Description

The present invention relates to an ink sheet for thermal transfer recording. Particularly, it relates to an ink composition which forms a coloring material layer (ink layer) of such an ink sheet.

An ink sheet for thermal transfer recording comprises a support such as paper or plastic film and a coloring material layer applied thereon and printing is carried out by fusing a solid ink and transferring the fused ink to a recording paper. The heating is carried out by the use of a heating element either from the coloring material-coated surface of the sheet via paper or from the other surface (i.e., coloring material-uncoated surface) thereof. Alternatively, it may be carried out by applying an electric current to a resistant layer formed in an ink sheet. The coloring material layer is composed of a composition comprising a heat-fusible material and a pigment or dyestuff as a coloring material.

For example, carnauba wax or paraffin wax is generally used as the heat-fusible material, while polyethylene terephthalate film or polycarbonate film excellent in surface smoothness and dimensional stability is generally sued as the support.

Transfer of an image from an ink sheet for thermal transfer recording to paper or the like is generally carried out with a thermal transfer printer having a thermal head and it is preferred in this transfer that the heat energy required for printing be as low as possible, because a decrease in heat energy required for printing serves not only to shorten the heating-cooling cycle time of the head to thereby accelerate printing and protect the head from thermal deterioration, but also to miniaturize the electric source of a line printer. Further, the decrease can make up a deficiency in heat resistance of base film. However, when an ink sheet containing a low-melting ink composition. is used in printing upon a paper with the purpose of enhancing transfer sensitivity, a non-image area of the paper is stained with low-melting components of the wax contained in the ink and the fixability and fastness of a printing are lowered. Further, when an ambient temperature increases during the storage of the ink sheet, the sheet causes so-called blocking. Thus, it is difficult in fact to reduce the heat energy required for printing.

To solve the above problems, addition of various thermo-plastic polymers to ink compositions has been attempted. For example, processes characterized by the addition of polyethylene wax (Japanese Patent Laid-Open No. 101094/1983), ethylene-alkyl acrylate copolymer (Japanese Patent Laid-Open No. 120092/1985) and 1,2-polybutadiene (Japanese Patent Laid-Open No. 127193/1985) are disclosed to allow low-energy printing without staining a non-image area. All of these processes are characterized by using a composition comprising a low-melting wax as a main component and a thermoplastic resin as an additive and aim at enhancing the film strength and preventing a non-image area from being stained by the network structure of the resin. Therefore, the performance of the sheet obtained by these processes has a limit.

The inventors of the present invention have studied to solve the above problems and have found that an ink composition which can form a fast coating film, exhibits a high transfer sensitivity enough to carry out low-energy printing and does not stain a non-image area can be obtained by using an ester oligomer having a specified melting point and a specified molecular weight as a main component of the heat-fusible material of the ink composition.

The invention provides an ink sheet for the thermal transfer recording which comprises a base layer coated with an ink layer, said ink layer comprising a colouring material and/or an inorganic or organic fine powder and a heat-fusible material containing 40 or more percent by weight of an ester oligomer having a number-average molecular weight of 500 to 6,000 and a melting point of 60 to 110 °c.

According to the present invention, the above object is attained by using an ester oligomer having a melting point of 60 to 110 °C and a number-average molecular weight of 500 to 6000. Therefore, the present invention is different in this point from the process of the prior art characterized by using a composition comprising a heat-fusible material (for example, wax) having a low melting point which serves to allow low-energy printing as a main component and a small amount of a high-melting thermoplastic resin which serves to prevent a non-image area from being stained with the low-melting material.

The ink sheet according to the present invention comprises a support and a coloring material layer containing a heat-fusible material applied thereon, wherein said heat-fusible material contains at least 40% by weight of the above ester oligomer to thereby attain the above object. If the ester oligomer content is less than 40% by weight, the obtained ink sheet will not exhibit high transfer sensitivity inherent in the ester oligomer.

The ink sheet for thermal transfer recording according to the present invention comprises a base film as a support and at least one coloring material layer applied thereon and the coloring material layer contains at least one ester oligomer. The coloring material layer further contains at least one coloring material or/and an inorganic or organic fine powder. The coloring material is not particularly limited and may be any ordinary dye or pig-

ment of yellow, red, blue, black or the like. For example, carbon black or oil black can be used as a black pigment. The fine powder to be used in the present invention can be selected depending upon the object and may be magnetic powder, other metal powder or conductive fine powder.

The ester oligomer to be used in the present invention is synthesized by the condensation polymerization between a polyhydric alcohol and a polybasic acid, preferably between a dihydroxy compound and a dibasic acid or anhydride thereof and has a lower degree of polymerization than that of the polyethylene terephthalate of the prior art. Therefore, the ester oligomer melts at a relatively low temperature and in a narrow temperature range, thus being suitable as a heat-fusible material for a thermal transfer ink. The number-average molecular weight and melting point of the ester oligomer is 300 to 10000 (calculated by the end-group analysis) and from 40 to 120°C, respectively, preferably 500 to 6000 and 60 to 110°C (determined by the ring-and-ball method), respectively. The above condensation polymerization may be carried out by an ordinary process.

Examples of the dibasic acid include adipic, azelaic, sebacic, succinic and dodecanedoic acids, while those of the dihydroxy compound include ethylene glycol, 1,4-butanediol, 1,5-pentanediol, 1,6-hexanediol, 1,8-octanediol, 1,9-nonanediol, 1,10-decanediol and neopentyl glycol.

According to the present invention, one of these ester oligomers may be used or a mixture of two or more of them may be used. Further, the ester oligomer may be used together with an ordinary wax (for example, paraffin or carnauba wax), a rosin derivative (for example, hydrogenated rosin or ester gum), polyethylene wax, ethylene-alkyl acrylate or the like. Further, the ink sheet according to the present invention comprises a base film and at least one coloring material layer applied thereon and, if necessary, other layers such as a topcoat or a resistance layer for electric heating.

The support to be used in the ink sheet according to the present invention is preferably one which is resistant to heat and excellent in dimensional stability and surface smoothness. Particularly, polyethylene terephthalate films which have been used as the base film up to this time and resin films having a thickness of 2 to 20 μ and made of polycarbonate, polyethylene, polystyrene, polypropylene, polyimide or the like can be preferably used.

As described above, the ink sheet for thermal transfer recording according to the present invention contains an ester oligomer having a low melting point of 60 to 110°C as a heat-fusible material, so that the ink sheet exhibits high transfer sensitivity and allows low-energy printing, thus being suitable for high-speed printing. Further, the ink sheet gives a printing having no unevenness without lowering the fastness thereof and is not in danger of causing blocking, because the ink sheet contains only a very small amount of low-melting components having a melting point of lower than 55°C.

[Examples]

The present invention will be described in more detail by the following Examples, though it is not limited by them.

Example 1

polydecamethylene adipate (number-average molecular weight : 1600 80 parts
melting point : 73°C)
rosin ester HS (a product of Arakawa Chemical) 5
carbon black 15

A mixture comprising the above components was kneaded with 200 parts of toluene in a ball mill for 12 hours to obtain a homogeneous coating fluid. This coating fluid was applied to a polyethylene terephthalate film having a thickness of 6 μ (a product of Toray Industries, Inc.; Lumirror) with a wire bar to form a coloring material layer having a thickness after drying of 3.5 μ on the film, thus producing an ink sheet for thermal transfer recording. Printing on paper was carried out by the use of the obtained ink sheet and a thermal transfer printer of line type (NIP 5234, 9.4 dots/mm, a product of Nippon Electric Co., Ltd.) to determine the density of the transferred image. To examine the relationship between printing energy and density of transferred image, the pulse width of the voltage to be applied was changed between 0.65 and 0.85 second by operating a density-controlling lever to measure the density of transferred image at each pulse width with a Macbeth densitometer (RD 514 type). As a result of this examination, the pulse width of the voltage applied for the formation of transferred image having a density of 1.2 was found to be 0.66 millisecond. No stain was observed in the non-image area. Five ink sheets for thermal transfer were piled up and preserved under a pressure of 500g/cm² for one week. The sheets were taken out and examined for blocking. No blocking was observed at all.

Example 2

polyhexamethylene sebacate (number-average molecular weight : 3200 80 parts
melting point : 75°C
rosin ester HS (A product of Arakawa Chemical) 5 parts
carbon black 15

The same procedure as the one described in Example 1 was repeated except that a mixture comprising the above components was used insted of the mixture used in Example 1 to carry out the production of an ink sheet and printing. The density of transferred image was measured with a Macbeth densitometer (RD 514 type). The pulse width of the voltage applied for the formation of transferred image having a density of 1.2 was 0.66 millisecond.

Comparative Example

paraffin wax 60 parts
carnauba wax 25
carbon black 15

A mixture comprising the above components was dispersed with an attritor of 100 °C for 4 hours to obtain an ink. This ink was applied to a polyethylene terephthalate film having a thickness of 6 µ by hot-melt coating to produce an ink sheet having an ink layer having a thickness of 3.5 µ.

Printing was carried out by the use of this ink sheet in a similar manner to the one described in Example 1. When the pulse width of the applied voltage was 0.65 millisecond, the transferred image had a density of only 0.20. The pulse width of the voltage applied for the formation of transferred image having a density of 1.2 was 0.85 millisecond.

Claims

1. An ink sheet for thermal transfer recording; which comprises a base layer coated with an ink layer, said ink layer comprising a colouring material and/or an inorganic or organic fine powder and a heat-fusible material containing 40 or more percent by weight of an ester oligomer having a number-average molecular weight of 500 to 6,000 and a melting point of 60 to 110 °c.

2. An ink sheet as claimed in Claim 1, in which said ester oligomer is a product of the condensation polymerization of a polyhydric alcohol and a polycarboxylic acid.

3. An ink sheet as claimed in Claim 1, in which said ester oligomer is a product of the condensation polymerization of a dihydroxy compound and a dibasic acid or dibasic acid anhydride.

Revendications

1. Feuille d'encre pour enregistrement par transfert thermique, qui comprend une couche de base recouverte d'une couche d'encre, ladite couche d'encre étant composée d'une matière colorante et/ou d'une poudre fine minérale ou organique et d'une matière thermofusible contenant 40 % en poids, ou plus, d'un ester oligomère dont la mise moléculaire moyenne en nombre vaut de 500 à 6000 et dont le point de fusion est compris entre 60 et 110 °C.

2. Feuille d'encre telle que revendiquée dans la revendication 1, dans laquelle ledit ester oligomère est un produit de la polymérisation par condensation d'un polyol et d'un acide polycarboxylique.

3. Feuille d'encre telle que revendiquée dans la revendication 1, dans laquelle ledit ester oligomère est un produit de la polymérisation par condensation d'un composé dihydroxylé et d'un diacide ou d'un anhydride de diacide.

Patentansprüche

1. Tintenschicht für Aufzeichnung durch Wärme, bestehend aus einer Grundschicht und einer darüberliegenden Tintenschicht, die aus einem farbgebenden Stoff und/oder einem feinen anorganischen oder organischen Pulver sowie einem unter Wärme-Einwirkung schmelzbaren Material besteht, das mindestens 40 Gew.-% eines Ester-Oligomers enthält, das ein Molekulargewicht (Zahlenmittel) zwischen 500 und 6000 und einen Schmelzbereich zwischen 60 und 110 °C aufweist.

2. Tintenschicht nach Anspruch 1, bei der das Ester-Oligomer ein Polykondensationsprodukt eines Polyols mit einer Polycarbonsäure ist.

3. Tintenschicht nach Anspruch 1, bei der das Ester-Oligomer ein Polykondensationsprodukt eines Diols mit einer zweibasigen Säure bzw. mit deren Anhydrid ist.

The same procedure as the one described in Example 1 was repeated except that a mixture comprising the above components was used insted of the mixture used in Example 1 to carry out the production of an ink sheet and printing. The density of transferred image was measured with a Macbeth densitometer (RD 514 type). The pulse width of the voltage applied for the formation of transferred image having a density of 1.2 was 0.66 millisecond.

Comparative Example

paraffin wax 60 parts
carnauba wax 25
carbon black 15

A mixture comprising the above components was dispersed with an attritor of 100 °C for 4 hours to obtain an ink. This ink was applied to a polyethylene terephthalate film having a thickness of 6 μ by hot-melt coating to produce an ink sheet having an ink layer having a thickness of 3.5 μ.

Printing was carried out by the use of this ink sheet in a similar manner to the one described in Example 1. When the pulse width of the applied voltage was 0.65 millisecond, the transferred image had a density of only 0.20. The pulse width of the voltage applied for the formation of transferred image having a density of 1.2 was 0.85 millisecond.

Claims

1. An ink sheet for thermal transfer recording; which comprises a base layer coated with an ink layer, said ink layer comprising a colouring material and/or an inorganic or organic fine powder and a heat-fusible material containing 40 or more percent by weight of an ester oligomer having a number-average molecular weight of 500 to 6,000 and a melting point of 60 to 110 °c.

2. An ink sheet as claimed in Claim 1, in which said ester oligomer is a product of the condensation polymerization of a polyhydric alcohol and a polycarboxylic acid.

3. An ink sheet as claimed in Claim 1, in which said ester oligomer is a product of the condensation polymerization of a dihydroxy compound and a dibasic acid or dibasic acid anhydride.

Revendications

1. Feuille d'encre pour enregistrement par transfert thermique, qui comprend une couche de base recouverte d'une couche d'encre, ladite couche d'encre étant composée d'une matière colorante et/ou d'une poudre fine minérale ou organique et d'une matière thermofusible contenant 40 % en poids, ou plus, d'un ester oligomère dont la mise moléculaire moyenne en nombre vaut de 500 à 6000 et dont le point de fusion est compris entre 60 et 110 °C.

2. Feuille d'encre telle que revendiquée dans la revendication 1, dans laquelle ledit ester oligomère est un produit de la polymérisation par condensation d'un polyol et d'un acide polycarboxylique.

3. Feuille d'encre telle que revendiquée dans la revendication 1, dans laquelle ledit ester oligomère est un produit de la polymérisation par condensation d'un composé dihydroxylé et d'un diacide ou d'un anhydride de diacide.

Patentansprüche

1. Tintenschicht für Aufzeichnung durch Wärme, bestehend aus einer Grundschicht und einer darüberliegenden Tintenschicht, die aus einem farbgebenden Stoff und/oder einem feinen anorganischen oder organischen Pulver sowie einem unter Wärme-Einwirkung schmelzbaren Material besteht, das mindestens 40 Gew.-% eines Ester-Oligomers enthält, das ein Molekulargewicht (Zahlenmittel) zwischen 500 und 6000 und einen Schmelzbereich zwischen 60 und 110 °C aufweist.

2. Tintenschicht nach Anspruch 1, bei der das Ester-Oligomer ein Polykondensationsprodukt eines Polyols mit einer Polycarbonsäure ist.

3. Tintenschicht nach Anspruch 1, bei der das Ester-Oligomer ein Polykondensationsprodukt eines Diols mit einer zweibasigen Säure bzw. mit deren Anhydrid ist.

* C L M S *