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(54) Heat-sensitive lithographic printing plate precursor

(57) A development-free, heat-sensitive lithographic printing plate precursor comprising a support on which an image-forming layer and an overcoat layer are provided in this order: with the image-forming layer comprising hydrophobic thermoplastic polymer particles dispersed in a hydrophilic binder polymer, and with the overcoat layer being soluble in water and comprising a compound capable of converting light into heat.

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a heat-sensitive lithographic printing plate precursor which requires no development-processing and has suitability for computer-to-plate system. More specifically, the present invention relates to a lithographic printing plate precursor in which images can be recorded by infrared radiation scanning exposure based on digital signals, and which can be mounted in a printing machine (i.e., printing press) after recording the images and subjected to printing operations without conventional development using a liquid developer.

BACKGROUND OF THE INVENTION

[0002] A large number of studies have been made on printing plates for computer-to-plate system that has achieved brilliant progress in recent years. Of those studies, the studies of development-free lithographic printing plate precursors which can be mounted in a printing machine without undergoing development after exposure have been made actively for the purpose of further rationalizing a platemaking process and resolving the liquid waste disposal problem, and many methods for attaining such a purpose have been proposed. One of the promising methods is a method of using a lithographic printing plate precursor whose image-forming layer is a hydrophilic layer comprising a hydrophilic binder polymer and hydrophobic thermoplastic polymer particles dispersed therein. And image formation in the printing plate precursor is carried out utilizing conversion of the hydrophilic layer surface into an lipophilic image area which is caused by applying heat to the image-forming layer, and melting and adhering the hydrophobic thermoplastic polymer particles present in the heat-applied area.

[0003] In a platemaking system of carrying out such a thermal recording by use of infrared laser exposure, it is important for printing plate materials (i.e., printing plate precursor) to have high sensitivity from a viewpoint of the rapidity of operation. Therefore, dyes or pigments capable of absorbing infrared radiation and generating heat, the so-called compounds capable of converting light into heat are used in heat-sensitive lithographic printing plate precursors.

[0004] In JP-A-9-123387, JP-A-9-131850, JP-A-9-171249 and JP-A-9-171250 (the term "JP-A" as used herein means an "unexamined published Japanese patent application") disclosing heat-sensitive lithographic printing plate precursors which each have an image-forming layer comprising hydrophobic thermoplastic polymer particles dispersed in a hydrophilic binder polymer, there is a description that a compound capable of converting light into heat, preferably carbon black, is incorporated in the hydrophilic binder polymer in a proportion of, e.g., 20 to 35 % of the image-forming layer as in the examples.

[0005] In the heat-sensitive lithographic printing plate precursor disclosed in European Patent 931,647, which also has an image-forming layer comprising hydrophobic thermoplastic polymer particles dispersed in a hydrophilic binder polymer, there is a description that an infrared-absorbing anionic cyanine dye as the compound capable of converting light into heat is incorporated in the hydrophilic binder polymer in a proportion of 1 to 40 % of the image-forming layer.

[0006] In those publications each, high sensitivity is achieved by incorporating a compound capable of converting light into heat in an image-forming layer. And the compound capable of converting light into heat is present in the image-forming layer in a state that it is compatible with or dispersed in a hydrophilic binder polymer. According to those publications, the proportion of the compound capable of converting light into heat to the hydrophilic binder polymer in the image-receiving layer ranges from 40 to 175 weight %, and it is assumed that the presence of compound capable of converting light into heat in such a high concentration can bring about high sensitivity. However, the compound capable of converting light into heat present in such a high concentration involves not only a problem of impairing the durability of non-image area in an image-forming layer to lower impression capacity but also a problem of lowering water wettability of the image-forming layer and causing changes in printing conditions, e.g., a reduction in fountain solution, to result in a staining trouble.

SUMMARY OF THE INVENTION

[0007] Therefore, an object of the present invention is to solve the aforementioned problems and provide a development-free heat-sensitive lithographic printing plate precursor that has high sensitivity and ensures high impression capacity and excellent stain-preventing properties.

[0008] As a result of our intensive studies of the foregoing problems, it has been found that, when a compound capable of converting light into heat is incorporated in a water-soluble overcoat layer which is dissolved and removed immediately after it is brought into contact with a fountain solution on a printing machine, the content of compound capable of converting light into heat can be increased without impairing the film strength and water wettability of an image-forming layer, thereby achieving the present invention.

[0009] More specifically, the embodiment and preferred embodiments of the present invention are shown below.

(1) A heat-sensitive lithographic printing plate precursor comprising a support on which an image-forming layer and an overcoat layer are provided in this order: with the image-forming layer comprising hydrophobic thermoplastic polymer particles and a hydrophilic binder polymer, and with the overcoat layer being soluble in water and comprising a compound capable of converting light into heat.

(2) The heat-sensitive lithographic printing plate precursor according to Embodiment (1) , wherein the compound capable of converting light into heat is a water-soluble dye capable of absorbing infrared radiation.

(3) The heat-sensitive lithographic printing plate precursor according to Embodiment (1) , wherein the compound capable of converting light into heat is a water-soluble cyanine dye capable of absorbing infrared radiation.

[0010] Additionally, JP-A-9-123387, JP-A-9-131850, JP-A-9-171249, JP-A-9-171250 and European Patent 931,647 have a description such that it is most appropriate for the heat-sensitive lithographic printing plate precursor to contain a compound capable of converting light into heat in its image-forming layer which comprises hydrophobic thermoplastic polymer particles dispersed in a hydrophilic binder polymer, but at least a part of the compound capable of converting light into heat may be added to a layer adjacent to the image-forming layer.

[0011] However, the layer adjacent to the image-forming layer in each of those references means the hydrophilic layer provided on a flexible support, such as paper or a plastic film, having thereon the image-forming layer. Therefore, those references neither disclose nor suggest incorporation of a compound capable of converting light into heat into a water soluble overcoat layer to increase the sensitivity without impairting impression capacity and stain-preventing properties according to the present invention.

[0012] On the other hand, the heat-sensitive lithographic printing plate precursor having a water-soluble polymer layer on the image-forming layer comprising hydrophobic thermoplastic polymer particles dispersed in a hydrophilic binder polymer is also disclosed in European Patent 816,070.

[0013] However, in the printing plate precursor of the European Patent, the compound capable of converting light into heat is added to the image-forming layer, and the conception that the high sensitivity without impairing impression capacity and stain-preventing property can be obtained by adding the compound capable of converting light into heat to the water-soluble overcoat layer.

DETAILED DESCRIPTION OF THE INVENTION

[0014] The embodiments of the present invention are described below in detail.

[0015] The water-soluble overcoat layer used in the present invention can be removed easily under printing, and comprises at least one resin selected from water-soluble organic or inorganic high molecular compounds. The water-soluble organic or inorganic high molecular compounds usable therein are compounds capable of forming films when coated and dried. Examples thereof include polyvinyl acetate (having a hydrolysis factor of at least 65 %) , polyacrylic acid and alkali metal or amine salts thereof, polyacrylic acid copolymers and alkali metal or amine salts thereof, polymethacrylic acid and alkali metal or amine salts thereof, polymethacrylic acid copolymers and alkali metal or amine salts thereof, polyacrylamide and copolymers thereof, polyhydroxyethyl acrylate, polyvinyl pyrrolidone and copolymers thereof, polyvinyl methyl ether, vinyl methyl ether-maleic anhydride copolymer, poly-2-acrylamide-2-methyl-1-propanesulfonic acid and alkali metal or amine salts thereof, 2-acrylamide-2-methyl-1-propanesulfonic acid copolymers and alkali metal or amine salts thereof, gum arabic, cellulose derivatives (such as carboxymethyl cellulose, carboxyethyl cellulose and methyl cellulose) and denatured products thereof, white dextrin, pullulan and enzyme-decomposed etherified dextrin. These resins may be used as a mixture of two or more thereof, if desired.

[0016] The compound capable of converting light into heat used in combination with the water-soluble resin as described above may be any of materials capable of absorbing light of wavelengths of not shorter than 700 nm, and various pigments and dyes are included therein. Specifically, pigments which can be utilized herein include commercially available pigments and pigments described in Color Index (C.I.) Binran (Color Index (C.I.) Handbook) , compiled by Nihon Ganryo Gijutsu Kyokai (1977), Saishin Ganryo Binran (Handbook of Latest Pigments), compiled by Nihon Ganryo Gijutsu Kyokai (1977) , Saishin Ganryo Oyo Gijutsu (Latest Pigment Application Techniquies) , published by CMC Publishing Co., Ltd. (1986) , and Insatsu Ink Gijutsu (Printing Ink techniques) , published by CMC Publishing Co., Ltd. (1984).

[0017] More specifically, various pigments, such as black pigments, brown pigments, red pigments, purple pigments, blue pigments, green pigments, fluorescent pigments, metallic powder pigments and polymer-attaching dyes, can be exemplified. Examples of such pigments include insoluble azo pigments, azo lake pigments, condensed azo pigments, chelate azo pigments, phthalocyanine pigments, anthraquinone pigments, perylene and perinone pigments, thioindigo pigments, quinacridone pigments, dioxazine pigments, isoindolinone pigments, quinophthalone pigments, in-mold lake pigments, azine pigments, nitroso pigments, nitro pigments, natural pigments, fluorescent pigments, inorganic pigments and carbon black.

[0018] Those pigments may be used without surface treatment, or they may undergo surface treatment before use. Suitable examples of a method of treating the surface of the pigment include a method of coating the pigment surface with a hydrophilic resin or an lipophilic resin, a method of adhering a surfactant to the pigment surface and a method of attaching a reactive substance (such as silica sol, alumina sol, silane coupling agents, epoxy compounds and isocyanate compounds) to the surface of the pigment. These surface treatment methods are described in Kinzoku Sekken no Seishitsu to Oyo (Natures and Applications of Metal Soaps), Saiwai Shobo Co., Ltd., Insatsu Ink Gijutsu (Printing Ink techniques), published by CMC Publishing Co., Ltd. (1984), and Saishin Ganryo Oyo Gijutsu (Latest Pigment Application Techniquies), published by CMC Publishing Co., Ltd. (1986) . Of the pigments described above, pigments capable of absorbing infrared radiation or near infrared radiation are much preferable since they can have important suitability for utilization of infrared laser.

[0019] Examples of a pigment suitable for infrared absorption include carbon black, hydrophilic resin-coated carbon black and silica sol-modified carbon black. In particular, carbon black having the surface coated with hydrophilic resin or silica sol is useful, because it is easily dispersed into water-soluble resins and the hydrophilicity is not impaired.

[0020] The suitable grain size of pigment is from 0.01 to 1 μm, preferably from 0.01 to 0.5 μm. As a method of dispersing pigments, conventional dispersion techniques for ink or toner production can be employed. Examples of a dispersing apparatus usable therein include an ultrasonic disperser, a sand mill, an attritor, a pearl mill, a super mill, a ball mill, an impeller, a disperser, a KD mill, a colloid mill, a dynatron, a three-roll mill and a pressure kneader. Details of dispersion techniques are described in Saishin Ganryo Oyo Gijutsu (Latest Pigment Application Techniquies), published by CMC Publishing Co., Ltd. (1986).

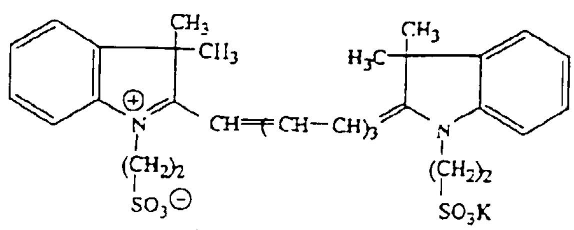
[0021] Dyes usable as a compound capable of converting light into heat include commercially available dyes and well-known dyes as described, e.g., in Senryou Binran (Handbook of Dyes) , compiled by Yuki Gosei Kagaku Kyokai (1970). As examples of such dyes, azo dyes, metal complex azo dyes, pyrazolone azo dyes, anthraquinone dyes, phthalocyanine dyes, carbonium dyes, quinoneimine dyes, methine dyes and cyanine dyes are exemplified. Of these dyes, infrared absorbing dyes are much preferable in use of lasers emitting the infrared radiation.

[0022] Examples of dyes absorbing infrared radiation include the cyanine dyes as disclosed in JP-A-58-125246, JP-A-59-84356 and JP-A-60-78787, the methine dyes as disclosed in JP-A-58-173696, JP-A-58-181690 and JP-A-58-194595, the naphthoquinone dyes as disclosed in JP-A-58-112793, JP-A-58-224793, JP-A-59-48187, JP-A-59-73996, JP-A-60-52940 and JP-A-60-63744, the squarylium dyes as disclosed in JP-A-58-112792, the cyanine dyes disclosed in British Patent 434,875, the dyes disclosed in U.S. Patent 4,756,993, the cyanine dyes disclosed in U.S. Patent 4,973,572, and the dyes disclosed in JP-A-10-268512.

[0023] In addition, the near infrared radiation-absorbing sensitizers disclosed in U.S. Patent 5,156,938 can be suitably used as dyes. Besides the dyes described above, the substituted arylbenzo(thio)pyrylium salts disclosed in U.S. Patent 3,881,924, the trimethinethiapyrylium salts disclosed in JP-A-57-142645 (corresponding to U.S. Patent 4,327,169), the pyrylium compounds disclosed in JP-A-58-181051, JP-A-58-220143, JP-A-59-41363, JP-A-59-84248, JP-A-59-84249, JP-A-59-146063 and JP-A-59-146061, the cyanine dyes disclosed in JP-A-59-216146, the pentamethinethiopyrylium salts disclosed in U.S. Patent 4,283,475, the pyrylium compounds disclosed in JP-B-5-13514 and JP-B-5-19702 (the term "JP-B" as used herein means an "examined Japanese patent publication ") and Epolight III-178, Epolight III-130 and Epolight III-125 (produced by Epolin Co., Ltd.) can be fovrably used.

[0024] Of the dyes as described above, water-soluble cyanine dyes are preferred in particular. Examples thereof are illustrated below by their respective structural formulae.

(D-1)



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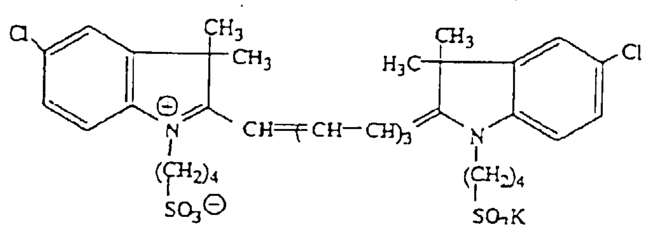

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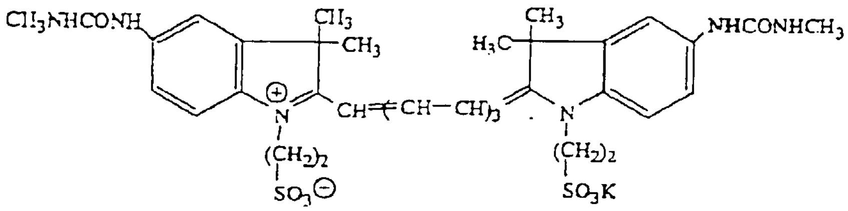

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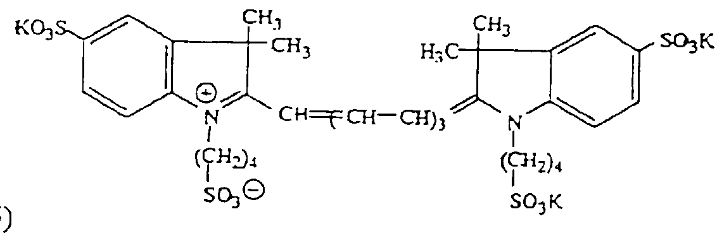

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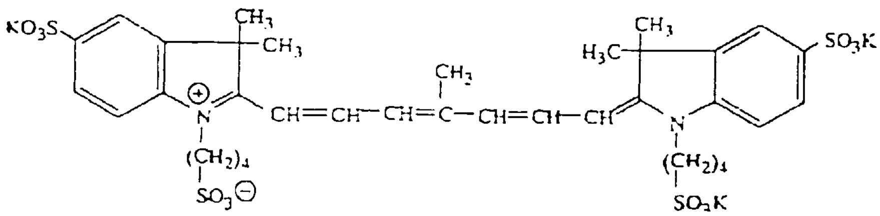

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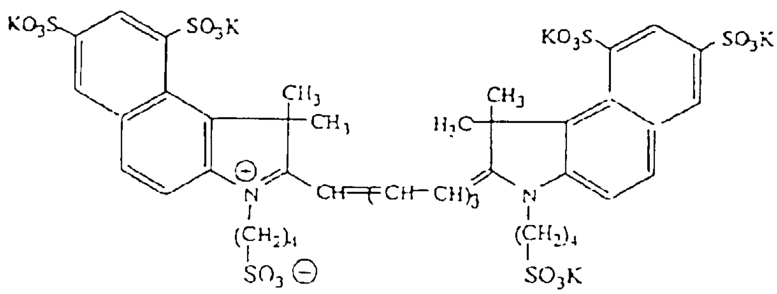

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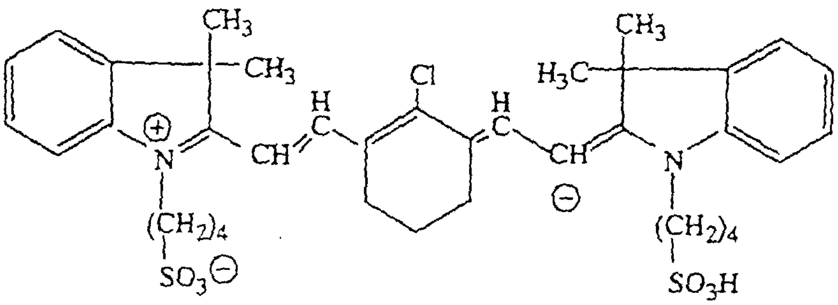

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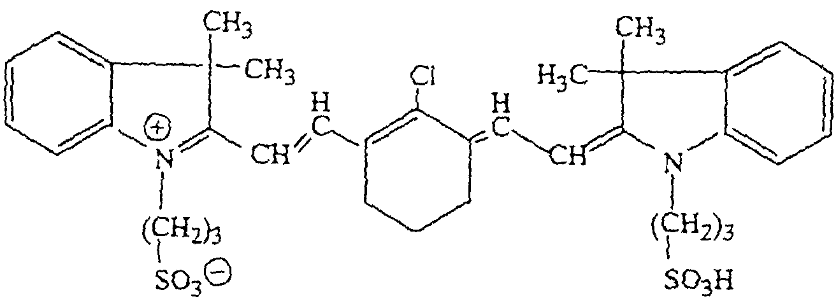
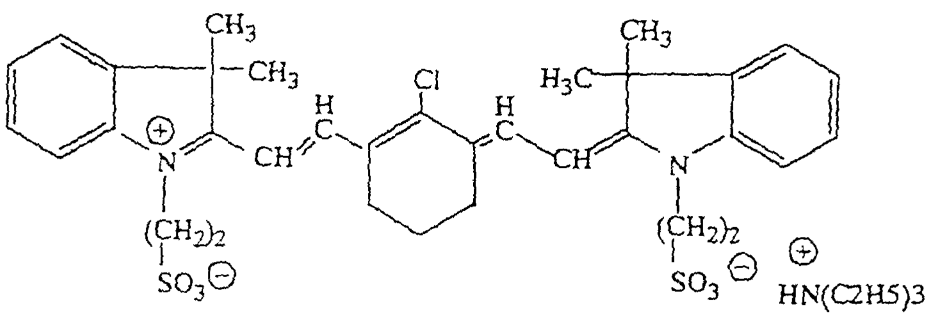
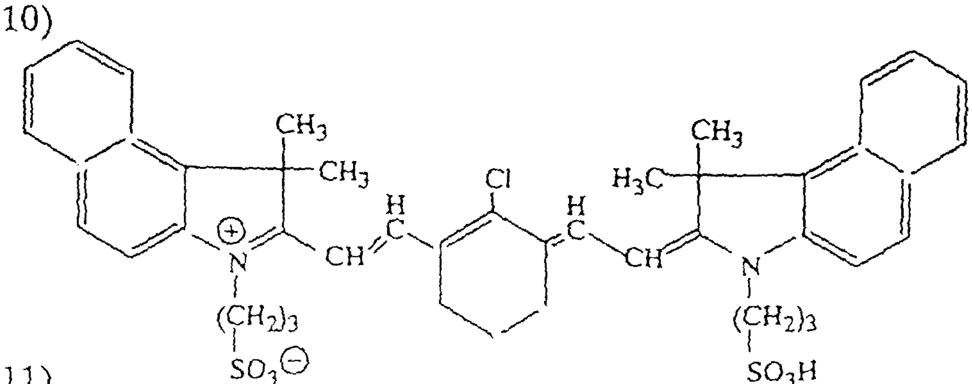


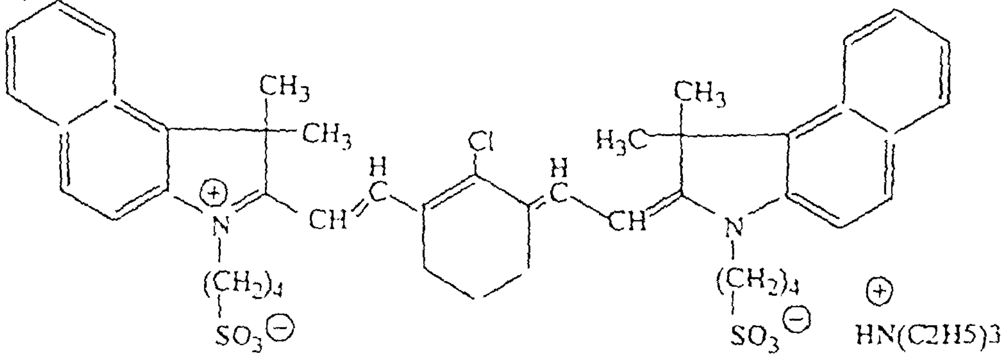
(D-9)



(D-10)



(D-11)



[0025] The suitable proportion of such a pigment or dye based on the total solid components in the overcoat layer is from 1 to 70 weight %, preferably from 2 to 50 weight %. In particular, the proportion ranging from 2 to 30 weight % is effective in the case of the dye being incorporated, while the proportion ranging from 20 to 50 weight % is effective in the case of the pigment being incorporated. When the proportion of the pigment or dye in the overcoat layer is lower than the aforesaid lower limit, the sensitivity becomes low; while it is higher than the aforesaid upper limit, the uniformity of the layer is lost and the durability of the layer is deteriorated.

[0026] In addition, nonionic surfactants can be added to the overcoat layer for the purpose of securing uniformity for the coating. Examples of a nonionic surfactant usable for such a purpose include sorbitan tristearate, sorbitan monopalmitate, sorbintan trioleate, stearic acid monoglyceride, polyoxyethylene nonyl phenyl ether, and polyoxyethylene dodecyl ether.

[0027] The suitable proportion of such a nonionic surfactant to the total solids in the overcoat layer is from 0.05 to 5 weight %, preferably from 1 to 3 weight %.

[0028] The suitable thickness of the overcoat layer provided in the present invention is from 0.05 to 4.0 μm, preferably from 0.1 to 1.0 μm. When the thickness is too thick, it takes a long time to remove the overcoat layer at the time of printing, and the water-soluble resin eluted in a large amount from the overcoat layer has adverse effects on a fountain solution to cause a roller strip trouble and no inking in the image areas under printing. When the thickness is too thin, on the other hand, the film properties tend to be impaired.

[0029] Examples of the hydrophilic binder polymers usable for the present image-forming layer of the present invention include synthetic homopolymers and copolymers, such as polyvinyl alcohol, poly(meth)acrylic acid, poly(meth) acrylamide, polyhydroxyethyl (meth)acrylate and polyvinyl methyl ether, and natural polymers such as gelatin and polysaccharides (e.g., dextran, pullulan, cellulose, gum arabic, alginic acid).

[0030] Hydrophobic thermoplastic polymer particles suitably used in the image-forming layer of the present invention are those having solidification temperatures of not lower than 35°C, preferably not lower than 50°C. The solidification occurs as a result of softening or melting of thermoplastic polymer particles under the influence of heat. The thermoplastic hydrophobic polymer particles have no particular upper limit for solidification temperature, but this temperature is required to be sufficiently lower than the decomposition point of the polymer particles. In a case where the polymer particles are exposed to temperatures higher than their solidification temperature, they form hydrophobic agglomerates during the solidification process in the hydrophilic image-forming layer, and thereby the areas wherein the solidification has occurred are rendered insoluble in water or an aqueous liquid and come to have ink receptivity.

[0031] Examples of a hydrophobic polymer which constitutes hydrophobic particles used in the image-forming layer of the present invention include homopolymers and copolymers of such monomers as ethylene, styrene, vinyl chloride, methyl (meth)acrylate, ethyl (meth)acrylate, vinylidene chloride, acrylonitrile and vinyl carbazole, and mixtures of two or more thereof. Of these polymers, polystyrene and polymethyl methacrylate are preferred.

[0032] The hydrophobic polymers usable in the image-forming layer of the present invention may have a weight average molecular weight of 5,000 to 1,000,000.

[0033] The hydrophobic particles used in the image-forming layer of the present invention may have a particle size of 0.01 to 50 μm, preferably 0.05 to 10 μm, particularly preferably 0.05 to 2 μm.

[0034] The suitable proportion of the hydrophobic particles in the image-forming layer of the present invention is from 20 to 65 weight %, preferably from 25 to 55 weight %, particularly preferably from 30 to 45 weight %.

[0035] The image-forming layer of the present invention may contain a cross-linking agent, if needed. Suitable examples of such a cross-linking agent include methylol group-containing compounds having low molecular weight, melamine-formaldehyde resin, hydantoin-formaldehyde resin, thiourea-formaldehyde resin and benzoguanamine-formaldehyde resin.

[0036] The suitable thickness of the image-forming layer of the present invention is from 0.1 to 3 pm, preferably from 0.15 to 2 pm, particularly preferably from 0.2 to 1 μm.

[0037] As a substrate used for coating thereon the ink-receptive layer of the present invention is a dimensionally stable plate is used. Examples thereof include paper, paper laminated with lipophilic plastic (e.g., polyethylene, polypropylene, polystyrene), metal plates (e.g., aluminum, zinc, copper, nickel and stainless steel plates), plastic films (e.g., cellulose diacetate, cellulose triacetate, cellulose propionate, cellulose butyrate, cellulose acetate butyrate, cellulose nitrate, polyethylene terephthalate, polyethylene, polystyrene, polypropylene, polycarbonate and polyvinyl acetal, etc.) , and paper and plastic films on which the metals as described above are laminated or deposited.

[0038] Of these substrates, a polyethylene terephthalate film, a polycarbonate film, an aluminum plate, a steel plate, and a lipophilic plastic film-laminated aluminum or steel plate are preferred over the others.

[0039] The aluminum plate used in the present invention can be selected properly from aluminum plates made of well-known conventional materials.

[0040] Prior to use of an aluminum plate, it is preferred that the surface of the aluminum plate is subjeected to graining (i.e., roughening). By graining the plate surface, the ink-receptive layer constituted of an organic high polymer can easily adhere to the aluminum plate as a substrate when coated thereon. For graining the aluminum plate surface, well-known conventional techniques for treating an aluminum plate surface can be adopted.

[0041] In the heat-sensitive lithographic printing plate precursor of the present invention, images are formed by the action of heat. More specifically, the image formation can be performed by direct image-drawing with a heat-recording head, scanning exposure with an infrared laser, high illumination intensity flash exposure with xenon discharge lamps, or exposure with an infrared lamp. In particular, the exposure with semiconductor laser emitting infrared radiation of wavelengths of 700 to 1200 nm or high-output solid-state infrared laser, such as YAG laser, can be preferably used.

[0042] The imagewise exposed printing plate precursor according to the present invention can be mounted in a printing machine (i.e., a printing press) without any additional processing. Soon after the start of printing with ink and a fountain solution, the overcoat layer is easily dissolved and removed through contact with the fountain solution, and the ink adheres to the ink-receptive image areas formed in the image-forming layer by exposure, thereby the printing begins.

EXAMPLE

[0043] Now, the present invention is illustrated in greater detail by reference to the following examples, but these examples should not be construed as limiting the scope of the present invention in any way.

EXAMPLE 1

[0044] On an aluminum plate the surface of which was subjected to graining and anodic oxidation treatments (quality: JISA1050, thickness: 0.24 mm), an undercoating solution containing a 0.25 weight % methanol solution of polyacrylic acid (weight average molecular weight: 25×10^4) was coated at a solution coverage of 10 g/m^2, and dried at 100°C for 60 seconds to form an undercoating layer having a dry coverage of 25 mg/m^2.

[0045] To the thus formed aluminum substrate, the coating solution for an image-forming layer prepared in the following manner was applied at a coating solution amount of 20 g/m^2, and dried at 100°C for 60 seconds to form on the substrate an image-forming layer having a dry coating weight of 1.0 g/m^2.

Preparation of Coating Solution for Image-forming Layer:

[0046] To 5 g of a 20 weight % dispersion prepared by dispersing polystyrene (Tg: 100°C, average particle diameter: 90 nm) into a deionized water by use of a nonionic surfactant, 0.24 g of polyoxyethylene nonyl phenyl ether and 15.46 g of a deionized water were added successively, and then 6 g of a 5 weight % of polyvinyl alcohol (PVA205, trade name, produced by Kuraray Co., Ltd.) was added with stirring.

[0047] To the image-forming layer thus formed on the aluminum substrate, the Coating Solution I for an overcoat layer having the following composition was applied at a coating solution amount of 10 g/m^2, and then dried at 100°C for 60 seconds to form an overcoat layer having a dry coating weight of 0.5 g/m^2. Thus, a heat-sensitive lithographic printing plate precursor was prepared.

Composition of Coating Solution I for Overcoat Layer:	
Polyacrylic acid (weight average molecular weight: 2.5×10^4)	1.0 g
20 weight % Ethanol solution of carbon black stabilized by nonionic surfactant	2.5 g
Methanol	26.5 g

Exposure and Printing:

[0048] The lithographic printing plate precursor thus formed was loaded in a plate setter equipped with a 830-nm semiconductor laser device of 40 watts, Trend Setter (trade name, made by CREO CO., Canada) , and exposed to the laser beams under a condition that the amount of energy applied thereto was adjusted to 40 mJ/cm^2. The exposed plate was mounted in a printer (i.e., a printing press), Harris-Aurelia, without any further processing, and subjected to printing operations using ink and a fountain solution containing a 10 volume % aqueous isopropyl alcohol solution containing an etching solution. As a result, 15000 plates of good-quality printed matter were obtained. In addition, the printing was tried under a condition that the amount of fountain solution applied to the plate was reduced from the standard amount by two graduations on the scale. In this case also, no stain was generated.

[0049] As is apparent from these results, the light-sensitive lithographic printing plate precursor prepared in accordance with the present invention had high sensitivity, high impression capacity and excellent stain-preventing properties.

COMPARATIVE EXAMPLE 1

[0050] On the undercoating layer-provided aluminum substrate as prepared in Example 1, a comparative Coating Solution (a) for the image-forming layer prepared as described below was coated and dried in the same manner as in Example 1, thereby forming on the substrate a compound capable of converting light into heat-containing image-forming layer having a dry coating weight of 1.0 g/m^2.

Preparation of Comparative Coating Solution (a) for Image-forming Layer:

[0051] To 5 g of the same 20 weight % polystyrene dispersion as prepared in Example 1, 2.5 g of a 20 weight % aqueous dispersion prepared by dispersing carbon black into a deionized water by use of a nonionic surfactant, 0.037 g of polyoxyethylene nonyl phenyl ether and 23.15 g of a deionized water were added successively, and then 6 g of a 5 weight % aqueous solution of polyvinyl alcohol (PVA205, produced by Kuraray Co., Ltd.) was added with stirring.

[0052] To the image-forming layer thus formed on the substrate, a comparative Coating Solution (a) for the overcoat layer having the composition described below was applied at a coating solution amount of 10 g/m^2, and then dried at 100°C for 60 seconds to form a comparative overcoat layer having a dry coating weight of 0.5 g/m^2. Thus, a light-sensitive lithographic printing plate precursor (a) for comparison was produced.

Comparative Coating Solution (a) for Overcoat Layer:	
Polyacrylic acid (weight average molecular weight: $2.5x10^4$)	1 g
Methanol	19 g

[0053] The comparative printing plate precursor (a) was exposed in the same manner as in Example 1, and subjected to printing operations using the same printing machine as in Example 1. As a result, the number of good-quality printed plates reached 9,000, but stain was generated when the number of printed plates was increased beyond 9,000 plates. In addition, the printing was carried out under a condition that the amount of fountain solution applied to the printing plate was reduced from the standard amount by two graduations on the scale. However, stain was generated in this case.

[0054] As is apparent from the results mentioned above, the printing plate precursor containing the compound capable of converting light into heat in the image-forming layer was inferior in stain-preventing properties and impression capacity to the printing plate precursor of the present invention containing the compound capable of converting light into heat in the overcoat layer.

EXAMPLE 2

[0055] A heat-sensitive lithographic printing plate precursor was prepared in the same manner as in Example 1, except that the Coating Solution I for the overcoat layer was replaced by the following Coating Solution II wherein the water-soluble dye (D-11) was incorporated.

[0056] Then, the thus produced printing plate precursor was subjected to the same exposure and printing operations as in Example 1. As a result, 15000 sheets of good-quality printed matter were obtained without staining trouble. Also, no stain was generated under the printing condition that the amount of fountain solution applied to the plate was reduced from the standard amount by two graduations on the scale.

Coating Solution II for Overcoat Layer:	
Polyacrylic acid (weight average molecular weight: $2.5x10^4$)	1.0 g
Water-soluble dye (D-11) illustrated in the specification	0.2 g
Methanol	22.8 g

COMPARATIVE EXAMPLE 2

[0057] On the undercoating layer-provided aluminum substrate as prepared in Example 1, a comparative Coating Solution (b) for the image-forming layer prepared as described below was coated and dried in the same manner as in Example 1, thereby forming on the substrate an image-forming layer having a dry coating weight of 1.0 g/m^2.

Preparation of Comparative Coating Solution (b) for Image-forming Layer:

[0058] To 5 g of the same 20 weight % polystyrene dispersion as prepared in Example 1, 0.20 g of a water-soluble Dye (D-11) illustrated in the specification, 0.03 g of polyoxyethylene nonyl phenyl ether and 19. 5 g of a deionized water were added successively, and then 6 g of a 5 weight % aqueous solution of polyvinyl alcohol (PVA205, produced by Kuraray Co., Ltd.) was added with stirring.
[0059] On the image-forming layer thus formed on the substrate, the same overcoat layer as in Comparative Example 1 was provided. Thus, a light-sensitive lithographic printing plate precursor (b) for comparison was produced.
[0060] The thus produced comparative printing plate precursor (b) was exposed in the same manner as in Example 1, and subjected to printing operations using the same printing machine as in Example 1. As a result, the number of good-quality printed sheets reached 10,000, but stain was generated when the number of printed sheets was increased beyond 10,000 sheets. In the other case of employing the printing condition that the amount of fountain solution applied to the plate was reduced from the standard amount by two graduations on the scale, stain was generated.

EXAMPLES 3 AND 4

[0061] Heat-sensitive lithographic printing plate precursors were produced in the same manner as in Example 2, except that instead of using the water-soluble dye (D-11) in the Coating Solution II for the overcoat layer the water-soluble dyes (D-1) and (D-9) were used in Example 3 and Example 4 respectively. The thus produced printing plate precursors were each subjected to the same exposure and printing operations as in Example 1. As a result, 15000 sheets of good-quality printed matter were obtained in each case without staining trouble. And in each case also, no stain was generated under the printing condition that the amount of fountain solution applied to the plate was reduced from the standard amount by two graduations on the scale.

EXAMPLE 5

[0062] A heat-sensitive lithographic printing plate precursor was produced in the same manner as in Example 1, except that the following Coating Solution III for the overcoat layer was used in place of the Coating Solution I for forming the overcoat layer. Then, the thus produced printing plate precursor was subjected to the same exposure and printing operations as in Example 1. As a result, 15000 sheets of good-quality printed matter were obtained without staining trouble. Also, no stain was generated under the printing condition that the amount of fountain solution applied to the plate was reduced from the standard amount by two graduations on the scale.

Coating Solution III for Overcoat Layer:	
Polyvinyl pyrrolidone (weight average molecular weight: $1x10^4$)	1.0 g
Water-soluble dye (D-11) illustrated in the specification	0.2 g
Methanol	22.8 g

EXAMPLE 6

[0063] In the same manner as in Example 1, an image-forming layer was formed at a dry coating weight of 1.0 g/m^2 on the same substrate as used in Example 1, except that the polystyrene dispersion contained in the coating solution for the image-forming layer was replaced by 5 g of a 20 % dispersion prepared by dispersing polymethyl methacrylate (Tg: 105°C, average particle diameter: 90 nm) into a deionized water by use of polyethylene oxide as a surfactant (in a proportion of 1 % to the polymer). Then, on this image-forming layer was provided the same overcoat layer as employed in Example 4.
[0064] The thus produced heat-sensitive lithographic printing plate precursor was subjected to the same exposure and printing operations as in Example 1. As a result, 15000 sheets of good-quality printed matter were obtained without staining trouble. Also, no stain was generated under the printing condition that the amount of fountain solution applied to the plate was reduced from the standard amount by two graduations on the scale.

EFFECT OF THE INVENTION

[0065] The problems of conventional heat-sensitive lithographic printing plate precursors can be solved by the present invention, and heat-sensitive lithographic printing plate precursors according to the present invention require no development-processing and have high sensitivity, high impression capacity and excellent stain-preventing properties.

Claims

1. A heat-sensitive lithographic printing plate precursor comprising a support on which an image-forming layer and an overcoat layer are provided in this order: said image-forming layer comprising hydrophobic thermoplastic polymer particles and a hydrophilic binder polymer, and said overcoat layer being soluble in water and comprising a compound capable of converting light into heat.

2. The heat-sensitive lithographic printing plate precursor as in claim 1, wherein the compound capable of converting light into heat is a water-soluble dye capable of absorbing infrared radiation.

3. The heat-sensitive lithographic printing plate precursor as in claim 1, wherein the compound capable of converting light into heat is a water-soluble cyanine dye capable of absorbing infrared radiation.

4. The heat-sensitive lithographic printing plate precursor as in claim 1, wherein the overcoat layer has a thickness of from 0.05 to 4.0 μm,

5. The heat-sensitive lithographic printing plate precursor as in claim 1, wherein the overcoat layer contains a dye or pigment capable of absorbing infrared radiation in a proportion of 1 to 70 weight % based on the total solid components in the overcoat layer.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 12 6435

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CATEGORY OF CITED DOCUMENTS

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