une des revendications 19 à 22, caractérisé en ce que la couche déformable (22) a une température de solidification de 80°C ou moins.

24. Système d'enregistrement selon l'une des revendications 19 à 23, caractérisé en ce que la couche déformable (22) a une pénétration de 15 ou plus.

25. Système d'enregistrement selon l'une des revendications 19 à 24, caractérisé en ce que la couche déformable de la matière d'enregistrement (3) a un module d'élasticité de 250 kg/mm² ou moins à 25°C.

26. Système d'enregistrement selon l'une des revendications 19 à 25, caractérisé en ce que la couche déformable de la matière d'enregistrement (3) a une épaisseur de couche d'au moins 5 μm ou 10 μm ou 20 μm.

27. Système d'enregistrement selon l'une des revendications 19 à 26, caractérisé en ce que la couche déformable (22) de la matière de réception d'image (4) a un module d'élasticité de 200 kg/mm² ou moins à 25°C.

28. Système d'enregistrement selon l'une des revendications 19 à 27, caractérisé en ce que la couche déformable (22) de la matière de réception d'image (4) a une viscosité de 1000 cp ou moins à 20°C.

29. Système d'enregistrement selon l'une des revendications 19 à 28, caractérisé en ce que la couche d'encre (14) de la matière d'enregistrement (3) contient un colorant, qui est capable d'absorber la chaleur.

30. Système d'enregistrement selon l'une des revendications 19 à 29, caractérisé en ce que la matière d'enregistrement (3) comprend le support (15), une couche intermédiaire (il), la couche déformable (22), la couche de conversion de la lumière en chaleur (13) et la couche d'encre (14) dans cet ordre.

31. Système d'enregistrement selon l'une des revendications 19 à 30, caractérisé en ce que la matière de réception d'image (4) comprend le support (24), une couche intermédiaire (21), la couche déformable (22) et la couche de réception d'image (23) dans cet ordre.

32. Système d'enregistrement selon l'une des revendications 19 à 31, caractérisé en ce que l'agent liant dans la couche d'encre comprend des substances thermofondantes ou des substances thermo-amollantes ou des résines thermodéplastiques.

33. Système d'enregistrement selon l'une des revendications 19 à 32, caractérisé en ce que la matière d'enregistrement (3) comprend la couche déformable, et que la transmission de lumière à travers du support et de la couche déformable de la matière d'enregistrement par rapport à la longueur d'onde de la lumière exposante ne reste pas au-dessous de 70%.

34. Système d'enregistrement selon l'une des revendications 19 à 33, caractérisé en ce que la matière d'enregistrement (3) comprend la couche déformable, et que la couche déformable de la matière d'enregistrement a un indice de réfraction qui est plus petit d'au moins 0.1 que l'indice de réfraction du support de la matière d'enregistrement.
FIG. 6

HEAT MODE RECORDING MATERIAL

HEAT MODE IMAGE RECEIVING MATERIAL

MATTING AGENT
FIG. 7

1. RACK FOR MEASUREMENT OF PENETRATION
2. DIAL GAUGE
3. HOLDER
4. CLAMP
5. WEIGHT
6. GLASS BEAKER
7. NEEDLE
8. SAMPLE CONTAINER
9. THREE-LEGGED METAL STAND
10. TESTING PEDESTAL
FIG. 8a

Approx. 32mm

40~45mm

d=3.2±0.02mm

d=1.00~1.02mm

842'~942'

50±1mm

FIG. 8b

d=1.00~1.02mm

842'~942'

5.0~5.8mm

5.9~6.7mm