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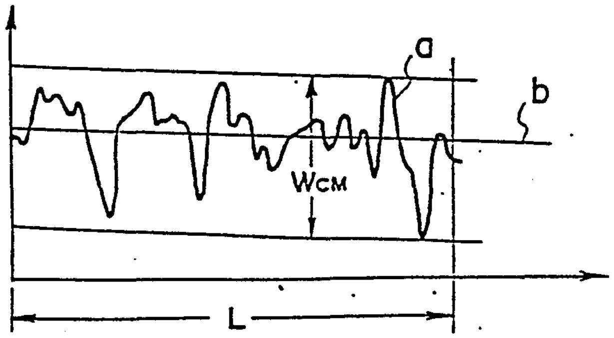
(54) Dye transfer method.

(57) A method for transferring a dye which comprises superimposing on a photographic material having a mobile dye distributed in an imagewise pattern on a support, a dye fixing material having a dye receiving layer on a support and transferring the local dye to the dye fixing material and wherein at least one of the two supports has such surface characteristics that the number of locations where the filtered maximum waviness value is 4 µm or greater is not more than 10 out of 100 locations on the support arbitarily selected for measuring the filtered maximum waviness of a basic length at 2.5 mm of a filtered waviness curve obtained with a cut-off value of 0.8 mm from a profile measured by JIS standard B 0610 with respect to the surface thickness of the support. The method evenly transfers the mobile dye to a dye fixing material from a heat development color photographic material containing a dye providing substance which upon heating reacts with a light-sensitive silver halide to produce or release a mobile dye in the substantial absence of water.



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DYE TRANSFER METHOD

FIELD OF THE INVENTION

The present invention relates to a method of transferring a mobile dye formed in an imagewise pattern on a light-sensitive element to a dye fixing element. More particularly, the present invention relates to a method of evenly transferring the mobile dye to a dye fixing material from a heat development color photographic material containing a dye providing substance which upon heating reacts with a light-sensitive silver halide to produce or release a mobile dye in the substantial absence of water.

BACKGROUND OF THE INVENTION

The photographic process employing silver halides is superior to other photographic processes such as electrophotography and the diazo process in photographic properties such as sensitivity and gradation control, and has so far been most extensively used. In recent years, a new image forming technique for processing light-sensitive materials using silver halides has been developed which enables us to obtain images simply and speedily, by employing the dry process utilizing heating and the like instead of the conventional wet process using developing solutions and the like.

Heat development light-sensitive materials are known in this technical field, and various heat development light-sensitive materials and the heat development process are described in, for example, "Shashin Kogaku no Kiso" (Introduction to Photographic Engineering) (published by Corona-sha, 1979), pp.553-555, "Eizo Joho" (Video Information) (April, 1978), p.40, "Nebletts Handbook of Photography and Reprography 7th Ed." (Van Nostrand Reinhold Company), pp.32-32, U.S. Patents Nos. 3,152,904, 3,301,678, 3,392,020 and 3,457,075, British Patents Nos. 1,131,108 and 1,167,777 and "Research Disclosure" (June, 1978), pp.9-15 (RD 17029).

Many processes have been proposed for obtaining color images by heat development. A process of forming color images by coupling an oxidation product of a developing agent with a coupler and various developing agents which may be used in such a process are described in,. for example, U.S. Patents Nos. 3,531,286, 3,761,270 and 4,021,240, Belgian Patent No. 802,519 and "Research Disclosure" (Sept., 1975), pp.31-32.

The process of introducing a nitrogen-containing heterocyclic group into a dye to form a silver salt and freeing the dye by heat development is also described in "Research Disclosure" (May, 1978), pp.54-58 (RD 16966).

With respect to the process of forming a positive color image by a thermal silver dye bleach process, processes of bleaching useful dyes are described in, for example, "Research Disclosure" (April, 1976), pp.30-32, (RD 14433), ibid. (Dec., 1976), pp.14-15, (RD 15227) and U.S. Patent No. 4,235,957.

Processes of forming color images by using leuco dyes are described in, for example, U.S. Patents No. 3,985,565 and 4,022,617.

However, these color image forming processes have the following defects: The discoloration of the formed color images caused by silver halides, silver complexes, developing agents which are also present in the photographic materials during a long storage period, as well as the stain of the background. Novel heat development color image forming processes wherein these defects are improved are disclosed in, for example, Japanese Patent Applications (OPI) Nos. 179840/82, 186774/82, 198458/82, 207250/82, 58543/83, 79247/83, 116537/83, 149046/83, 48764/84, 65839/84, 71046/84, 87450/84 and 88730/84 (the term "OPI" as used herein refers to a "published unexamined Japanese patent application").

These processes comprise producing or releasing mobile dyes in patterns corresponding to the reduced or unreduced area resulting from a reduction reaction of light-sensitive silver halides and/or organic silver salts to silver by heat development thereby to transfer the mobile dyes to dye fixing elements.

These processes provide superior color images free from discoloration or stain of the background. On the other hand, these processes have the disadvantage that irregular circular areas having diameters of about 10 microns to about 1 mm and extremely low densities of the transferred dyes are found interspersed in areas of the dye fixing materials where the dyes should be transferred uniformly (this phenomenon will hereinafter be called "unevenness of transfer"). Such a disadvantage does not occur in conventional color image forming methods employing the wet process using developing solutions and the like (e.g., the color diffusion transfer method). This problem specifically occurs in such color image forming methods as that of the present invention wherein an extremely small amount of water is present in the process of transferring mobile dyes to dye fixing materials. It has also been found that the extent of unevenness of transfer depends on the thickness of the support of the light-sensitive material and/or the dye fixing material to be used, and becomes more conspicuous with the use of a thinner support. This uneven transfer constitutes a serious problem in using thinner supports with the view to storing large quantities of the dye fixing materials after the transfer process in small space; increasing the amount of the lightsensitive material or dye fixing material which can be made into a roll; easy cut; or reducing the production cost.

SUMMARY OF THE INVENTION

The object of the present invention is, therefore, to provide a dye transfer method free from the above-described unevenness of transfer.

The present inventors have conducted intensive research for the purpose of accomplishing the above-identified object, and have discovered that the above-described unevenness of transfer occurred as a result of the uneven surfaces of the supports used for the light-sensitive material and the dye fixing material. In other words, when the coated surfaces of these materials are brought into contact by superimposing the light-sensitive material on the dye fixing material for effecting transfer, the two coated surfaces fail to come into close contact in some areas, where the mobile dye is not transferred as desired. The present inventors investigated and selected various materials for use as the support, finally found materials which do not cause the above-described unevenness of transfer even if they are used in thin forms, and have succeeded in accomplishing the present invention.

The object of the present invention can be accomplished by a method of transferring a dye which comprises superimposing on a photographic material having a mobile dye distributed in an imagewise pattern on a first support a dye fixing material having a dye receiving layer on a second support and transferring said mobile dye to said dye fixing material, and wherein at least one of said two supports has such surface properties that the number of locations where the filtered maximum waviness value is 4 μm or more is not more than 10 out of 100 locations on the support arbitrarily selected for measuring the filtered maximum waviness of a basic length of 2.5 mm of a filtered waviness curve obtained with a cut-off value of 0.8 mm from a profile measured by JIS Standard B 0610 with regard to the surface smoothness of the support.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows a profile of a support.

Fig. 2 shows the filtered waviness curve of Fig. 1.

Fig. 3 shows the method of obtaining a maximum filtered waviness value.

'a' is a filtered waviness curve and 'b' is a mean line.

'L' is a basic length.

DETAILED DESCRIPTION OF THE INVENTION

The "profile" as used herein refers to a contour which is presented on a sectional plane, when a surface to be measured has been cut by a plane perpendicular to the mean surface of the surface to be measured. The "filtered waviness curve" as used herein means a curve obtained by removing the short wave length components of surface roughness from the above-identified profile using a low-pass filter. The "cut-off value" as used herein means a wave length corresponding to the frequency at which its gain becomes 70% when a low-pass filter of attenuation rate of -12dB/oct is used to obtain a filtered waviness curve. The "filtered maximum waviness" as used herein means the maximum height of wave (W_{CM}) of a portion extracted as long as a certain length (basic length) (L) from the filtered waviness curve, as expressed in micrometer units (μm).

A filtered waviness curve using a high band cut-off value is used as a means of expressing the surface roughness of the support as described above, because the above-identified unevenness of transfer is hardly affected by roughness shorter than a certain wavelength. The basic length is set at 2.5 mm because unevenness of transfer is rarely affected by surface roughness having long wavelengths. This tendency is particularly apparent when the length of the support is not longer than 100 μm.

The advantages of the present invention are particularly remarkable when paper supports are used. The present invention also provides marked advantages when natural or synthetic fabrics are used as supports.

The present invention will now be described in detail by referring to the attached drawings.

Fig. 1 is an example of a profile obtained by measuring by the stylus method the surface smoothness of a support in accordance with JIS Standard B 610.

Fig. 2 is a filtered waviness curve obtained from the profile of Fig. 1 by using a low-pass filter having a cut-off value of 0.8 mm.

Fig. 3 shows a manner of determining a filtered maximum waviness value with a basic length of L. Specifically, any portion corresponding to the length of L is extracted from the filtered waviness curve, and a mean line is obtained for an arbitrary portion with a length extracted from the filtered waviness curve. The mean line is such that the sum of the squares of the distances between the mean line and the waviness curve at selected points is minimum. The filtered maximum waviness W_{CM} is the sum of the deviations of the mean line from the maximum wave height and the minimum wave height.

The present invention is characterized in that when 100 W_{CM} values are obtained at arbitrarily selected 100 locations as described above, a W_{CM} value of 4 μm or greater can be obtained at not more than 10 such locations.

Coated paper, for example, can be used as the support having the above-described properties. In other words, the present invention provides a dye transfer method which comprises superimposing a mobile-dye-containing light-sensitive material on a dye fixing material having a dye fixing layer to thereby transfer said dye to this dye fixing layer, and wherein the support of at least one of said mobile-dye-containing material and said dye fixing material comprises coated paper. The "coated paper" as used in the present invention refers to paper made by coating a base (e.g., wood free paper and medium quality paper) on one side or both sides thereof with a coating made by mixing a mineral pigment such as clay with an adhesive (e.g., casein, starch, latex, polyvinyl alcohol or combinations thereof). The term "coated paper" includes "art paper" (coating weight: about 20 g/m^2), "coated paper" (coating weight: about 10 g/m^2) and "light weight coated paper" (coating weight: about 5 g/m^2), the classification being made depending on the amount of the coating used. The term "coated paper" further includes "cast coated paper", which is made by drying the coated paper while its plasticity still remains by bringing it into close contact under pressure application with a drum drier having a mirror surface to thereby provide a strong gloss. (For detail, see "Technical Handbook of Pulp and Paper" edited and published by the Japanese Technical Association of the Pulp and Paper Industry, (1982), p.415 and pp.535-536, etc.).

The coated paper has high smoothness of the surface even in the case of paper made with a thin base (cast coated paper particularly has a remarkably high surface smoothness), and as a result, the surface of the light-sensitive layer or dye fixing layer coated onto such paper is also smooth. Consequently, the light-sensitive material and the dye fixing material can be brought into extremely close contact, thus preventing unevenness of transfer.

The coated paper used in accordance with the present invention is preferably of a relatively thin (light) type, the basis weight being in the range of 20 g/m^2 to 200 g/m^2, and particularly in the range of 50 g/m^2 to 100 g/m^2.

In accordance with the present invention. Such coated paper may be directly coated with a coating layer or a dye fixing layer used for the below-described light-sensitive material. Alternatively, the coated paper may be coated or laminated with a polymer such as polyethylene on one side or on both sides, providing a subbing layer as required, and then with a coating layer or a dye fixing layer of the above-described light-sensitive material. A white pigment such as titanium dioxide may be incorporated into the polymer such as polyethylene as required to thereby form a white-colored reflective layer. The polymer such as polyethylene is coated or laminated preferably to the thickness of 5 to 50 microns, and in particular, the advantages of the support of the present invention become conspicuous by using a relatively thin layer having a thickness of 40 microns or less.

The present invention is effective for preventing unevenness of transfer in any process for transferring a mobile dye from one material to another material. The present invention, however, reveals particularly superior effects in a dye transfer process which comprises giving imagewise exposure to a light-sensitive material having on a support a dye providing substance which produces or releases a mobile dye in a pattern corresponding to the reduced or unreduced areas resulting from a reaction in which a light-sensitive silver halide is reduced to silver in a reaction system comprising at least (1) a light-sensitive silver halide, (2) a binder and (3) an elevated temperature; simultaneously or subsequently heating the light-sensitive material to form a mobile dye in an imagewise pattern; and superimposing the light-sensitive material on a dye fixing material having a dye fixing layer on a support to thereby transfer said mobile dye to said dye fixing layer. In this case, the above-identified coated paper is used for the support of at least one of said light-sensitive material and said dye fixing material, particularly the support of said dye fixing material.

The advantages of the present invention are particularly remarkable in heat development light-sensitive materials.

Preferred heat development light-sensitive materials include those as described in European Patents Nos. 76,492 and 79,056; i.e., those which contain on a support at least a light-sensitive silver halide, a binder and a dye providing substance which releases or forms a mobile dye upon heating. The dye providing substance may also serve as a reducing agent.

Another embodiment of the heat development light-sensitive material used in the present invention has on a support at least one photographic layer comprising a light-sensitive diazo compound, a binder and a coupling component capable of coupling with the diazo compound.

In a process employing a heat development diazo copying material, the light-sensitive layer contains a light-sensitive diazo compound, a coupling component capable of coupling with the diazo compound, and a substance which produces a base upon heating, i.e., a base precursor. These components undergo a coupling reaction upon heating to about 100 to 200°C to thereby form an azo dye.

Processes employing heat development diazo copying materials are described in, for example, Japanese Patent Application (OPI) Nos. 11229/75, 109924/77, 45094/82, 133033/80 and 150014/77 and Japanese Patent Publications Nos. 19620/81, 24726/68, 40455/76, 41202/73 and 28663/69.

The diazonium salts, coupler compounds capable of coupling with the diazo compounds, stabilizers and the like which are used for the above materials are described in the above-illustrated patent literature.

In accordance with the present invention, the light-sensitive materials are used in combination with dye fixing elements as required.

The silver halides used in the present invention may be any silver chloride, silver bromide, silver iodide, silver chlorobromide, silver chloroiodide, silver iodobromide and silver chloroiodobromide. These silver halide grains may either have a uniform halogen composition or have a structure with different inner and outer halogen compositions, as described in Japanese Patent Application (OPI) Nos. 154232/82, 108533/83, 48755/84 and 52237/84 (the term "OPI" as used herein refers to a "published unexamined Japanese patent application"), U.S. Patent 4,433,048 and European Patent 100,984. Regarding the shape of the silver halide grains, tabular grains having a thickness of about 0.5 μm or less, a diameter of at least about 0.6 μm and an average aspect ratio of about 5 or more (as described, e.g., in U.S. Patents 4,414,310 and 4,435,499 and West German Patent Application (OLS) No. 3,241,646 A1) may be used in the present invention. In addition, a monodisperse emulsion, containing silver halide grains of nearly uniform grain size distribution (as described, e.g., in Japanese Patent Application (OPI) Nos. 178235/82, 100846/83 and 14829/83, International Patent Publication No. 83/02338A1, and European Patents 64,412A3 and 83,377A1) may also be used in the present invention. Furthermore, two or more kinds of silver halides each having different crystal habit, halogen composition, grain size and grain size distribution may be used together; and it is also possible to blend two or more kinds of monodisperse emulsions each having different grain size thereby to suitably regulate the gradation of an image to be formed.

The average grain size of silver halide grains to be used in the present invention is preferably within the range of about 0.001 μm to 10 μm, more preferably about 0.001 μm to 5 μm. The silver halide emulsion may be prepared by any conventional means such as an acid method, a neutral method or an ammonia method. For the reaction of a soluble silver salt and a soluble halogen salt, any of a single jet method or a double jet method or a combination thereof may be used. In addition, a reverse mixing method where silver halide grains are formed in the presence of an excess of silver ion; or a controlled double jet method where the value of pAg is kept constant may also be used. In order to accelerate the growth of silver halide grains in the reaction, the concentration of the silver salt and halogen salt to be added as well as the amount thereof and the rate of addition thereof may be elevated appropriately, as disclosed in Japanese Patent Application (OPI) Nos. 142329/80 and 158124/80 and U.S. Patent 3,650,757.

Silver halide grains of epitaxial over grown type may also be used in the present invention, as disclosed in Japanese Patent Application (OPI) No. 16124/81 and U.S. Patent 4,094,684.

When a silver halide alone is used in the present invention, i.e., without the combined use of an organic silver salt oxidizing agent, it is preferred to use silver chloroiodide, silver iodobromide and silver chloroiodobromide exhibiting an X-ray diffraction pattern of silver iodide crystals.

Such silver halides may be formed, for example, by first adding a silver nitrate solution to a potassium bromide solution to form silver bromide grains, and then adding potassium iodide thereto, to obtain silver iodobromide having this characteristic.

In the step of forming silver halide grains to be used in the present invention, a solvent for dissolving a silver halide may be used, such as ammonia or an organic thioether derivative as described in Japanese Patent Publication No. 11386/72, or a sulfur-containing compound as described in Japanese Patent Application (OPI) No. 144319/78.

During the step of formation of silver halide grains or physical ripening thereof, a cadmium salt, a zinc salt, a lead salt, a thallium salt may be used.

In addition, in order to improve any high intensity reciprocity failure or low intensity reciprocity failure, a water-soluble iridium salt such as iridium (III, IV) chloride or ammonium hexachloroiridate, or a water-soluble rhodium salt such as rhodium chloride may further be used in preparing the silver halide grains or their physical ripening.

Soluble salts, if any, may be removed from the silver halide emulsion, after the formation of silver halide precipitates or after the physical ripening thereof, by noodle washing or by a sedimentation method.

The silver halide emulsion may be used without being postripened, but in general, the emulsion is used after being chemically sensitized. An emulsion for a light-sensitive material, in general, may be ripened by conventional sulfur sensitization, reduction sensitization or noble metal sensitization or a combination of said conventional sensitization means, which may be carried out in the presence of a nitrogen-containing heterocyclic ring compound as described, e.g., in Japanese Patent Application (OPI) Nos. 126526/83 and 215644/83.

The silver halide emulsion to be used in the present invention may be any of a surface latent image type where a latent image is formed mainly on the surface of silver halide grains, or an internal latent image type where a latent image is formed mainly in the inner part of the grains. In addition, a direct reversal emulsion comprising a combination of the internal latent image type emulsion and a nucleating agent may also be used in the present invention. Various kinds of internal latent image type emulsions which are suitable are described, e.g., in U.S. Patents 2,592,250 and 3,761,276, Japanese Patent Publication No. 3534/83 and Japanese Patent Application (OPI) No. 136641/82. Preferred nucleating agents which may be used in the present invention in combination with the internal latent image type emulsion are described, e.g., in U.S. Patents 3,227,552, 4,245,037, 4,255,511, 4,266,013 and 4,276,364 and West German Patent Application (OLS) No. 2,635,316.

The amount of the light-sensitive silver halide in the light-sensitive layer of the present invention is from about 1 mg/m^2 to 10 g/m^2, preferably about 50 mg/m^2 to 8 g/m^2, calculated in terms of the content of silver therein.

In the present invention, an organic metal salt which is relatively stable to light may be used as an oxidizing agent, together with the light-sensitive silver halide. In this case, it is necessary that the light-sensitive silver halide and organic metal salt be in close relation, e.g., either kept in contact with each other or kept near to each other. An organic silver salt is especially preferably used as the organic metal salts. Although not desiring to be bound by theory, when an organic silver salt is used in the heat developable light-sensitive material according to the present invention, when the exposed light-sensitive material is heated at a temperature of about 80°C or higher, preferably about 100°C or higher, the organic silver salt oxidizing agent is considered to participate in a redox reaction occurring under heat in the presence of a silver halide latent image as a catalyst.

Examples of organic compounds which may be used as the organic component of said organic silver salt oxidizing agents include aliphatic or aromatic carboxylic acids, thiocarbonyl group-containing compounds having a mercapto group or α-hydrogen and imino group-containing compounds.

Typical examples of aliphatic carboxylic acids used as the organic component include behenic acid, stearic acid, oleic acid, lauric acid, capric acid, myristic acid, palmitic acid, maleic acid, fumaric acid, tartaric acid, furoinic acid, linoleic acid, linolenic acid, adipic acid, sebacic acid, succinic acid, acetic acid, butyric acid or camphoric acid. In addition, silver salts of halogen-substituted or hydroxyl-substituted derivatives of these fatty acids or salts of thioether group-containing aliphatic carboxylic acids may also be used in the present invention.

Examples of aromatic carboxylic acids or other carboxyl-containing compounds used as the organic component of the organic silver salts include benzoic acid, 3,5-dihydroxybenzoic acid, o-, m- or p-methylbenzoic acid, 2,4-dichlorobenzoic acid, acetamidobenzoic acid, p-phenylbenzoic acid, gallic acid, tannic acid, phthalic acid, terephthalic acid, salicylic acid, phenylacetic acid, pyromellitic acid or 3-carboxymethyl-4-methyl-4-thiazoline-2-thione.

Examples of mercapto- or thiocarbonyl-containing organic components of the organic silver salt include 3-mercapto-4-phenyl-1,2,4-triazole, 2-

mercaptobenzimidazole, 2-mercapto-5-aminothiadiazole, 2-mercaptobenzothiazole, s-alkylthioglycolic acid in which the alkyl moiety has about 12 to 22 carbon atoms, dithiocarboxylic acids such as dithioacetic acid, thioamides such as thiostearoamide, 5-carboxy-1-methyl-2-phenyl-4-thiopyridine, mercaptotriazine, 2-mercaptobenzoxazole, mercaptooxadiazole or 3-amino-5-benzylthio-1,2,4-triazole and other mercapto compounds, as described in U.S. Patent 4,123,274.

Examples of imino-containing compounds which may be used as the organic component include benzotriazole or derivatives thereof as described in Japanese Patent Publication Nos. 30270/69 and 18416/70, for example, benzotriazole, methylbenzotriazole and other alkyl-substituted benzotriazoles, 5-chlorobenzotriazole and other halogen-substituted benzotriazoles, and butylcarboimidobenzotriazole and other carboimidobenzotriazoles; nitrobenzotriazoles as described in Japanese Patent Application (OPI) No. 118639/83; sulfobenzotriazole, carboxybenzotriazole or salts thereof, and nitrobenzotriazole as described in Japanese Patent Application (OPI) No. 118638/83; and 1,2,4-triazole, 1H-tetrazole, carbazole, saccharin, imidazole and derivatives thereof as described in U.S. Patent 4,220,709.

In addition, silver salts as described in Research Disclosure RD 17029 (June, 1978), organic metal salts other than silver salts such as copper stearate, and silver salts of alkyl-containing carboxylic acids such as phenylpropiolic acid as described in Japanese Patent Application (OPI) No. 113235/85 may also be used in the present invention.

The amount of organic silver salt used in the light-sensitive material of the present invention is about 0.01 to 10 mols, preferably about 0.01 to 1 mol, per mol of light-sensitive silver halide used. The total amount of the light-sensitive silver halide and organic silver salt is suitably from about 50 mg/m^2 to 10 g/m^2.

The silver halide to be used in the present invention may be spectrally sensitized with a methine dye or other sensitizing dye. Sensitizing dyes which may be used for spectral sensitization include cyanine dyes, merocyanine dyes, complex cyanine dyes, complex merocyanine dyes, holopolar cyanine dyes, hemicyanine dyes, styryl dyes and hemioxonol dyes. Especially preferred dyes are cyanine dyes, merocyanine dyes and complex merocyanine dyes. These dyes may contain any conventional basic heterocyclic nucleus, which is typically used in conventional cyanine dyes, including a pyrroline nucleus, an oxazoline nucleus, a thiazoline nucleus, a pyrrole nucleus, an oxazole nucleus, a thizole nucleus, a selenazole nucleus, an imidazole nucleus, a tetrazole nucleus, or a pyridine nucleus; these nuclei fused with an alicyclic hydrocarbon ring; and these nuclei fused with an aromatic hydrocarbon ring, such as an indolenine nucleus, a benzindolenine nucleus, an indole nucleus, a benzoxazole nucleus, a naphthoxazole nucleus, a benzothiazole nucleus, a naphthothiazole nucleus, a benzoselenazole nucleus, a benzimidazole nucleus, or a quinoline nucleus. These nuclei may optionally have substituent(s) on their carbon atom(s).

The merocyanine dyes and complex merocyanine dyes may contain a ketomethylene structural nucleus, such as 5- or 6-membered heterocyclic nuclei including a pyrazolin-5-one nucleus, a thiohydantoin nucleus, a 2-thiooxazolidine-2,4-dione nucleus, a thiazolidine-2,4-dione nucleus, a rhodanine nucleus or a thiobarbituric acid nucleus.

The sensitizing dyes may be used alone or in combination of two or more sensitizing dyes. The combination use of such sensitizing dyes is often utilized for the purpose of supersensitization.

The light-sensitive emulsion of the present invention may further contain, together with the sensitizing dye, a dye which itself does not have any spectral sensitization activity or a compound which does not itself substantially absorb visible light but exhibits a supersensitization activity. For example, the present emulsion may contain an aminostyryl compound substituted by a nitrogen-containing heterocyclic group (e.g., as described in U.S. Patents 2,933,390 and 3,635,721), an aromatic organic acid/formaldehyde condensation product (e.g., as described in U.S. Patent 3,743,510), a cadmium salt or an azaindene compound. In particular, the combinations described in U.S. Patents 3,615,613, 3,615,641, 3,617,295 and 3,635,721 are especially preferred.

In order to incorporate the sensitizing dye into the silver halide light-sensitive emulsion of the present invention, the dye may be dispersed directly in the emulsion, or alternatively, the dye may be first dissolved in a solvent such as water, methanol, ethanol, acetone or methyl cellosolve or a mixture thereof and thereafter the resultant solution added to the emulsion. In addition, the sensitizing dye may be first dissolved in a solvent which is immiscible with water such as phenoxyethanol, and the resultant solution dispersed in water or in a hydrophilic colloid, and thereafter the resultant dispersion added to the emulsion. In another method for incorporation of the sensitizing dye into the present photographic emulsion, the sensitizing dye is admixed with a lipophilic compound such as a dye providing compound, and the sensitizing dye is incorporated into the emulsion together with the dye providing compound. When the sensitizing dye is dissolved, another sensitizing dye used in combination may be dissolved separately in a separate solvent, or alternatively, the mixture of sensitizing dyes to be used together may be dissolved in the same solvent. When the sensitizing dye is added to an emulsion, two or more sensitizing dyes may be added simultaneously in the form of a mixture thereof, each sensitizing dye may be added separately, or each sensitizing dye may be added together with any other additives. Regarding the point in time when the sensitizing dye is added to the emulsion, the dye may be added during chemical ripening or before or after chemical ripening. Alternatively, the dye may be added to the emulsion before or after the formation of silver halide grain nuclei, as disclosed in U.S. Patents 4,183,756 or 4,225,666.

The amount of the sensitizing dye added to the emulsion is, in general, about 10^{-8} to 10^{-2} mol per mol of silver halide.

In the light-sensitive material of the present invention, various dye providing substances may be used as an image forming substance capable of forming a diffusible dye.

The dye-providing compounds which can be used in the present invention firstly include couplers capable of reacting with a developing agent. In the system utilizing such a coupler, color formation is achieved by the reaction between the coupler and an oxidation product of a developing agent resulting from an oxidation-reduction reaction with a silver salt. This system is described in a number of literature references. Specific examples of the developing agents and couplers are given, e.g., in T.H. James, The Theory of the Photographic Process, 4th Ed., 291-334 & 354-361, Shinichi Kikuchi, Shashin Kagaku, 4th Ed., 284-295, Kyoritsu Shuppan, etc.

The dye-providing compounds secondly include dye-silver compounds, i.e., combinations of silver and a dye. Specific examples of dye-silver compounds are given, e.g., in Research Disclosure (RD-16966), 54-58 (May, 1978), etc.

The dye-providing compounds thirdly include azo dyes used in a heat developable silver dye bleach process. Specific examples of usable diazo dyes and methods of bleaching are described, e.g., in U.S. Patent 4,235,957, Research Disclosure (RD-14433), 30-32 (Apr., 1976), etc.

Another example of the dye-providing compounds is leuco dyes as described, e.g., in U.S. Patents 3,985,565 and 4,022,617, etc.

Still another example of the dye-providing compounds is compounds capable of imagewise releasing or diffusing diffusible dyes which are useful in the systems described, e.g., in EPC Patents 76,492 and 79,056. The effect of the present invention is particularly conspicuous in these systems.

The above-mentioned compounds capable of imagewise releasing or diffusing diffusible dyes can be represented by the formula (LI):

$$(\text{Dye-X})_n\text{-Y} \qquad \text{(LI)}$$

wherein Dye represents a dye group or a dye precursor group; X represents a mere bond or a linking group; Y represents a group capable of imagewise making a variation in diffusibility of $(\text{Dye-X})_n\text{-Y}$ or capable of imagewise releasing Dye thereby making a difference in diffusibility between the released Dye and $(\text{Dye-X})_n\text{-Y}$, both in correspondence or counter correspondence with a light-sensitive silver salt having a latent image; and n represents 1 or 2, when n is 2, two (Dye-X) groups may be the same or different.

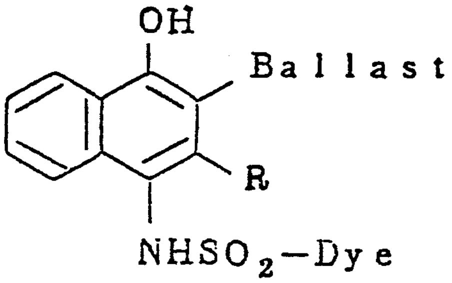
Examples of the dye-providing compounds represented by the above-described formula (LI) include dye developers composed of a hydroquinone type developer moiety and a dye moiety as disclosed in U.S. Patents 3,134,764, 3,362,819, 3,597,200, 3,544,545 and 3,482,972, etc.; compounds capable of releasing diffusible dyes through intramolecular nucleophilic substitution as disclosed in Japanese Patent Application (OPI) No. 63618/76; and compounds capable of releasing diffusible dyes through an intermolecular rearrangement reaction of an isoxazolone ring as described in Japanese Patent Application (OPI) No. 111628/74. In any of the systems using these dye-providing compounds, diffusible dyes are released or diffused in non-developed areas but neither released nor diffused in developed areas.

In the above-described systems, since release or diffusion of a dye takes place in parallel with development, it is very difficult to obtain an image having a high S/N ratio. In order to overcome this disadvantage, it has been proposed that the dye-providing compound is converted beforehand to an oxidized form having no capability to release a dye and is present together with a reducing agent or its precursor and, after development, the oxidized dye-providing compound is reduced with the reducing agent remaining non-oxidized to thereby release a diffusible dye. Specific examples of the dye-providing compounds used in this proposed system are given in Japanese Patent Application (OPI) Nos.

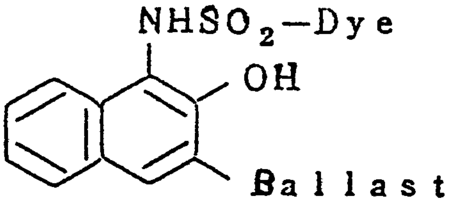
110827/78, 130927/79, 164342/81 and 35533/78, etc.

On the other hand, compounds which release diffusible dyes in the areas where development takes place are also known. For example, compounds having a diffusible dye as a releasable group and capable of releasing a diffusible dye upon reacting with an oxidized developing agent are disclosed in British Patent 1,330,524, Japanese Patent Publication No. 39165/73, U.S. Patent 3,443,940, etc., and compounds having an anti-diffusible group as a releasable group and capable of forming a diffusible dye upon reacting with an oxidized developing agent are described in U.S. Patent 3,227,550, etc.

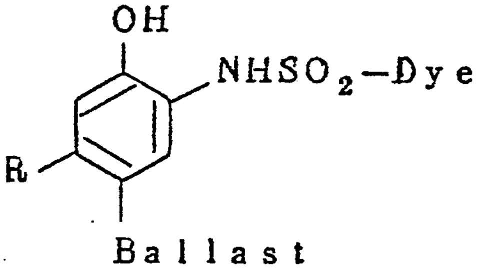
In the systems using these color developing agents, stain of an image due to oxidative decomposition products of developing agents present a serious problem. In order to solve this problem, dye-releasing compounds possessing reducing properties themselves which need no developing agent are proposed. Typical examples of such compounds are shown below together with the references therefor. Definitions for symbols in the following formulae are given in the respective references:



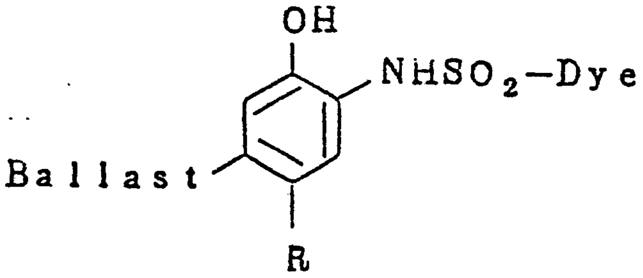
U.S. Patent 3,928,312



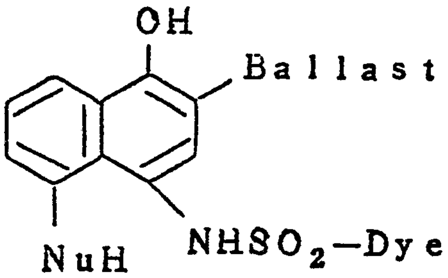
U.S. Patent 4,053,312



U.S. Patent 4,055,428



U.S. Patent 4,336,322



Japanese Patent Application
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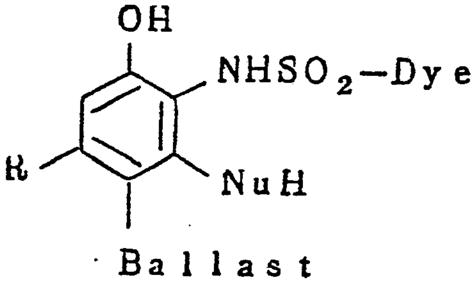

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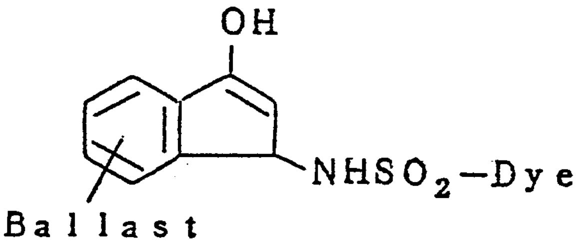

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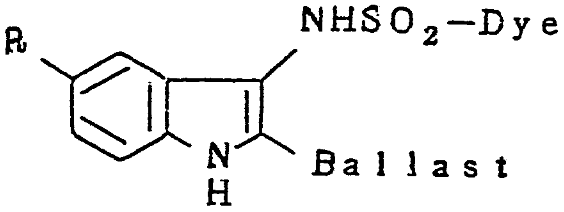
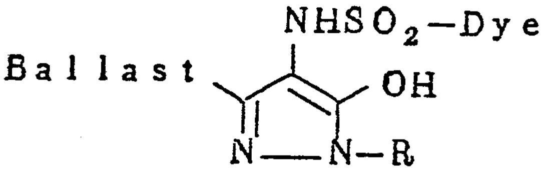
(OPI)No. 3819/78



Japanese Patent Application
(OPI) No. 104343/76



Japanese Patent Application
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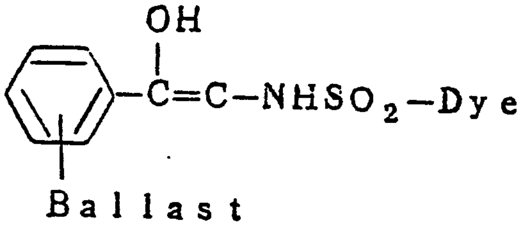

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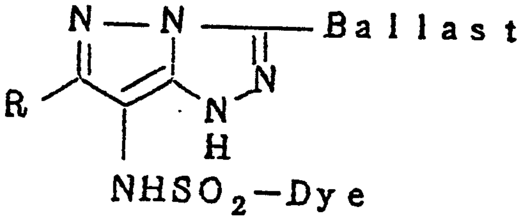
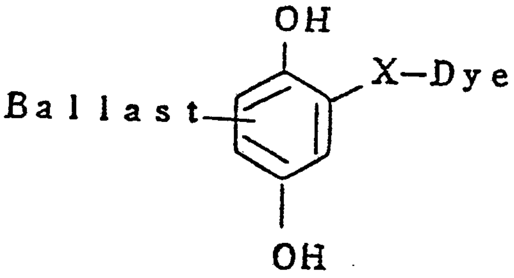
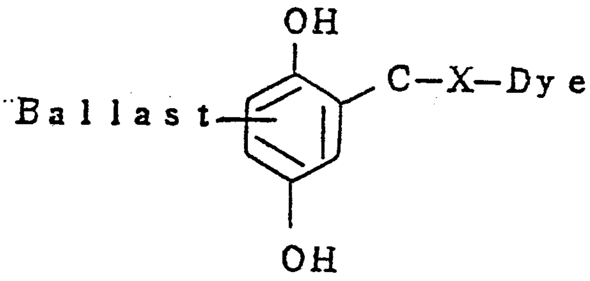


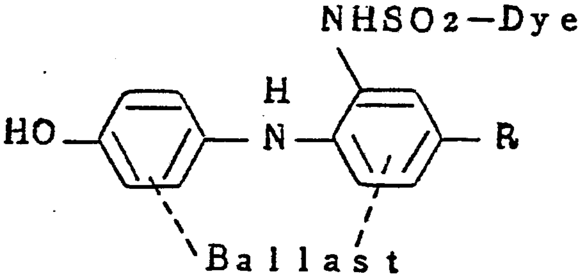
<u>Research Disclosure</u>, No. 17465



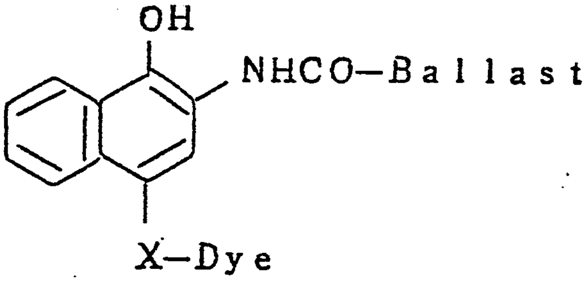
U.S. Patent 3,725,062



U.S. Patent 3,728,113



U.S. Patent 3,443,939



Japanese Patent Application
(OPI)No. 116537/83

In the present invention, the dye providing substance as described above may be incorporated into layer(s) of a light-sensitive material in a known manner, for example, according to the method described in U.S. Patent 2,322,027. In this case, an organic solvent having a high boiling point or an organic solvent having a low boiling point may be used.

For instance, the dye providing substance is first dissolved in an organic solvent having a high boiling point such as an alkyl phthalate (e.g., dibutyl phthalate or dioctyl phthalate), a phosphate (e.g., diphenyl phosphate, triphenyl phosphate, tricresyl phosphate or dioctylbutyl phosphate), a citrate (e.g., tributyl acetyl citrate), a benzoate (e.g., octyl benzoate), an alkylamide (e.g., diethyllaurylamide), a fatty acid ester (e.g., dibutoxyethyl sccuinate or dioctyl azelate) or a trimesate (e.g., tributyl trimesate); or in an organic solvent having a low boiling point of about 30°C to 160°C, such as a lower alkyl acetate (e.g., ethyl acetate or butyl acetate) or ethyl propionate, secondary butyl alcohol, methyl isobutyl ketone, β-ethoxyethyl acetate, methyl cellosolve acetate or cyclohexanone;

and thereafter the resultant solution is dispersed in a hydrophilic colloid. A mixture of an organic solvent having a high boiling point and an organic solvent having a low boiling point may also be used.

In addition, a dispersion method using a polymer, as described in Japanese Patent Publication No. 39853/76 and Japanese Patent Application (OPI) No. 59943/76 may be used for incorporation of the dye-providing substance into the photographic material of the present invention. When the dye-providing substance is dispersed in a hydrophilic colloid, various surfactants may be used, and examples of such surfactants are described in U.S. Patent 4,511,650, Col. 18-19.

The amount of an organic solvent having a high boiling point used in the present invention is 10 g or less, preferably is 5 g or less, per g of the dye-providing substance which is used in the present invention.

The light-sensitive materials of the present invention preferably contain a reductive substance, including conventional reducing agents and the above described dye providing substances having reductivity. In addition, reducing agent precursors may also be used, which themselves do not have any reductivity but may develop reductivity due to the action of a nucleophilic reagent or under heat during development.

Examples of reducing agents which may be used in the present invention include inorganic reducing agents such as sodium sulfite or sodium hydrogensulfite; benzenesulfinic acids, hydroxylamines, hydrazines, hydrazides, borane/amine complexes, hydroquinones, aminophenols, catechols, p-phenylenediamines, 3-pyrazolidinones, hydroxytetronic acids, ascorbic acids and 4-amino-5-pyrazolones. In addition, other reducing agents as described in T.H. James, The Theory of the Photographic Process, pp. 291-334 (4th Ed., 1977) may also be used. Moreover, reducing agent precursors described in Japanese Patent Application (OPI) Nos. 138736/81 and 40245/82 and U.S. Patent 4,330,617 may also be used. Furthermore, combinations of various kinds of developing agents as illustrated in U.S. Patent 3,039,869 may also be used in the present invention.

In the light-sensitive material of the present invention, the amount of the reducing agent to be added is about 0.01 to 20 mols, especially preferably about 0.1 to 10 mols, per mol of silver contained in the light-sensitive material.

In the present invention, various kinds of image forming accelerators may be used. Image forming accelerators have various function, for example, to accelerate the oxidation reduction reaction of a silver salt oxidizing agent and a reducing agent, to accelerate the formation of a dye from a dye providing substance or the decomposition of the formed dye or the release of a diffusible dye from a dye providing substance, or to accelerate the transfer of the formed dye from the light-sensitive element layer to the dye fixing element layer. According to the physicochemical functions of these accelerators, they may be classified as bases or base precursors, nucleophilic compounds, oils, thermal solvents, surfactants and compounds having a mutual action with silver or silver ion. In this connection, such accelerator substances generally have composite functions and have two or more accelerating functions as mentioned above.

Image forming accelerators are classified by function into the following groups, and examples within the classified groups are illustrated. However, the following classification is not critical, and in practice, many compounds often have plural functions.

(a) Bases:

Examples of preferred bases are inorganic bases such as alkali metal or alkaline earth metal hydroxides, secondary or tertiary phosphates, borates, carbonates, quinolinates, metaborates; ammonium hydroxides; quaternary alkylammonium hydroxides; and other metal hydroxides; and organic bases such as aliphatic amines (e.g., trialkylamines, hydroxylamines, aliphatic polyamines); aromatic amines (e.g., N-alkyl-substituted aromatic amines, N-hydroxyalkyl-substituted aromatic amines and bis[p-(dialkylamino)phenyl]methanes); heterocyclic amines, amidines, cyclic amidines, guanidines, cyclic guanidines. Among them, bases having a pKa value of 8 or more are especially preferred.

(b) Base precursors:

As base precursors, those capable of releasing a base through some reaction under heat are preferably used, including a salt of an organic acid and a base capable of decarboxylating and decomposing under heat, or a compound capable of decomposing and releasing an amine by an intramolecular nucleophilic substitution reaction, Lossen rearrangement, Beckmann rearrangement or other reaction. Examples of preferred base precursors are salts of trichloroacetic acid, as described in British Patent 998,949; salts of α-sulfonylacetic acid as described in U.S. Patent 4,060,420; salts of propiolic acids as described in Japanese Patent Application (OPI) No. 180537/84; 2-carboxycarboxamide derivatives as described in U.S. Patent 4,088,496; salts of pyrolytic acids, in which an alkali metal or alkaline earth metal component is used besides an organic base, as a base component, as described in Japanese Patent Application (OPI) No. 195237/84; hydroxame carbamates as described in U.S. Patent 4,511,650, in which a Lossen rearrangement occurs; and aldoxime carbamates capable of forming a nitrile under heat, as described in U.S. Patent 4,499,180. In addition, other base precursors as described in British Patent 998,945, U.S. Patent 3,220,846, Japanese Patent Application (OPI) No. 22625/75 and British Patent 2,079,480 are also useful.

(c) Nucleophilic compounds:

Water and water releasing compounds, amines, amidines, guanidines, hydroxylamines, hydrazines, hydrazides, oximes, hydroxamic acids, sulfonamides, active methylene compounds, alcohols and thiols may be used, as well as salts and precursors of these compounds.

(d) Oils:

Organic solvents having a high boiling point ("plasticizers") which are used for emulsification and dispersion of hydrophobic compounds may be used in the present invention.

(e) Thermal solvents:

Thermal solvents are those which are solid at room temperature but are capable of melting at developing temperature to be able to act as a solvent, including ureas, urethanes, amides, pyridines, sulfonamides, sulfonsulfoxides, esters, ketones, ethers or other compounds, which are solid at about 40°C or lower.

(f) Surfactants:

Pyridinium salts, ammonium salts, phosphonium salts as described in Japanese Patent Application (OPI) No. 74547/84; and polyalkylene oxides as described in Japanese Patent Application (OPI) No. 57231/84 may be used.

(g) Compounds having mutual action with silver or silver ion:

Imides; nitrogen-containing heterocyclic compounds as described in Japanese Patent Application (OPI) No. 177550/84; and thiols, thioureas and thioethers as described in Japanese Patent Application (OPI) No. 111636/84 may be used.

Such image forming accelerators may be incorporated in either the light-sensitive element or the dye fixing element of the present invention, or may be incorporated in both of these elements. The accelerators may be incorporated in any of an emulsion layer, an intermediate layer, a protective layer, a dye fixing layer or an adjacent layers to any of these layers.

The image forming accelerator may be used alone, or alternatively, several accelerators may be used together, and, in general, it is preferred to use a mixture of image forming accelerators to obtain a greater image forming acceleration effect. In particular, the combined use of a base or base precursor and another accelerator is preferred, as an extremely remarkable image forming acceleration effect may be attained.

In the present invention, various kinds of development stopping agents may be used for the purpose of consistently obtaining a desired image quality, irrespective of any variation in treatment temperature and treatment time during heat development.

The term "development stopping agent" as used herein designates a compound which may rapidly neutralize a base or react therewith, after completion of sufficient development, to lower the base concentration in the photographic film and thereby to stop the development, or a compound which may mutually react with the existing silver or silver salt thereby to inhibit the development reaction. Examples of such development stopping agents are acid precursors capable of releasing an acid under heat, electrophilic compounds capable of reacting (by a substitution reaction) with a coexisting base under heat, nitrogen-containing heterocyclic compounds and mercapto compounds. Specific examples of acid precursors are oxime esters as described in Japanese Patent Application (OPI) No. 108837/85 and Japanese Patent Application No. 48305/84 (U.S. Patent Application Serial No. 711,885, filed on March 14, 1985), and compounds capable of releasing an acid by Rossen rearrangement as described in Japanese Patent Application No. 85834/84 (U.S. Patent Application Serial No. 727,718, filed on April 26, 1985). Specific examples of electrophilic compounds capable of reacting with a coexisting base under heat by a substitution reaction are described in Japanese Patent Application No. 85836/84 (U.S. Patent Application Serial No. 727,978, filed on April 26, 1985).

It is especially preferred that the development stopping agent used in the present invention contain a base precursor, as the effect of this agent is particularly remarkable, and the molar ratio of (base precursor)/(acid precursor) is preferably about 1/20 to 20/1, more preferably about 1/5 to 5/1.

The light-sensitive materials of the present invention may further contain additional compounds for the purpose of activation of development and stabilization of the image formed. Examples of especially preferred compounds for these purposes are isothiuroniums such as 2-hydroxyethyl-isothiuronium trichloroacetate described in U.S. Patent 3,301,678; bisisothiuroniums such as 1,8-(3,6-dioxaoctane)bis(isothiuronium trichloroacetate) described in U.S. Patent 3,669,670; thiol compounds described in West German Patent Application (OLS) No. 2,162,714; thiazolium compounds such as 2-amino-2-thiazolium trichloroacetate, 2-amino-5-bromoethyl-2-thiazolium trichloroacetate described in U.S. Patent 4,012,260; and compounds having an acidic 2-carboxycarboxyamide group, such as bis(2-amino-2-thiazolium)methylenebis(sulfonylacetate), 2-amino-2-thiazolium phenylsulfonylacetate, described in U.S. Patent 4,060,420.

In addition, other compounds may preferably be used in the present invention, for example, azolethioethers and blocked azolylthione compounds described in Belgian Patent 768,071; 4-aryl-1-carbamyl-2-tetrazolyl-5-thione compounds described in U.S. Patent 3,893,859; and compounds described in U.S. Patents 3,839,041, 3,844,788 and 3,877,940.

In the present invention, an image toning agent may optionally be used. Effective toning agents are 1,2,4-triazole, 1H-tetrazole, thiouracil, 1,3,4-thiadiazole or the like compounds. Preferred examples of these toning agents include 5-amino-1,3,4-thiadiazole-2-thiol, 3-mercapto-1,2,4-triazole, bis(dimethylcarbamyl)-disulfide, 6-methylthiouracil and 1-phenyl-2-tetrazolyl-5-thione. Especially preferred toning agents are compounds capable of forming black images.

The concentration of the toning agent incorporated in the light-sensitive material of the present invention varies, depending upon the kind of light-sensitive materials, the treatment condition employed and the kind of desired image, and other various conditions, but, in general, the amount of toning agent used is about 0.001 to 0.1 mol per mol of silver contained in the light-sensitive material.

Binders which can be used in the present invention are generally selected from conventional transparent or semi-transparent hydrophilic binders, including natural substances, such as proteins, e.g., gelatin, gelatin derivatives, etc., cellulose derivatives, polysaccharides, e.g., starch, gum arabic, etc.; and synthetic polymers, such as water-soluble polyvinyl compounds, e.g., polyvinylpyrrolidone, acrylamide polymers, and the like. In addition, dispersed vinyl compounds in the form of a latex which are effective to improve dimensional stability of photographic materials can also be used as binders. These binders can be used alone or in combinations thereof.

The amount of the binder to be coated is not more than 20 g, preferably not more than 10 g, and more preferably not more than 7 g, per m^2 of the photographic material.

The amount of high-boiling organic solvent that is dispersed in the binder together with hydrophobic compounds, such as dye-providing compounds, is not more than 1 ml, preferably not more than 0.5 ml, and more preferably not more than 0.3 ml, per gram of the binder.

The photographic emulsion layer or other binder layers of the photographic light-sensitive materials or dye-fixing materials may contain organic or inorganic hardeners, such as chromates, e.g., chromium alum, chromium acetate, etc., aldehydes, e.g., formaldehyde, glyoxal, glutaraldehyde, etc., N-methylol compounds, e.g., dimethylolurea, methyloldimethyl hydantoin, etc., dioxane derivatives, e.g., 2,3-dihydroxydioxane, etc., active vinyl compounds, e.g., 1,3,5-triacryloyl-hexahydro-s-triazine, 1,3-vinylsulfonyl-2-propanol, 1,2-bis(vinylsulfonylacetamido)ethane, etc., active halogen compounds, e.g., 2,4-dichloro-6-hydroxy-s-triazine, etc., mucohalogenic acids, e.g., mucochloric acid, mucophenoxychloric acid, etc., and the like, either alone or in combination thereof.

In either one of the light-sensitive material or dye-fixing material according to the present invention, a support other than the above-described support of the present invention may be used. Such supports generally include glass, paper, metals and the like, and in addition, polymer films, e.g., an acetyl cellulose film, a cellulose ester film, a polyvinyl acetal film, a polyethylene terephthalate film and the like. Paper supports laminated with polymers, e.g., polyethylene, can be used. For lamination, polyesters described in U.S. Patents 3,634,089 and 3,725,070 are preferrred. The polyester support of the present invention may also be used as a support for a dye-fixing material.

When the dye-providing compounds which imagewise release mobile dyes are employed, transfer of the dyes from a light-sensitive layer to a dye-fixing layer can be effected by using a dye transfer aid.

The dye transfer aid may either be supplied from the outside of the system between a light-sensitive layer and a dye-fixing layer or be previously incorporated in a light-sensitive layer and/or a dye-fixing layer. The dye transfer aid to be used in the former case includes water, a basic aqueous solution containing sodium hydroxide, potassium hydroxide or an inorganic alkali metal salt, a low boiling solvent, e.g., methanol, N,N-dimethylformamide, acetone, diisobutyl ketone, etc., and a mixed solvent of the low boiling solvent and water or the aforesaid basic aqueous solution. An image-receiving layer may be wet with the dye transfer aid.

In the latter case, the above-described dye transfer aid is previously incorporated in a light-sensitive material and/or a dye-fixing material in the form of a crystal water, microcapsules or a precursor capable of releasing a solvent at high temperatures. In a preferred embodiment, a hydrophilic thermal solvent which is solid at room temperature but is melted at high temperatures is incorporated in a light-sensitive material and/or a dye-fixing material. The thermal solvent may be incorporated in any of an emulsion layer, a protective layer and a dye-fixing layer, but preferably in a dye-fixing layer and/or a layer adjacent thereto. Examples of the thermal solvent to be used are ureas, pyridines, amides, sulfonamides, imides, alcohols, oximes and other heterocyclic compounds.

In the cases when the above-described dye-providing compounds, inter alia, those represented by the formula (LI), are incorporated in the light-sensitive materials, since the dye-providing compounds are colored per se, it is not so necessary to add an anti-irradiation agent, an antihalation agent or various dyes to the light-sensitive materials. However, the light-sensitive materials may contain, if desired, filter dyes or absorbing substances, etc. for obtaining improved sharpness of an image, as described in Japanese Patent Publication No. 3692/73, U.S. Patents 3,253,921, 2,527,583 and 2,956,879, etc.

The light-sensitive materials which can be used in the present invention can further contain, if desired, various additives known to be used in heat-developable light-sensitive materials, such as plasticizers, dyes for improving sharpness, antihalation dyes, sensitizing dyes, matting agents, surface active agents, fluorescent brightening agents, decoloration inhibitors, and the like, as described in Research Disclosure, Vol. 170, No. 17029 (June, 1978).

The light-sensitive element or dye-fixing element may have a structure containing an electrically conductive heating element layer as a heating means for heat development or diffusion transfer of dyes.

In order to obtain a color image having a wide range of colors in a chromaticity diagram by using three primary colors of yellow, magenta and cyan, the light-sensitive element should have at least three silver halide emulsion layers being sensitive to different spectral regions.

Typical combinations of the light-sensitive silver halide emulsion layers being sensitive to different spectral regions include a combination of a blue-sensitive emulsion layer, a green-sensitive emulsion layer, a red-sensitive emulsion layer and an infrared light-sensitive emulsion layer; a combination of a green-sensitive emulsion layer, a red-sensitive emulsion layer and an infrared light-sensitive emulsion layer; a combination of a blue-sensitive emulsion layer, a green-sensitive emulsion layer and an infrared light-sensitive emulsion layer; a combination of a blue-sensitive emulsion layer, a red-sensitive emulsion layer and an infrared light-sensitive emulsion layer; and the like. The infrared light-sensitive emulsion layer herein used is an emulsion layer having sensitivity to light of 700 nm or more, particularly 740 nm or more.

If desired, the light-sensitive materials to be used in the present invention may contain two or more emulsion layers being sensitive to the same spectral region but having different sensitivities.

The aforesaid emulsion layers and/or light-insensitive hydrophilic colloidal layers adjacent to the respective emulsion layers should contain at least one each of a dye-providing compound capable of releasing or forming a hydrophilic yellow dye, a dye-providing compound capable of releasing or forming a hydrophilic magenta dye, and a dye-providing compound capable of releasing or forming a hydrophilic cyan dye. In other words, it is necessary that each of the emulsion layers and/or the respective light-insensitive hydrophilic colloidal layers adjacent thereto should contain a dye-providing compound capable of releasing or forming a hydrophilic dye showing a hue different to each other. If desired, mixtures of two or more dye-providing compounds having the same hue may be used. If using initially colored dye-providing compounds, it is particularly advantageous to incorporate such a dye-providing compound in a layer different from the emulsion layer. The light-sensitive materials used in the present invention can further have additional auxiliary layers, such as a protective layer, an intermediate layer, an antistatic layer, an anticurling layer, a parting layer, a matting layer, and the like.

In particular, a protective layer usually contains an organic or inorganic matting agent for the purpose of preventing adhesion. The protective layer may further contain a mordant, an ultraviolet absorbent, etc. The intermediate layer can contain a reducing agent for color mixing prevention, an ultraviolet absorbent, and a white pigment, e.g., titanium dioxide. The white pigment may be added not only to the intermediate layer but also to emulsion layers for the purpose of increasing sensitivity. The protective layer or intermediate layer may comprise two or more layers.

Color sensitization of silver halide emulsions can be effected by using known sensitizing dyes so as to impart desired spectral sensitivities.

The dye-fixing element which can be used in the present invention comprises at least one layer containing a mordant. In the cases where a dye-fixing layer is provided on the surface of the dye-fixing element, a protective layer may be provided thereon, if necessary.

If desired, the dye-fixing element can further have a water-absorbing layer or a dye transfer aid-containing layer in order to ensure sufficient penetration of a dye-transfer aid or to control the dye transfer aid. The water-absorbing layer or dye transfer aid-containing layer is formed adjacent to the dye-fixing layer with or without an intermediate layer being interposed therebetween.

The dye-fixing layer may be composed of two or more layers containing mordants having different mordanting powers, if desired.

The dye-fixing element can further have, in addition to the above-described layers, auxiliary layers, such as a parting layer, a matting agent-containing layer, an anticurling layer, etc., according to necessity.

One or a plurality of the above-described layers may contain a base and/or a base precursor for accelerating dye transfer, a hydrophilic thermal solvent, a discoloration inhibitor for preventing color mixing, an ultraviolet absorbent, a dispersed vinyl compound for increasing dimensional stability, a fluorescent brightening agent, and the like.

In addition to the above-described layer, the dye-fixing element may have a reflecting layer containing a white pigment, e.g., titanium oxide, a neutralizing layer, a neutralization timing layer, and the like depending on the purpose. These layers may be provided not only in the dye-fixing element but also in the light-sensitive element. Layer structures for the reflecting layer, neutralization layer and neutralization timing layer are described, e.g., in U.S. Patents 2,983,606, 3,362,819, 3,362,821 and 3,415,644, Canadian Patent 928,559, etc.

It is advantageous that the dye-fixing element according to the present invention contains the above-mentioned dye transfer aid either in the above-described dye-fixing layer or in an independent layer.

In the present invention, when heat development is effected by electric heating, a transparent or opaque resistance heating element to be employed can be produced by a conventionally known technique so as to have a desired temperature characteristic.

The resistance heating element includes a thin film made of semi-conductive inorganic material, such as silicon carbide, molybdenum silicate, lanthanum chromate, barium titanate ceramics used as PTC thermistors, titanium oxide, zinc oxide, etc.; and an organic thin film made of conductive fine particles of metals, carbon black, graphite, etc. dispersed in a binder, e.g., rubber, synthetic polymers, gelatin, etc. These resistance elements may be provided in contact with a light-sensitive element either directly or via a support, an intermediate layer, and the like.

Examples of a positional relation of the heating element and light-sensitive element are illustrated below:

Heating Element/Support/Light-Sensitive Element,

Support/Heating Element/Light-Sensitive Element,

Support/Heating Element/Intermediate Layer/Light-Sensitive Element,

Support/Light-Sensitive Element/Heating Element, and

Support/Light-Sensitive Element/Intermediate Layer/Heating Element.

An image-receiving layer according to the present invention includes a dye-fixing layer used in heat developable color light-sensitive material. Mordants to be contained are selected from generally employed mordants. Among them, polymer mordants containing a tertiary amino group, a nitrogen-containing heterocyclic moiety or a quaternary cation group thereof are preferred.

Polymers containing a vinyl monomer unit having a tertiary amino group are described in Japanese Patent Application (OPI) Nos. 60643/85, 57836/85, etc., and polymers containing a vinyl monomer unit having a tertiary imidazole ring are desdribed in U.S. Patent Application Serial No. 676,987, filed on November 11, '84, Japanese Patent Application No. 232071/83, U.S. Patents 4,282,305, 4,115,124 and 3,148,061,etc.

Preferred examples of polymers containing a vinyl monomer having a quaternary imidazolium cation are described in British Patents 2,056,101, 2,093,041 and 1,594,961, U.S. Patents 4,124,386, 4,115,124, 4,273,853 and 4,450,224, Japanese Patent Application OPI No. 28225/73, etc.

Preferred examples of polymers containing a vinyl monomer having a quaternary ammonium cation are given in U.S. Patents 3,709,690, 3,898,088 and 3,958,995, Japanese Patent Application (OPI) Nos.57836/85 and 60643/85, Japanese Patent Application Nos. 232070/83 and 232072/83 and U.S. Patent Application Serial No.731,695 filed on May 8, '84.

The light-sensitive materials of the present invention can be obtained by formulating coating compositions for a heat developable light-sensitive layer, protective layer, intermediate layer, subbing layer, backing layer and other layers and consequently applying the compositions by various known coating methods, such as dip coating, air knife coating, curtain coating, and hopper coating as described in U.S. Patent 3,681,294, on a support, followed by drying.

If desired, two or more layers can be coated simultaneously in accordance with the method disclosed in U.S. Patent 2,761,791 and British Patent 837,095.

Exposure for image formation is carried out with radiation including visible light. In general, light sources which can be employed for exposure include those for usual color prints, e.g., a tungsten lamp, a halogen lamp (e.g., an iodine lamp), a xenon lamp, a laser beam, a CRT spot, a fluorescent lamp, a light-emitting diode (LED), and the like.

Heating temperatures for the heat development process range from about 80° to about 250°C, preferably from about 110° to about 180°C, more preferably from 120° to 180°C, and most preferably from 140° to 180°C.

Heating temperatures in a transfer process range from room temperature up to the temperature employed in the heat development process, and preferably from 60°C up to a temperature lower than that employed in the heat development process by about 10°C. Heating means in the development or transfer process include a hot plate, an iron, a hot roller, a heating element made of carbon or titanium white, and the like.

When a dye-providing substance capable of imagewise releasing a diffusible dye is used in the present invention, a dye transfer assistant may be used for the purpose of efficient diffusion of the dye formed from the light-sensitive layer to the dye fixing layer.

The dye transfer assistant may be applied to the light-sensitive material and/or the dye-fixing material after development, or alternatively may previously be incorporated therein before development.

For the addition of the dye transfer assistant to the light-sensitive layer and/or the dye fixing layer, various means may be utilized; for example, a roller coating method or a wire bar coating method, as described in Japanese Patent Application No. 55907/83; a method where water is coated on the surface of a dye-fixing layer by the use of a water absorptive material, as described in Japanese Patent Application (OPI) No.181354/84; a method where beads are formed between a water repellant roller and a dye fixing layer and thereafter a dye transfer assistant is imparted thereto, as described in Japanese Patent Application (OPI) No. 181345/84; and other dip methods, extrusion methods, jetting method in which a dye transfer assistant is jetted from small orifices, a method in which pods including a dye transfer assistant are crushed, or other conventional means may be utilized.

Regarding the amount of dye transfer assistant added to the light-sensitive material of the present invention, a previously determined amount of said assistant may be added, as described in Japanese Patent Application (OPI) No. 164551/84, or alternatively, an excess and sufficient amount of the assistant is added and thereafter the amount may be appropriately regulated by squeezing any unnecessary amount of the assistant from the light-sensitive material by the use of rollers or the like under pressure or by evaporating the agent under heat.

Various conventional heating means may be used in the transfer step in the treatment of the light-sensitive material of the present invention; for example, the material may be heated by being passed through hot plates or by being contacted with hot plates (e.g., as described in Japanese Patent Application (OPI) No. 62635/75); by being contacted with hot drums or hot rollers, while rotated (e.g., as described in Japanese Patent Publication No.10791/68); by being passed through hot air (e.g., as described in Japanese Patent Application (OPI) No. 32737/78); by being passed through an inert liquid kept at a determined temperature; or by being led along a heat source by the use of guide rollers, conveyor belt or the like guide parts (e.g., as described in Japanese Patent Publication No. 2546/69). Apart from such methods, the dye fixing element may directly be heated by applying an electric current to an electroconductive material layer containing graphite, carbon black or a metal substance provided on said dye fixing element layer, to heat the dye fixing element layer.

The heating temperature in the transfer step is within a range of from room temperature to the temperature in the heat development step, and is preferably within a range of from about 60°C up to a temperature lower than the heat development temperature by 10°C or more.

The heat-developable light-sensitive material and the dye-fixing material are brought into intimate contact under a pressure of from 0.1 to 100 Kg/cm^2, and preferably from 1 to 50 Kg/cm^2, as described in Japanese Patent Application No. 55691/83, though varying depending upon the material used. The pressure is applied by a known manner, such as passing through a pair of rollers, pressing using smooth plates and the like. The roller or plate used for pressure application can be heated to a temperature of from room temperature to that employed in the heat development process.

The present invention will now be illustrated in greater detail with reference to the following examples, but it should be understood that the present invention is not limited thereto. In these examples, all parts and percents are given by weight unless otherwise indicated.

EXAMPLES

The present invention will now be described by reference to specific examples which are not meant to be limiting. Unless otherwise specified, all ratios, percents, etc., are by weight.

Example 1

A benzotriazole silver emulsion was prepared in the following manner.

Gelatin (28 g) and benzotriazole (13.2 g) were dissolved in water (300 ml). The resulting solution was held at 40°C and stirred. To this solution a solution of silver nitrate (17 g) in water (100 ml) was added over 2 min.

After pH adjustment, the resulting benzotriazole silver emulsion was precipitated to remove excess salts. Then the pH was adjusted to 6.30 to obtain a benzotriazole silver emulsion at a yield of 400 g.

The silver halide for the fifth and the first layers was prepared in the following manner.

An aqueous solution (600 ml) of sodium chloride and potassium bromide and an aqueous solution of silver nitrate (silver nitrate: 0.50 mole, water: 600 ml) were simultaneously added at a constant flow rate over 40 min to an aqueous gelatin solution (gelatin: 20 g, sodium chloride: 3 g and water: 1,000 ml, held at 75°C) which was being thoroughly stirred. A monodisperse cubic silver chlorobromide emulsion (Br: 50 mole%) having an average grain size of 0.40 μm was prepared in this way.

After washing and desalting of the thus obtained emulsion, sodium thiosulfate (5 mg) and 4-hydroxy-6-methl-1,3,31,7-tetraazaindene (20 mg) were added and chemical sensitization was performed at 60°C. The yield of the emulsion was 600 g.

The silver halide emulsion for the third layer was prepared in the following manner.

To an aqueous gelatin solution (gelatin: 20 g, sodium chloride: 3 g, water: 1,000 ml, held at 75°C) which is being thoroughly stirred, an aqueous solution (600 ml) of soium chloride and potassium bromide and an aqueous silver nitrate solution (silver nitrate: 0.59 mole, water: 600 ml) were simultaneously added at a constant flow rate over 40 min. A monodisperse cubic silver chlorobromide emulsion (Br: 80 mole%) having an average grain size of 0.35 μm was obtained.

After washing and desalting of the resulting emulsion, sodium thiosulfate (5 mg) and 4-hydroxy-6-methyl-1,3,3a,7-tetraazaindene (20 mg) were added and chemical sensitization was effected at 60°C. The yield of the emulsion was 600 g.

A gelatin dispersion of a dye providing

substance was prepared in the following manner.

A yellow dye providing substance (A) (5 g), sodium 2-ethylhexylsulfosuccinate (0.5 g) and triisononyl phosphate (10 g) as surfactants, and ethyl acetate (30 ml) were mixed and heated at about 60°C to form a uniform solution. The resulting solution and an aqueous 10% lime treated gelatin solution (100 g) were mixed under stirring and then dispersed by a homogenizer at 10,000 rpm for 10 min. This dispersion was termed a "dispersion of a yellow dye providing substance".

A dispersion of a magenta dye providing substance was prepared in a manner similar to the above-described method, except that a magenta dye providing substance (B) and tricresyl phosphate (7.5 g) as a high boiling solvent were used.

A dispersion of a cyan dye providing substance was prepared in a manner similar to the above-identified yellow dye dispersion using a cyan dye providing substance (C).

Using the above-described materials, a multilayer color light-sensitive material was prepared as shown in Table 1.

Table 1

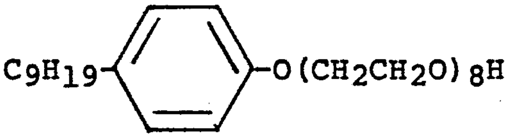
Sixth layer	Gelatin (coating weight: 1,000 mg/m^2), base precursor *3 (coating weight: 600 mg/m^2), silica *5 (coating weight: 100 mg/m^2), hardening agent *6 (coating weight: 100 mg/m^2)
Fifth layer	(Green-sensitive emulsion layer) Silver chlorobromide emulsion (Br: 50 mole%, coating weight: AG 4000 mg/m^2), benzenesulfonamide (coating weight: 160 mg/m^2), benzotriazole silver emulsion (coating weight: 100 mg/m^2), sensitizing dye D-1 (coating weight: 10^{-6} mole/m^2), base precursor *3 (coating weight: 390 mg/m^2), yellow dye providing substance (A) (coating weight: 400 mg/m^2), gelatin (coating weight: 1,000 mg/m^2), high boiling solvent *4 (coating weight: 800 mg/m^2), surfactant *2 (coating weight: 100 mg/m^2)

Fourth layer	(Intermediate layer) Gelatin (coating weight: 1,200 mg/m^2), base precursor *3 (coating weight: 600 mg/m^2)
Third layer	(Red-sensitive emulsion layer) Silver chlorobromide emulsion (Br: 80 mole%, coating weight: Ag 300 g/m^2), benzenesulfonamide (coating weight: 180 mg/m^2), benzotriazole silver emulsion (coating weight: Ag 100 mg/m^2), sensitizing dye D-2 (8×10^{-7} mole/m^2), base precursor *3 (coating weight: 350 mg/m^2), magenta dye providing substance (B) (coating weight: 400 mg/m^2), gelatin (coating weight: 1,000 mg/m^2), high boiling solvent *1 (coating weight: 600 mg/m^2), surfactant *2 (coating weight: 100 mg/m^2)
Second layer	(Intermediate layer) Gelatin (coating weight: 1,000 mg/m^2), base precursor *3 (coating weight: 600 mg/m^2)

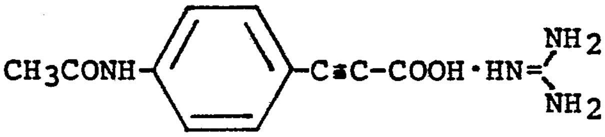
First layer	(Infrared-sensitive emulsion layer) Silver chlorobromide emulsion (Br: 50 mole%, coating weight: Ag 300 mg/m^2), benzenesulfonamide (coating weight: 180 mg/m^2), benzenetriazole silver emulsion (coating weight: Ag 100 mg/m^2), sensitizing dye D-3 (coating weight: 10^{-8} mole/m^2), base precursor *3 (coating weight: 390 mg/m^2), Cyan dye providing substance (C) (coating weight: 300 mg/m^2), gelatin (coating weight: 1,000 mg/m^2), high boiling solvent *4 (coating weight: 600 mg/m^2), surfactant *2 (coating weight: 100 mg/m^2)
Support	

*1: tricresyl phosphate

*2:



*3:



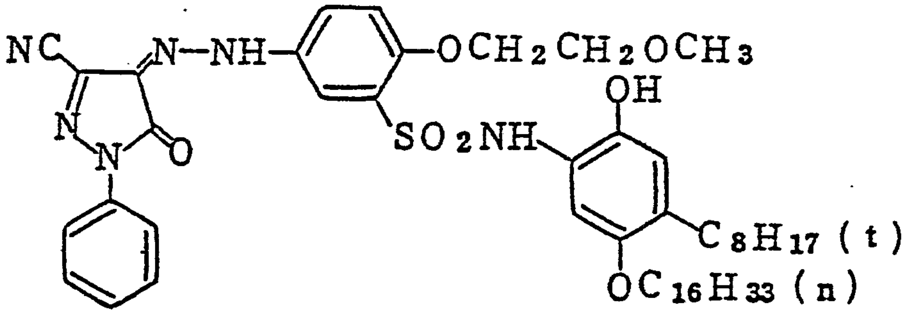
*4: (iso $C_9H_{19}O)_3P=O$

*5: size 4 μm

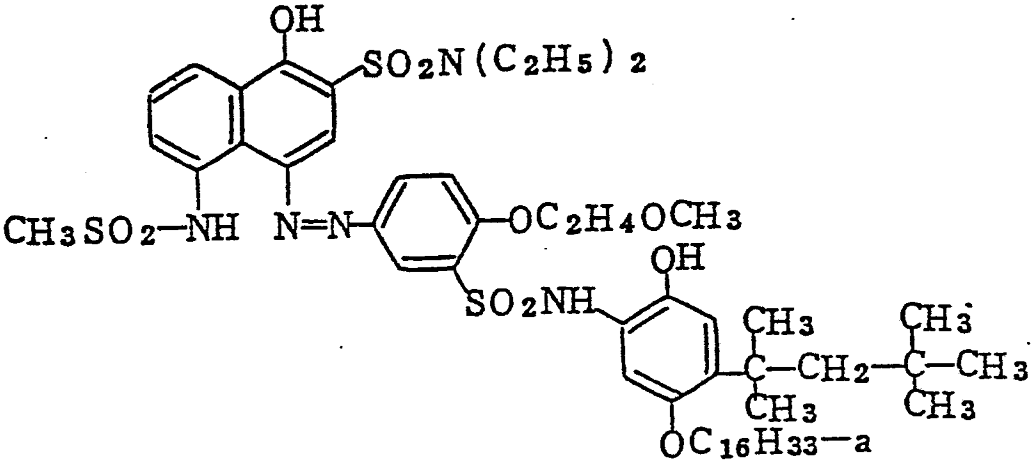
*6: 1,2-bis(vinylsulfonylacetamido)ethane

Dye providing substances

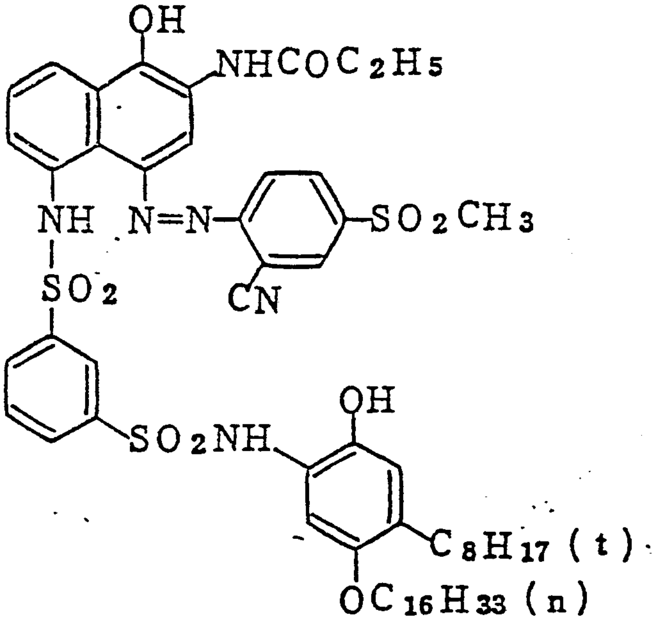
(A)



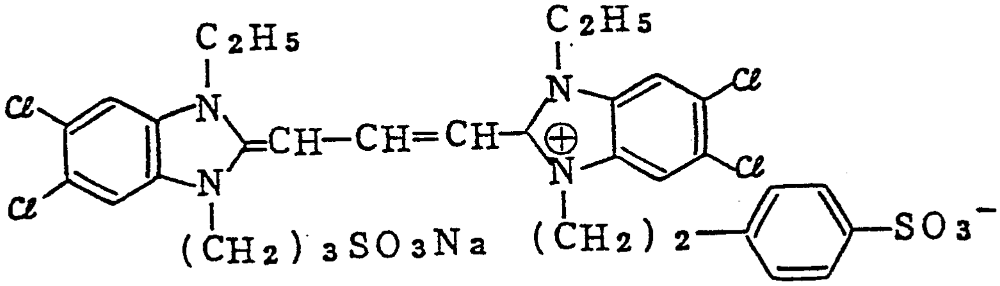
(B)



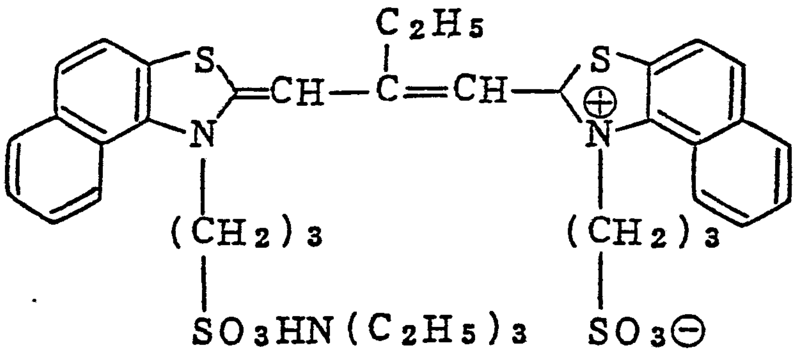
(C)



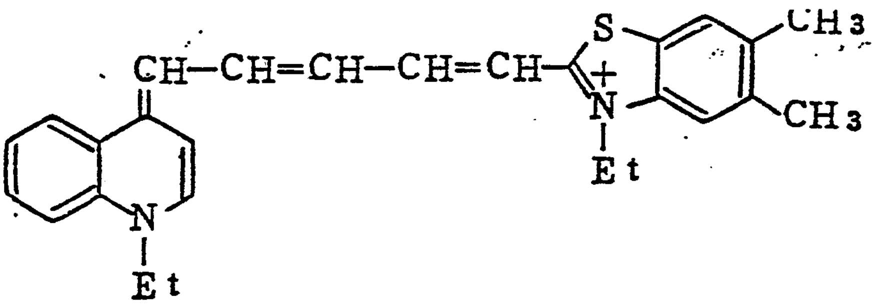
(D-1)



(D-2)


C2H5
S
S
CH
C
CH
N
N
(CH2)3
(CH2)3
SO3HN(C2H5)3
SO3⊖

(D-3)


CH—CH=CH—CH=CH
S
N
CH3
CH3
N
Et
Et

A dye fixing material having a dye fixing layer was prepared in the following manner.

Gelatine hardening agents (H-1) (0.75 g) and (H-2) (0.25 g), water (160 ml) and a 10% lime treated gelatin solution (100 g) were uniformly mixed. The resulting mixture was evenly coated on each of the paper supports (a), (b) and (c) as shown in the following table, which were laminated with polyethylene wherein titanium oxide was dispersed, to a wet thickness of 60 μm and dried.

No.		Paper support				Number of W_{CM} values of 4 μm or more when W_{CM} values were measured at 100 location
		Paper type	Paper basis weight	Thickness of polyethylene front	Thickness of polyethylene back	
(I)	(a)	Wood free paper	84.3 g/m^2	15 μ	20 μ	91
(II)	(b)	Coated paper	84.9 g/m^2	15 μ	20 μ	8
(III)	(c)	Cast coated paper	84.9 g/m^2	15 μ	20 μ	2

Gelatin hardening agent (H-1):

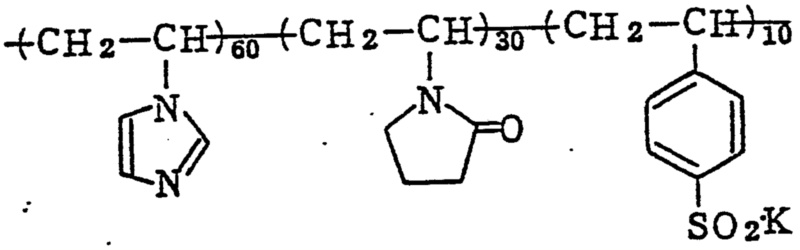
$CH_2=CH-SO_2CH_2CONHCH_2CH_2NHCOCH_2SO_2CH=CH_2$

Gelatin hardening agent (H-2):

$CH_2=CH-SO_2CH_2CONHCH_2CH_2CH_2NHCOCH_2SO_2CH=CH_2$

A polymer (15 g) of the following formula was dissolved in water (200 ml) and the resulting solution was uniformly mixed with 10% lime treated gelatin (100 g). The resulting mixture was uniformly coated on the above-described coated supports to a wet thickness of 85 μm to obtain dye fixing materials (I), (II) and (III).

Polymer:



The above-described multilayer color light-sensitive materials were exposed to light under a tungsten lamp (500 lx) for one second through a separation (G, R and IR) of continuous density change (G filter: 500-600 nm band pass filter, R filter: 600-700 nm band pass filter, IR filter: filter passing wavelengths of 700 nm or longer).

The light-sensitive material was subsequently evenly heated for 30 sec on a heated block at 140°C.

Then water (15 ml/m^2) was supplied to the film side of the dye fixing material and then the above-described light-sensitive coated material which had been heat treated was superimposed on the dye fixing material such that the film sides were brought into contact.

After heating for 6 sec on a heated block at 80°C, the dye fixing material was peeled off the light-sensitive material to obtain yellow, magenta and cyan images on the fixing material corresponding to the G, R and IR lights separated by the separation filter respectively.

The maximum density of each color (Dmax) was measured using a Macbeth reflection densitometer (RD-519) and the degree of unevenness of transfer of each dye fixing material was visually evaluated.

The results are shown in Table 2.

Table 2

Dye fixing material	Paper support	Separation filter	Color image	Dmax	Unevenness of transfer
(I) Comparative example	(a)	G R IR	Yellow Magenta Cyan	2.19 2.29 2.20	Scattered all over the color images.1)
(II) Present invention	(b)	G R IR	Yellow Magenta Cyan	2.18 2.29 2.19	Very few specks of uneven transfer.2)
(III) Present invention	(c)	G R IR	Yellow Magenta Cyan	2.19 2.29 2.20	None.

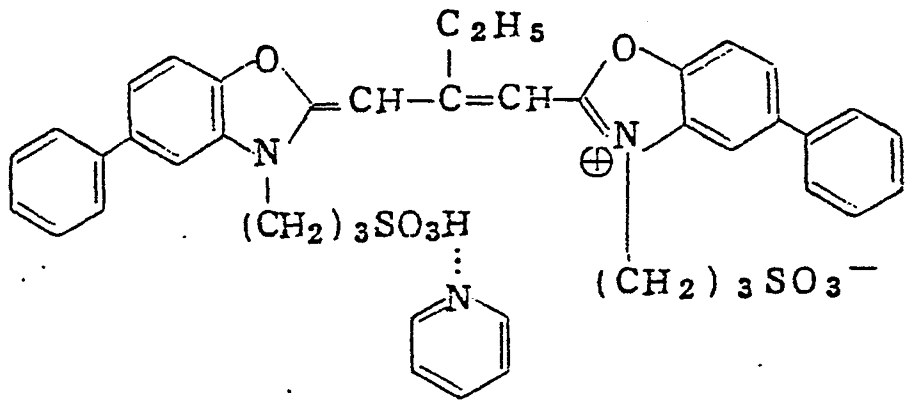
Number of specks of uneven transfer (circular specks of 10 μm - 1 mm) found in 1 cm^2 of the image area: 1) > 50, 2) < 5.

0.59 mole) and the following dye solution (I) were simultaneously added at a constant flow rate over a period of 40 min. A monodisperse cubic silver chlorobromide emulsion (Br: 80 mole%) wherein a dye having an average grain size of 0.35 μm was absorbed was obtained.

After washing and desalting of the emulsion, sodium thiosulfate (5 mg) and 4-hydroxy-6-methyl-1,3,31,7-tetraazaindene (20 mg) were added to the emulsion and chemical sensitization was effected at 60°C.

The emulsion was obtained in a yield of 600 g.

Dye solution [1]



methanol 160 mg

400 mg

The emulsion for the fifth layer as shown in Table 3 was prepared in the following manner.

To an aqueous gelatin solution (water: 1,000 ml, gelatin: 20 g, ammonia, and held at 50°C) which was being

Table 2 shows that use of the coated paper or cast coated paper of the present invention markedly decreases unevenness of transfer even when the basis weight of the paper is small (i.e., the paper is thin), and that particularly, use of cast coated paper eliminates uneven transfer almost completely.

Example 2

A multilayer color light-sensitive material as shown in Table 3 was prepared in the following manner.

The silver chlorobromide emulsion for the first layer shown in Table 3 is the same as the silver chlorobromide emulsion used for the third layer of Example 1.

Dye providing substances (A), (B) and (C) as shown in Table 3 are each the same as that used in Example 1.

The benzotriazole silver shown in Table 3 is the same as that of Example 1.

The emulsion for the third layer shown in Table 3 was prepared in the following manner.

To an aqueous gelatin solution (water: 1,000 ml, gelatin: 20 g, sodium chloride: 3 g, and held at 75°C) under vigorous agitation an aqueous solution (600 ml) of sodium chloride, patassium bromide and an aqueous solution of silver nitrate (water: 600 ml, silver nitrate:

thoroughly stirred an aqueous solution (1,000 ml) of potassium iodide and potassium bromide and an aqueous silver nitrate solution (water: 1,000 ml, silver nitrate: 1 mole) were simultaneously added while keeping the pAg constant. A monodisperse silver irodobromide octahedral emulsion (I: 5 mole%) having an average grain size of 0.5 μm was obtained.

After washing and desalting of the emulsion, chloroauric acid (tetrahydrate) (5 mg) and sodium thiosulfate (2 mg) were added to the emulsion to effect gold and sulfur sensitization at 60°C. The emulsion was obtained in a yield of 1.0 kg.

Table 3

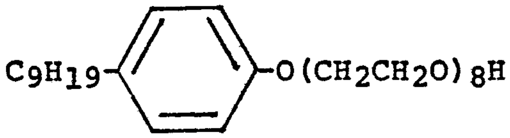
Sixth layer	Gelatin (coating weight: 740 mg/m^2), base precursor *3 (coating weight: 250 mg/m^2)
Fifth layer	(Blue-sensitive emulsion layer) Silver iodobromide emulsion (I: 5 mole%, coating weight: Ag 500 mg/m^2), dimethylsulfamide (coating weight: 160 mg/m^2), benzotriazole silver emulsion (coating weight: 300 mg/m^2), base precursor *3 (coating weight: 270 mg/m^2), development stopping agent (A) *6 (coating weight: 120 mg/m^2), development stopping agent (B) *7 (coating weight: 25 mg/m^2), yellow dye providing substance (A) (coating weight: 400 mg/,^{2}), gelatin (coating weight: 1,200 mg/m^2), high boiling solvent *4 (coating weight: 700 mg/m^2), surfactant *2 (coating weight: 70 mg/m^2)

Fourth layer	(Intermediate layer) Gelatin (coating weight: 700 mg/m^2), base precursor *3 (coating weight: 240 mg/m^2)
Third layer	(Green-sensitive emulsion layer) Silver chlorobromide emulsion (Br: 80 mole%, coating weight: Ag 200 mg/m^2), dimethylsulfamide (coating weight: 140 mg/m^2), benzotriazole silver emulsion (coating weight: Ag 100 mg/m^2), base precursor *3 (coating weight: 210 mg/m^2), development stopping agent (A) *6 (coating weight: 150 mg/m^2), development stopping agent (B) *7 (coating weight: 10 mg/m^2), magenta dye providing substance (B) (coating weight: 330 mg/m^2), gelatin (coating weight: 860 mg/m^2), high boiling solvent *1 (coating weight: 430 mg/m^2), surfactant *2 (coating weight: 60 mg/m^2)
Second layer	(Intermediate layer) Gelatin (coating weight: 700 mg/m^2), base precursor *3 (coating weight: 240 mg/m^2)

First layer	(Infrared-sensitive emulsion layer) Silver chlorobromide emulsion (Br: 80 mole%, coating weight: Ag 200 mg/m^2), benzenesulfonamide (coating weight: 140 mg/m^2), benzenetriazole silver emulsion (coating weight: Ag 100 mg/m^2), sensitizing dye *5 (coating weight: 8 x 10^{-7} mole/m^2), base precursor *3 (coating weight: 230 mg/m^2), development stopping agent (A) *6 (coating weight: 170 mg/m^2, development stopping agent (B) *7 (coating weight: 10 mg/m^2), cyan dye importing substance (C) (coating weight: 300 mg/m^2), gelatin (coating weight: 850 mg/m^2), high boiling solvent *4 (coating: 540 mg/m^2), surfactant *2 (coating weight: 60 mg/m^2)
Support	

*1: tricresyl phosphate

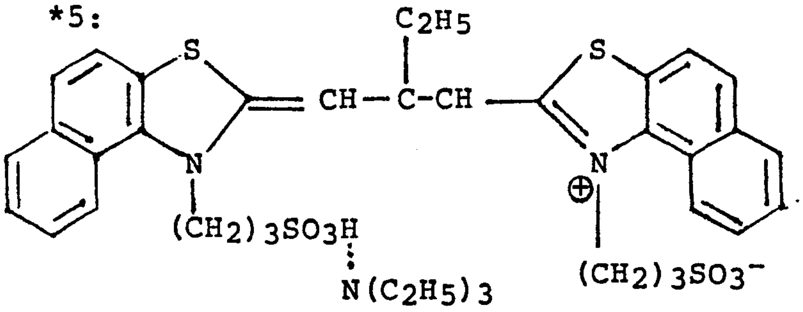
*2:



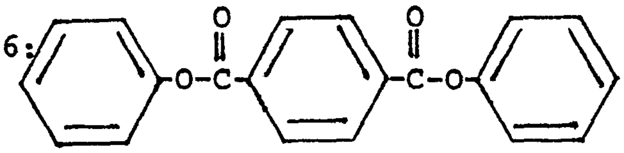
*3: guanidine 4-methylsulfonyl-phenylsulfonyl acetate

*4: $(\mathrm{isoC_9H_{19}O})_3P = O$

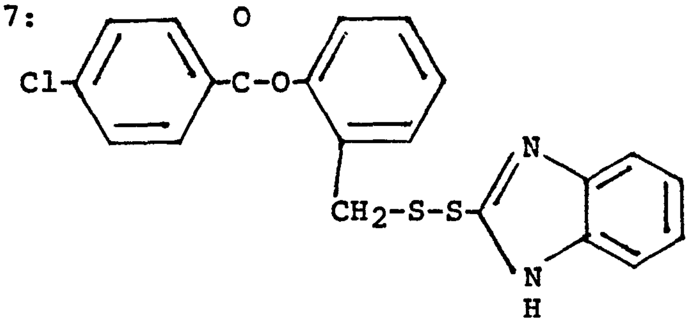
*5:



*6:



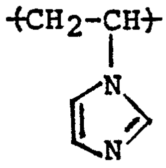
*7:



The dye fixing material was prepared as follows:

Lime-treated gelatin (12 g) was dissolved in water (200 ml), and an aqueous 0.5 M zinc acetate solution (16 ml) was added and the resulting solution was uniformly mixed. This solution was coated on each of paper supports (a), (b) and (c) similar to those used in Example 1 to a wet thickness of 85 μm, and a coating solution having the following composition was further coated evenly in a superimposed fashion on the above-described coating to a wet thickness of 90 μm to obtain dye fixing materials (IV), (V) and (VI).

Formula of the coating solution for the dye fixing layer:

10% aqueous solution of polyvinyl alcohol (polymerization degree: about 2,000)	120 g
Urea	20 g
N-methyl urea	20 g
12% aqueous solution of 	80 g
Water	60 ml

The above-identified multilayer structure color light-sensitive material was exposed to light (2,000 lx) using a tungsten lamp for 1 sec through a separation filter (B, G and R) of continuous density change. Thereafter the light-sensitive material was evenly heated for 30 sec on a heated block at 140°C.

The thus-obtained light-sensitive material and the dye-fixing material were superimposed on each other such that the coated surfaces are brought into contact, and were passed between heated rollers (130°C) under pressure application, and immediately thereafter heated on a heated block (120°C) for 30 sec. Immediately after the heating, the dye fixing material was peeled off the light-sensitive material to obtain yellow, magenta and cyan images which respectively correspond to the three colors B, G and R were obtained on the dye fixing material. The maximum density (Dmax) of each color was determined using a Macbeth reflection densitometer (RD-519) and the degree of uneven transfer was visually evaluated.

The results are shown in Table 4.

Table 4

Dye fixing material	Paper support	Separation filter	Color image	Dmax	Unevenness of transfer
(IV)	(a)	B	Yellow	2.02	Scattered all over the color images.
		G	Magenta	2.05	
		R	Cyan	2.10	
(V)	(b)	B	Yellow	2.02	Very few specks of uneven transfer.
		G	Magenta	2.04	
		R	Cyan	2.11	
(VI)	(c)	B	Yellow	2.00	None.
		G	Magenta	2.05	
		R	Cyan	2.11	

From Table 4, it is seen that when the coated paper or cast coated paper of the present invention are used, no uneven transfer occurs even if the transfer is effected in the total absence of water and in the presence of a hydrophilic hot solvent, and that unevenness of transfer can be completely eliminated particularly by using cast coated paper.

While the invention has been described in detail and with reference to specific embodiments thereof, it will be apparent to one skilled in the art that various changes and modifications can be made therein without departing from the spirit and scope thereof.

WAHT IS CLAIMED IS:

1. A method of transferring a dye which comprises superimposing on a photographic material having a mobile dye distributed in an imagewise pattern on a first support a dye fixing material having a dye receiving layer on a second support and transferring said mobile dye to said dye fixing material, and wherein at least one of said two supports has such surface characteristics that the number of locations where the filtered maximum waviness value is 4 μm or greater is not more than 10 out of 100 locations on the support arbitrarily selected for measuring the filtered maximum waviness of a basic length of 2.5 mm of a filtered waviness curve obtained with a cut-off value of 0.8 mm from a profile measured by JIS Standard B 0610 with respect to the surface smoothness of the support.

2. A method of transferring a dye comprising superimposing a mobile-dye-containing light-sensitive material on a first support on a dye fixing material having a dye fixing layer on a second support to thereby transfer said dye to the dye fixing layer, the support of at least one of said mobile-dye-containing light-sensitive material and said dye fixing material comprising coated paper.

3. A method of transferring a dye as described in Claim 2, wherein said coated paper is cast coated paper.

4. A method of transferring a dye as described in Claim 1, wherein said photographic material is one obtained by heat developing a heat development photographic material containing on a support at least a light-sensitive silver halide, a binder, and a dye-providing substance which releases or forms a mobile dye upon heating, after or during the heat development.

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Fig. 1

Fig. 2

Fig. 3