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(71) Applicant: **FUJI PHOTO FILM CO., LTD.**
210 Nakanuma Minami Ashigara-shi
Kanagawa 250-01(JP)

(72) Inventor: **Taguchi, Toshiki c/o Fuji Photo Film Co., Ltd.**
No. 210, Nakanuma
Minami Ashigara-shi Kangawa(JP)

(74) Representative: **Patentanwälte Grünecker, Kinkeldey, Stockmair & Partner**
Maximilianstrasse 58
D-8000 München 22(DE)

(54) Heat-developable color light-sensitive material and method of forming image with the same.

(57) Disclosed is a heat-developable color light-sensitive material comprising a support having provided thereon a light-sensitive silver halide, a binder, and a dye providing compound capable of releasing or forming a diffusible dye in coprrespondence or reverse correspondence with the reaction of reducing the silver halide into silver on a support. said light-sensitive material having a hydrophilic binder layer containing an adsorbent substance capable of adsorbing a color substance formed during the step of processing the light-sensitive material for forming an image therewith. For forming an image with the material, the material is heated during or after imagewise exposure thereof to release or form a diffusible dye whereupon the dye is transferred to a dye-fixing layer different from the hydrophilic binder layer containing the adsorbent substance. The light-sensitive material gives a color image having a high image density but a low stain and has an excellent storage stability.

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HEAT-DEVELOPABLE COLOR LIGHT-SENSITIVE MATERIAL AND METHOD OF FORMING IMAGE WITH THE SAME

FIELD OF THE INVENTION

The present invention relates to a heat-developable color light-sensitive material and, in particular, to that which may form a color image having a high image density but a low stain and which has an excellent storage stability.

BACKGROUND OF THE INVENTION

Various heat-developable light-sensitive materials are known in this technical field, and for example, such materials and photographic process thereof are described in Shashin Kogaku No Kiso, Edition of Nonsilver Photography (published by Corona Publishing Co., 1982), pages 242 to 255.

Various methods have been proposed for forming color images by heat development.

For instance, U.S. Patents 3,531,286, 3,761,270 and 4,021,240, Belgian Patent 802,519 and Research Disclosure (hereinafter referred to as "RD"), September 1975, pages 31 to 32 have proposed methods of forming a color image by bonding of the oxidation product of a developing agent and a coupler.

However, as the heat-developable light-sensitive materials to be used in said methods for forming color images are ones of a non-fixable type, the silver halide would still remain in the material even after formation of images. Accordingly, such materials have a serious problem that the white portion in the material is gradually colored after it has been exposed to a strong light or has been stored for a long period of time. In addition, the known methods generally require a relatively long period of time for development, and these have an additional drawback that the image formed is noticeably fogged and has a low image density.

In order to overcome the drawbacks, a method has been proposed where a diffusible dye is imagewise formed or released under heat and the diffusible dye is transferred to an image-receiving material having a mordant agent by means of a solvent such as water. (Refer to U.S. Patents 4,500,626, 4,483,914, 4,503,137 and 4,559,290 and JP-A-59-165054.) (The term "JP-A" as used herein means an "unexamined published Japanese patent application".)

In accordance with said method, however, the development temperature is still high and the storage stability of the light-sensitive material processed by the method could not be said to be sufficient. On the other hand, there is known a method of heat-developing a light-sensitive material and transferring the dye formed in the presence of a base or base precursor and a slight amount of water, whereby development is accelerated, the development temperature is lowered and the processing step is simplified, as illustrated in JP-A-59-218443 and JP-A-61-238056 and European Patent 210,660A2.

Other various methods have also be proposed for forming a positive color image by heat development.

For instance, U.S. Patent 4,559,290 has proposed a method where a compound of an oxidized form with no dye-releasing function, which has been derived from a so-called DRR compound, is used in the presence of a reducing agent or a precursor thereof, the said reducing agent is oxidized by heat development in accordance with the exposed amount of the silver halide, and the compound of oxidized form is reduced with the reducing agent which has not been oxidized by the heat development but has remained as it is so as to release a diffusible dye therefrom. European Patent 220,746A and Kokai Giho, 87-6199 (Vol. 12, No. 22) mention a heat-developable color light-sensitive material having a compound which releases a diffusible dye by the same mechanism as mentioned above, or that is, releases a diffusible dye by reductive cleavage of the N-X bond of the compound (where X means an oxygen atom, a nitrogen atom or a sulfur atom).

However, it has been found that the aforesaid heat-developable color light-sensitive material has a problem of forming colored substances by decomposition or other side-reaction of the dye providing substance during photographic processing or by side-reaction of other components constituting the light-sensitive material during photographic processing thereby to give transferred stains in the white background portion and to worsen the S/N ratio. In addition, it has further been found that the light-sensitive material has another problem of having the above-mentioned unfavorable transferred stains when stored for a long period of time and therefore the storage stability of the light-sensitive material is bad.

SUMMARY OF THE INVENTION

The object of the present invention is to improve the S/N ratio and storage stability of a heat-developable color light-sensitive material at least having a light-sensitive silver halide, a binder and a dye providing compound capable of releasing or forming a diffusible dye in correspondence or reverse correspondence with the reaction of reducing the silver halide into silver on a support.

This object has been attained by a heat-developable color light-sensitive material comprising a support having provided thereon a light-sensitive silver halide, a binder, and a dye providing compound capable of releasing or forming a diffusible dye in correspondence or reverse correspondence with the reaction of reducing the silver halide into silver, said light-sensitive material having a hydrophilic binder layer containing an adsorbent substance capable of adsorbing a color substance formed during the step of processing the light-sensitive material for forming an image therewith.

DETAILED DESCRIPTION OF THE INVENTION

As the "adsorbent substance capable of adsorbing a color substance" for use in the present invention, any adsorbent can be employed regardless of the adsorbing type of physical adsorption or chemical adsorption, such as, for example, active charcoal, carbon black, cation or anion exchange resins, silica gel, aluminosilica gel, active alumina, etc. Specific examples of some of these adsorbents will be mentioned below.

Active Charcoal: This is defined in JIS K-147475 and has a physical adsorbing capacity. It is either powdery or granular. Manufacturers of the substance include Sanwa Carbon Co., Ltd., Tsurumi Coal Co., Ltd., Fujisawa Pharmaceutical Co., Ltd., Hokuetsu Carbon Co., Kuraray Co., Ltd., Takeda Chemical Industries, Ltd. and Wako Pure Chemical Industries, Ltd.

Ion Exchange Resins: As commercial products, there are Amberlite® IR-120B (Japan Organo Co., Ltd.) and Dowex® (Muromachi Chemicals Co.) as strong acidic cation exchange resins; Amberlite® IRC-50 and Diaion® WK10 as weak acidic cation exchange resins; Amberlite® IRA-401, Amberlite® IRA-410, Diaion® SA-11A, Diaion® SA-20A, Dowex® I and Dowex® Z as strong basic anion exchange resins; and Amberlite® IR-4B, Amberlite® IR-45, Diaion® WA20 and Dowex® 3 as weak basic anion exchange resins. These are known to adsorb substances because of the chemical adsorption to dissociating groups. As the color substances to be formed in the light-sensitive material of the present invention is essentially a dissociating dye, anion exchange resins are preferred so as to adsorb the substance.

Regarding the other alumina, aluminosilica gel and silica gel, commercial products of Sumitomo Aluminium Co., Mizusawa Chemicals Co., Catalysts & Chemicals Industries Co., Ltd. and Wako Pure Chemical Industries, Ltd. can be employed.

The adsorbent employed in the present invention may be in the form of an aqueous dispersion containing fine solid grains thereof (0.2 to 1 μm). As other adsorbent than the aforesaid solid granular adsorbents, mordant polymers which are known in U.S. Patent 4,500,626, JP-A-61-88256, JP-A-62-244036, JP-A-60-57836, JP-A-60-60643, JP-A-60-118834, JP-A-60-119557, JP-A-60-122940, JP-A-60-122941, JP-A-60-122942, JP-A-61-46948 and JP-A-62-244043 can also be employed in the present invention.

Where the adsorbent substance is added to the light-sensitive material of the present invention, any method of adding the same to the light-sensitive layer or of adding to the interlayer or protective layer can be employed. Alternatively, one or more additional layers containing the adsorbent substance, other than the foregoing layers, may be provided in any desired position of the multilayer light-sensitive material of the present invention. In that case, an interlayer may be provided between the adsorbent substance containing layer and other layers.

As the adsorbent substance of the present invention is in a hydrophilic binder in the light-sensitive material, it may efficiently adsorb any color substances which are unnecessary for forming images. The hydrophilic binder to be used for the purpose can be selected from hydrophilic colloids and biders which are known usable for light-sensitive materials and/or dye-fixing materials and which will be mentioned in detail hereunder.

The amount of the adsorbent substance to be incorporated into the light-sensitive material of the present invention is, though varying in accordance with the kind of the substance and the layer to which the substance is to be added and the amount and affinity of dye, generally from 1 mg to 2 g, especially from 10 mg to 500 mg, per m^2 of the support.

The heat-developable light-sensitive materials herein are essentially characterized in that light-sensitive silver halides and a binder are provided on a support. Furthermore, the heat-developable light-sensitive material optionally may comprise an organometallic salt oxidizing agent, a dye providing compound or the like. (As described later, a reducing agent may concurrently serve as a dye providing compound.) These components may be incorporated in the same layer but may be incorporated in separate layers if they are reactive with each other. For example, if a colored dye providing compound is present in an underlayer of a silver halide emulsion, it can inhibit a decrease in sensitivity. The reducing agent may be preferably incorporated in the heat-developable light-sensitive material. However, the reducing agent may be supplied from other elements. For example, the reducing agent may be diffused into the heat-developable light-sensitive material from a dye-fixing material as described later.

In order to obtain a wide range of color in a normal chromaticity diagram with the three primary colors (yellow, magenta and cyan), at least three silver halide emulsion layers having sensitivity in different spectral regions may be used in combination. Examples of such a combination of silver halide emulsion layers include a combination of a blue-sensitive layer, a green-sensitive layer and a red-sensitive layer and a combination of a green-sensitive layer, a red-sensitive layer and an infrared-sensitive layer. These light-sensitive layers may be arranged in various orders commonly used for ordinary color light-sensitive materials. These light-sensitive layers may be optionally divided into two or more layers.

The heat-developable light-sensitive material may comprise various auxiliary layers such as a protective layer, subbing layer, interlayer, yellow filter layer, antihalation layer or backing layer.

The silver halide which may be used in the present invention may be any of silver chloride, silver bromide, silver iodobromide, silver chlorobromide, silver chloroiodide and silver chloroiodobromide.

The silver halide emulsion used in the present invention may be a surface latent image type emulsion or an internal latent image type emulsion. The internal latent image type emulsion may be used as a direct reversal emulsion in combination with a nucleating agent or a light fogging agent. Alternatively, the light-sensitive silver halide emulsion may be a core/shell emulsion in which the interior and the surface of the grain are different from each other in phase. The light-sensitive silver halide emulsion may be a monodisperse or polydisperse emulsion or a mixture thereof. The grain size of the emulsion is preferably in the range of from 0.1 to 2 μm, particularly from 0.2 to 1.5 μm. The crystal habit of the silver halide grains may be cubic, octahedral, tetradecahedral or tabular with a high aspect ratio.

In particular, silver halide emulsions as described in U.S. Patents 4,500,626 and 4,628,021, Research Disclosure, No. 17029 (1978), and JP-A-62-253159 may be used in the present invention.

The silver halide emulsion may be used unripened but is normally used after being chemically sensitized. For emulsions for the light-sensitive materials, known sulfur sensitization processes, reduction sensitization processes and noble metal sensitization processes may be used singly or in combination. These chemical sensitization processes may be optionally effected in the presence of a nitrogen-containing heterocyclic compound as disclosed in JP-A-62-253159.

The amount of the light-sensitive silver halide emulsion coated is in the range of from 1 mg to 10 g/m^2 (calculated in terms of amount of silver).

In the present invention, organometallic salts may be used as oxidizing agents in combination with the light-sensitive silver halide. Among such organometallic salts, organic silver salts are particularly preferably used.

Examples of organic compounds which can be used to form such an organic silver salt oxidizing agent include benzotriazoles, fatty acids, and other compounds as described in U.S. Patent 4,500,626 (52nd column to 53rd column). Other useful examples of such organic compounds include carboxylic acid silver salts containing an alkynyl group such as silver phenylpropiolate as described in JP-A-60-113235, and silver acetylide as described in JP-A-61-249044. These organic silver salts may be used in combination.

These organic silver salts are generally used in an amount of from 0.01 to 10 mols, preferably from 0.01 to 1 mol, per mol of light-sensitive silver halide. The total amount of light-sensitive silver salt and organic silver salt coated is preferably in the range of from 50 mg to 10 g/m^2 (calculated in terms of amount of silver).

In the present invention, various fog inhibitors or photographic stabilizers may be used. Examples of such fog inhibitors or photographic stabilizers include azoles or azaindenes as described in Research Disclosure, No. 17643 (1978), pp. 24-25, nitrogen-containing carboxylic acids or phosphoric acids as described in JP-A-59-168442, mercapto compounds and metal salts thereof as described in JP-A-59-111636, and acetylenic compounds as described in JP-A-62-87957.

The light-sensitive silver halide used in the present invention may be conventionally spectrally sensitized with a methine dye or the like. Examples of such dyes include cyanine dyes, merocyanine dyes, complex cyanine dyes, complex merocyanine dyes, holopolar cyanine dyes, hemicyanine dyes, styryl dyes

and hemioxonol dyes.

Specific examples of dyes include sensitizing dyes as described in U.S. Patent 4,617,257, JP-A-59-180550, JP-A-60-140335, and Research Disclosure, No. 17029 (1978), pp. 12-13.

These sensitizing dyes may be used singly or in combination. In particular, combinations of sensitizing dyes are often used for the purpose of supersensitization.

The light-sensitive silver halide emulsion may comprise a dye which does not exhibit a spectral sensitizing effect by itself or a compound which does not substantially absorb visible light but exhibits a supersensitizing effect (as described in U.S. Patent 3,615,641 and JP-A-63-23145) together with such a sensitizing dye.

Such sensitizing dyes may be incorporated in the emulsion during, before or after chemical sensitization. Alternatively, the sensitizing dye may be incorporated in the emulsion before or after the nucleation of light-sensitive silver halide grains as described in U.S. Patents 4,183,756 and 4,225,666. The amount of sensitizing dye incorporated is normally in the range of from 10^{-8} to 10^{-2} mol per mol of light-sensitive silver halide.

As suitable binders incorporated in the light-sensitive material or dye-fixing material there may be used a hydrophilic binder. Examples of such hydrophilic binders include those described in JP-A-62-253159 (pp. 26-28). Specific examples of such hydrophilic binder include transparent or semi-transparent hydrophilic binders such as proteins (e.g., gelatin, gelatin derivative), polysaccharides (e.g., cellulose derivatives, starch, gum arabic, dextran, pullulan), and synthetic high molecular compounds (e.g., polyvinyl alcohol, polyvinylpyrrolidone, acrylamide polymers). Alternatively, a high water-absorbing polymer as described in JP-A-62-245260, i.e., a homopolymer of a vinyl monomer containing -COOM or $-SO_3M$ (wherein M represents a hydrogen atom or alkali metal) or a copolymer of such vinyl monomers or such a vinyl monomer with other vinyl monomers (e.g., sodium methacrylate, ammonium methacrylate, SUMIKAGEL® L-5H made by Sumitomo Chemical Co., Ltd.) may be used. These binders may be used singly or in combination.

In a system wherein heat development is effected with a slight amount of water, the above described high water-absorbing polymer may be used to expedite the absorption of water. Such a high water-absorbing polymer may be incorporated in the dye fixing layer or in a protective layer therefor to prevent dye which has been transferred from being re-transferred from the dye-fixing material to other elements.

In the present invention, the amount of the binder coated is preferably in the range of 20 g or less, more preferably 10 g or less, particularly 7 g or less per m^2.

The layers (including backing layer) constituting the light-sensitive material or dye-fixing material of the present invention can contain various polymer latexes for the purpose of improving the film property of the material, for example, for the purpose of dimensional stabilization, curling prevention, blocking prevention, film cracking prevention and prevention of pressure sensitization and desensitization pressure marks). For instance, any of the polymer latexes described in JP-A-62-245258, JP-A-62-136648 and JP-A-62-110066 can be employed for the purpose. In particular, when a polymer latex having a low glass transition temperature (40 °C or lower) is incorporated into the mordant layer, cracking of the mordant layer may be prevented; or when a polymer latex having a high glass transition temperature is incorporated into the backing layer, a curling preventing effect can be attained.

As suitable reducing agents for the present invention there may be used conventional reducing agents known in the field of heat-developable light-sensitive materials. Alternatively, reducing dye providing compounds as described later may be used. These reducing dye providing compounds may be used in combination with other reducing agents. Further, a reducing agent precursor which does not exhibit a reducing effect but undergoes reaction with a nucleophilic reagent or under heating to exhibit a reducing effect may be used in the present invention.

Examples of reducing agents used in the present invention include reducing agents or reducing agent precursors as described in U.S. Patents 4,500,626 (49th column to 50th column), 4,483,914 (30th column to 31st column), 4,330,617, and 4,590,152, JP-A-60-140335, JP-A-57-40245, JP-A-56-138736, JP-A-59-178458, JP-A-59-53831, JP-A-59-182449, JP-A-59-182450, JP-A-60-119555, JP-A-60-128436, JP-A-60-128437, JP-A-60-128438, JP-A-60-128439, JP-60-198540, JP-A-60-181742, JP-A-61-259253, JP-A-62-244044, JP-A-62-131253, JP-A-62-131254, JP-A-62-131255, and JP-A-62-131256, and European Patent 220,746A2 (pp. 78-96).

Combinations of various reducing agents as disclosed in U.S. Patent 3,039,869 may also be used in the present invention.

If a non-diffusible reducing agent is used, an electron transfer agent and/or electron transfer agent precursor may optionally be used in combination therewith in order to accelerate the transfer of electrons between the non-diffusible reducing agent and the developable silver halide.

Such an electron transfer agent or its precursor may be selected from the above described reducing

agents or precursors thereof. Such an electron transfer agent or its precursor is preferably greater than the non-diffusible reducing agent (electron donor) in mobility. Particularly useful electron transfer agents are 1-phenyl-3-pyrazolidones or aminophenols.

As non-diffusible reducing agents (electron donors) used in combination with such an electron transfer agent there may be used any of the above described reducing agents which are substantially non-diffusible in the layer of light-sensitive material in which they are located. Preferred examples of such non-diffusible reducing agents include hydroquinones, sulfonamidophenols, sulfonamidonaphthols, compounds described as electron donors in JP-A-53-110827, and non-diffusible reducing dye providing compounds as later described.

In the present invention, the amount of such reducing agent(s) incorporated is preferably in the range of from 0.01 to 20 mols, particularly from 0.1 to 10 mols per mol of silver.

In the present invention, silver may be used as an image-forming substance. A compound which produces or releases a mobile dye in correspondence or counter correspondence to the reduction of silver ions to silver at elevated temperature, i.e., dye providing compounds, may be incorporated in the light-sensitive material.

Examples of such dye providing compounds which may be used in the present invention include compounds which undergo an oxidation coupling reaction with a color developing agent to form a dye (coupler). Such a coupler may be a two-equivalent coupler or four-equivalent coupler. A two-equivalent coupler containing a non-diffusible group as a split-off group which undergoes oxidation coupling reaction to form a diffusible dye is preferably used. Specific examples of suitable developing agents and couplers are described in T.H. James, The Theory of the Photographic Process, pp. 291-334 and 354-361, JP-A-58-123533, JP-A-58-149046, JP-A-58-149047, JP-A-59-111148, JP-A-59-124399, JP-A-59-174835, JP-A-59-231539, JP-A-59-231540, JP-A-60-2950, JP-A-60-2951, JP-A-60-14242, JP-A-60-23474, and JP-A-60-66249.

Examples of different dye providing compounds include compounds which serves to imagewise release or diffuse a diffusible dye. Such a compound can be represented by the following general formula (LI):

$$(Dye\text{-}Y)_n\text{-}Z \quad (LI)$$

wherein Dye represents a dye group, a dye group which has been temporarily shifted to a short wavelength range or a dye precursor group; Y represents a mere bond or connecting group; Z represents a group which makes a difference in the diffusibility of the compound represented by $(Dye\text{-}Y)_n\text{-}Z$ in corresponding or counter-corresponding to light-sensitive silver salts having a latent image distributed imagewise or releases Dye in corresponding or counter-corresponding to light-sensitive silver salts having a latent image distributed imagewise to make no difference in the diffusibility between Dye thus released and $(Dye\text{-}Y)_n\text{-}Z$; and n represents an integer of 1 or 2. If n is 2, two (Dye-Y)'s may be the same or different.

Specific examples of the dye providing compound represented by the general formula (LI) include the following compounds i to v. The compounds i to iii form a diffusible dye image (positive dye image) in counter-corresponding to the development of silver halide while the compounds iv and v form a diffusible dye image (negative dye image) in corresponding to the development of silver halide.

i. Dye developing agents comprising a hydroquinone developing agent connected to a dye component as described in U.S. Patents 3,134,764, 3,362,819, 3,597,200 3,544,545, and 3,482,972. These dye developing agents are diffusible in alkaline conditions but become non-diffusible upon reaction with silver halide.

ii. Non-diffusible compounds which release a diffusible dye in alkaline conditions but lose their function upon reaction with silver halide as described in U.S. Patent 4,503,137. Examples of such compounds include compounds which undergo intramolecular nucleophilic displacement reactions to release a diffusible dye as described in U.S. Patent 3,980,479, and compounds which undergo an intramolecular rewinding reaction of the isooxazolone ring to release a diffusible dye as described in U.S. Patent 4,199,354.

iii. Non-diffusible compounds that react with a reducing agent left unoxidized after being developed to release a diffusible dye as described in U.S. Patent 4,559,290, European Patent 220,746A2, and Kokai Giho, 87-6,199.

Examples of such compounds include compounds which undergo intramolecular nucleophilic displacement reaction after being reduced to release a diffusible dye as described in U.S. Patents 4,139,389 and 4,139,379, and JP-A-59-185333, and JP-A-57-84453, compounds which undergo an intramolecular electron transfer reaction after being reduced to release a diffusible dye as described in U.S. Patent 4,232,107, JP-A-59-101649, JP-A-61-88257, and Research Disclosure, No. 24,025 (1984), compounds which undergo cleavage of a single bond after being reduced to release a diffusible dye as described in West German Patent 3,008,588A, JP-A-56-142530, and U.S. Patents 4,343,893, and 4,619,884, nitro compounds which receive electrons to release a diffusible dye as described in U.S. Patent 4,450,223, and compounds which receive electrons to release a diffusible dye as described in U.S. Patent 4,609,610.

Preferred examples of such compounds include compounds containing an N-X bond (wherein X represents oxygen atom, sulfur atom or nitrogen atom) and an electrophilic group in one molecule as described in European Patent 220,746A2, Kokai Giho, 87-6,199, JP-A-63-201653, and JP-63-201654, compounds containing an SO_2-X group (wherein X is as defined above) and an electrophilic group in one molecule as described in U.S. Application SN 07/188,779, compounds containing a PO-X bond (wherein X is as defined above) and an electrophilic group in one molecule as described in JP-A-63-271344, and compounds containing a C-X′ bond (wherein X′ is as defined above for X or represents -SO_2-) and an electrophilic group in one molecule as described in JP-A-63-271341.

Particularly preferred among these compounds are compounds containing an N-X bond and an electrophilic group in one molecule. Specific examples of such compounds include Compounds (1) to (3), (7) to (10), (12), (13), (15), (23) to (26), (31), (32), (35), (36), (40), (41), (44), (53) to (59), (64), and (70) described in European Patent 220,746A2, and Compounds (11) to (23) described in Kokai Giho, 87-6,199.

iv. Couplers containing a diffusible dye as the split-off group which reacts with an oxidation product of a reducing agent to release a diffusible dye (DDR coupler). Specific examples of such compounds include those described in British Patent 1,330,524, JP-B-48-39165, and U.S. Patents 3,443,940, 4,474,867, and 4,483,914.

v. Compounds which are capable of reducing silver halide or organic silver salts and release a diffusible dye after reducing silver halide or organic silver salts (DDR compound). These compounds are advantageous in that they need no other reducing agents. They eliminate image staining due to the action of oxidation decomposition products of reducing agents. Typical examples of such compounds are described in U.S. Patents 3,928,312, 4,053,312, 4,055,428, 4,336,322, 3,725,062, 3,728,113, 3,443,939, and 4,500,626, JP-A-59- 65839, JP-A-59-69839, JP-A-53-3819, JP-A-51-104343, JP-A-58-116537, JP-A-57-179840, and Research Disclosure, No. 17,465. Specific examples of DRR compounds include compounds as described in U.S. Patent 4,500,626, 22nd column to 44th column, and particularly preferred among these compounds are compounds (1) to (3), (10) to (13), 16) to (19), (28) to (30), (33) to (35), (38) to (40), and (42) to (64). Other preferred examples of such compounds include those described in U.S. Patent 4,639,408, 37th column to 39th column.

Examples of dye providing compounds other than the above described couplers and compounds of the general formula [LI] include silver dye compounds comprising an organic silver salt connected to a dye as described in Research Disclosure (May 1978, pp. 54-58), azo dyes for use in heat developable silver dye bleaching processes as described in U.S. Patent 4,235,957 and Research Disclosure (April 1976, pp. 30-32), and leuco dyes as described in U.S. Patents 3,985,565 and 4,022,617.

The incorporation of a hydrophobic additive such as a dye providing compound or a non-diffusible reducing agent in a layer of light-sensitive material can be accomplished by any known method as described in U.S. Patent 2,322,027. In this case, a high boiling organic solvent as described in JP-A-59-83154, JP-A-59-178451, JP-A-59-178452, JP-A-59-178453, JP-A-59-178454, JP-A-59-178455, and JP-A-59-178457 may optionally be used in combination with a low boiling organic solvent having a boiling point of from 50 to 160°C.

The amount of such a high boiling organic solvent incorporated is generally in the range of from 1 to 10 g, preferably 5 g or less, per gram of dye providing compound used or 1 cc or less, preferably 0.5 cc or less, particularly preferably 0.3 cc or less, per gram of binder.

A dispersion process as described in JP-B-51-39853 (the term "JP-B" as used herein means an "examined Japanese Patent Publication") and JP-A-51-59943 which comprises using a polymerization product may also be used.

If a compound which is substantially insoluble in water is used, it may be incorporated in the binder in the form of dispersion of finely divided particles rather than by the above described processes.

In order to disperse a hydrophobic compound in a hydrophilic colloid, various surface active agents can be used. Examples of such surface active agents which may be used in this dispersion process include those described as surface active agent in JP-A-59-157636 (pp. 37-38).

In the present invention, a compound which serves both to accelerate the development of light-sensitive materials and stabilize images may be used. Specific examples of such compounds preferably used in the present invention are described in U.S. Patent 4,500,626 (51st column to 52nd column).

In a system where the diffusion transfer of a dye(s) is used to form images, a dye-fixing material is used in combination with the light-sensitive material. Such a dye-fixing material may be either coated on a separate support from the light-sensitive material or coated on the same support as the light-sensitive material. For the relationship of the light-sensitive material with the dye-fixing material, the support and a white reflecting layer which can be used, those described in U.S. Patent 4,500,626 (57th column) are useful.

The dye-fixing material preferably used in the present invention may comprise at least one layer

containing a mordant and a binder. As such mordants there may be used those known in the field of photography. Specific examples of such mordants include those described in U.S. Patent 4,500,626 (58th column to 59th column), JP-A-61-88256 (pp. 32-41), JP-A-62-244043 and JP-A-62-244036. Alternatively, a dye-receiving high molecular weight compound as described in U.S. Patent 4,463,079 may be used.

The dye-fixing material may optionally comprise auxiliary layers such as a protective layer, strippable layer or anti-curling layer. Particularly, a protective layer can be advantageously incorporated in the dye-fixing material.

The constituent layers of the light-sensitive material or dye-fixing material may comprise a high boiling organic solvent as a plasticizer, lubricant or agent for improving the strippability of the light-sensitive material from the dye-fixing material. Specific examples of such a high boiling organic solvent include those described in JP-A-62-253159 (page 25) and JP-A-62-245253.

For the above described purposes, various silicone oils ranging from dimethyl silicone oil to modified silicone oil obtained by incorporating various organic groups into dimethylcycloxane may be used. For example, various modified silicone oils, particularly carboxy-modified silicone (trade name: X-22-3710), described at pp. 6-8 of "Modified Silicone Oil", technical data reported by Shin-Etsu Silicone Co., Ltd., may be effectively used.

Silicone oils as described in JP-A-62-215953 and JP-A-63-46449 may also be effectively used.

The light-sensitive material or dye-fixing material may comprise a discoloration inhibitor. As such a discoloration inhibitor there may be used an antioxidant, ultraviolet absorber or certain kinds of metal complexes.

Examples of such an antioxidant include chroman compounds, coumaran compounds, phenol compounds (e.g., hindered phenols), hydroquinone derivatives, hindered amine derivatives, and spiroindane compounds. Other useful antioxidants include compounds as described in JP-A-61-159644.

Examples of suitable ultraviolet absorbers include benzotriazole compounds as described in U.S. Patent 3,533,794, 4-thiazolidone compounds as described in U.S. Patent 3,352,681, benzophenone compounds as described in JP-A-46-2784, and compounds as described in JP-A-54-48535, JP-A-62-136641, and JP-A-61-8256. Other useful ultraviolet absorbers include ultraviolet-absorbing polymers as described in JP-A-62-260152.

Examples of suitable metal complexes include compounds as described in U.S. Patents 4,241,155, 4,245,018, (3rd column to 36th column), and 4,254,195 (3rd column to 8th column), JP-A-62-174741, JP-A-61-88256 (pp. 27-29), and JP-A-63-199248.

Useful examples of other discoloration inhibitors are described in JP-A-62-215272 (pp. 125-137).

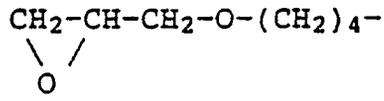
A discoloration inhibitor for inhibiting discoloration of a dye to be transferred to the dye-fixing material may be previously incorporated in the dye-fixing material or supplied into the dye-fixing material from other elements such as light-sensitive material.

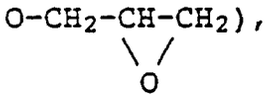
The above described antioxidants, ultraviolet absorbers and metal complexes may be used in combination.

The light-sensitive material or dye-fixing material may comprise a fluorescent brightening agent. In particular, such a fluorescent brightening agent may be incorporated in the dye-fixing material or supplied into the dye-fixing material from other materials such as light-sensitive material. Examples of such fluorescent brightening agents include compounds as described in K. Veenkataraman, The Chemistry of Synthetic Dyes, Vol. V, Chapter 8, and JP-A-61-143752. Specific examples of such compounds include stilbene compounds, coumarin compounds, biphenyl compounds, benzoxazolyl compounds, naphthalimide compounds, pyrazoline compounds, and carbostyryl carboxy compounds.

Such a fluorescent brightening agent may be used in combination with a discoloration inhibitor.

Examples of film hardening agents which may be incoroporated in the light-sensitive material or dye-fixing material include those described in U.S. Patent 4,678,739 (41st column), JP-A-59-116655, JP-A-62-245261, and JP-A-61-18942. Specific examples of such film hardening agents include aldehyde film hardening agents (e.g., formaldehyde), aziridene film hardening agents, epoxy film hardening agents (e.g.,





vinylsulfone film hardening agents (e.g., N,N′-ethylenebis(vinylsulfonylacetamido)ethane), N-methylol film hardening agents (e.g., dimethylol urea), and high molecular film hardening agents (e.g., compounds as described in JP-A-62-234157).

The constituent layers of the light-sensitive material or dye-fixing material may comprise various surface active agents for the purpose of aiding of coating, improving strippability and lubricity, inhibit ing static electrification or accelerating development. Specific examples of such surface active agents are described in JP-A-62-173463 and JP-A-62-183457.

The constituent layers of the light-sensitive material or dye-fixing material may comprise an organofluoro compound for the purpose of improving lubricity and strippability or inhibiting static electrification. Typical examples of such an organofluoro compound include fluorine surface active agents as described in JP-B-57-9053 (8th column to 17th column), JP-A-61-20944, and JP-A-62-135826, and hydrophobic fluorine compounds such as oily fluorine compounds (e.g., fluorine oil) or solid fluorine compound resins (e.g., tetrafluoroethylene resin).

The light-sensitive material or dye-fixing material may comprise a matting agent. Examples of such a matting agent include compounds as described in JP-A-61-88256 (pp. 29) (e.g., silicon dioxide, polyolefin, polymethacrylate) and compounds as described in JP-A-63-279944 and JP-A-63-274952 (e.g., benzoguanamine resin beads, polycarbonate resin beads, AS resin beads).

Furthermore, the constituent layers of the light-sensitive material or dye-fixing material may comprise a thermal solvent, an anti-foaming agent, an anti-bacterial and anti-fungal agent or colloidal silica. Specific examples of these additives are described in JP-A-61-88256 (pp. 26-32).

In the present invention, the light-sensitive material and/or dye-fixing material may include an image formation accelerator. Such an image formation accelerator serves to accelerate a redox reaction between a silver salt oxidizing agent and a reducing agent, accelerate production or decomposition of a dye from a dye providing compound or release of a diffusible dye from the dye providing compound, or accelerate transfer of a dye from a light-sensitive material layer to a dye fixing layer. From the physicochemical standpoint, image formation accelerators can be classified into various groups such as base or base precursor, nucleophilic compound, high boiling organic solvent (oil), thermal solvent, surface active agent, and compounds capable of interacting with silver or silver ion. However, these groups normally have composite functions and therefore exhibit a combination of the above described accelerating effects. Details are given in U.S. Patent 4,678,739 (38th column to 40th column).

Examples of such base precursors include salts of an organic acid capable of being heat-decarboxylated with a base, and compounds which undergo an intramolecular nucleophilic displacement reaction, Lossen rearrangement or Beckman rearrangement to release an amine. Specific examples of such base precursors are described in U.S. Patent 4,511,493 and JP-A-62-65038.

In a system where heat development and dye transfer are simultaneously effected in the presence of a small amount of water, such a base and/base precursor may be preferably incorporated in the dye-fixing material to improve the storage stability of the light-sensitive material.

Other examples of suitable base precursors include a combination of a sparingly soluble metallic compound and a compound capable of complexing with metal ions constituting said metallic compound as described in European Patent 210,660A, and a compound as described in JP-A-61-232451 which undergoes electrolysis to produce a base. Particularly, the former compound may be effectively used. The sparingly soluble metallic compound and the complexing compound may advantageously be incorporated separately in the light-sensitive material and the dye-fixing material.

The present light-sensitive material and/or dye-fixing material may comprise various development stopping agents for the purpose of providing images resistant against fluctuations in temperature and time for development.

The term "development stopping agent" as used herein means a compound which readily neutralizes or reacts with a base to reduce the base concentration in the film to stopping development, or which

interacts with silver or silver salt to inhibit development, after a proper development period. Specific examples of such compounds include acid precursors which release an acid on heating, electrophilic compounds which undergo a displacement reaction with a base present therewith on heating, and nitrogen-containing heterocyclic compounds, mercapto compounds and precursors thereof.

Details are given in JP-A-62-253159 (pp. 31-32).

As a suitable support for the light-sensitive material or dye-fixing material of the present invention, there may be used a material capable of withstanding the processing temperature. In general, paper or a synthetic high molecular weight compound (film) may be used. Specific examples of such a support material which may be used in the present invention include polyethylene terephthalate, polycarbonates, polyvinyl chloride, polystyrene, polypropylene, polyimides or celluloses (e.g., triacetyl cellulose) or a material obtained by incorporating a pigment such as titanium oxide in such a film, a synthetic paper film formed of polypropylene or the like, a mixed paper made of synthetic resin pulp such as polyethylene and natural pulp, Yankee paper, baryta paper, coated paper (particularly cast coat paper), metals, fabrics, and glass.

Such a support material may be used as it is or in the form of a material laminated with a synthetic high molecular weight compound such as polyethylene on one or both sides thereof.

Alternatively, a support material as described in JP-A-62-253159 (pp. 29-31) may be used in the present invention.

These support materials may be coated with a hydrophilic binder, a semiconducting metal oxide such as alumina sol or tin oxide, carbon black or other antistatic agents.

Examples of process for exposing the light-sensitive material to light for imaging include processes which comprise using a camera to photograph scenery or persons, processes which comprise using a printer or enlarger to expose the light-sensitive material to light through a reversal film or negative film, processes which comprise using an exposing machine such as a copying machine to effect scanning exposure of the light-sensitive material to an original through a slit, processes which comprise exposing the light-sensitive material to light representative of image data emitted by a light emitting diode or various lasers, and processes which comprise exposing the light-sensitive material directly or through an optical system to light representative of image data emitted by an image display apparatus such as a CRT, liquid crystal display, electroluminescence display or plasma display.

As a light source for recording images on the light-sensitive material there may be used natural light, tungsten lamp, a light emitting diode, a laser, a CRT or light sources as described in U.S. Patent 4,500,626 (56th column).

A wavelength converting element comprising a combination of a non-lienar optical material and a coherent light source such as laser rays can also be used for image exposure. The terminology "non-linear optical material" as used herein means a material capable of expressing non-linear property between the polarization to be caued by some strong photoelectric field such as laser rays and the electric field. As such materials, inorganic compounds such as lithium niobate, potassium dihydrogenphosphate (KDP), lithium iodate and BaB_2O_4, as well as urea derivatives, nitroaniline derivatives, nitropyridine-N-oxide derivatives (e.g., 3-methyl-4-nitropyridine-N-oxide (POM) and the compounds described in JP-A-61-54362 and JP-A-62-210432 are preferably employed in the present invention. As the form of the wavelength converting element, single crystal optical wave guide type and fiber type are known both of which are employable in the present invention.

As the image information to be applicable to the light-sensitive material of the present invention, any of the image signal to be obtained from video camera or electronic still camera; the television signal as standarized by Nippon Television Signal Code (NTSC); the image signal obtained by dividing the original into plural elements with a scanner; and the image signal formed by the use of a computer such as CG or CAD, can be employed.

The light-sensitive material and/or the dye-fixing material may be in a form that has an electroconductive heating element layer as the heating means for heat development and diffusion and transfer of the formed dyes. In this case, the heating element may be either transparent or opaque, and the elements described in JP-A-61-145544 can be employed. The electroconductive layer acts also as an antistatic layer.

The heating temperature at which heat development can be effected is preferably in the range of from about 50 °C to about 250 °C, particularly from about 80 °C to about 180 °C. The dye diffusion transfer process may be effected simultaneously with or after heat development. In the latter case, the heating temperature at which dye transfer can be effected is preferably in the range of from the heating temperature for heat development to room temperature, particularly from 50 °C to a temperature about 10 °C lower than the heating temperature for heat development.

The transfer of a dye can be effected by heating alone. In order to accelerate the dye transfer, a solvent

may be used.

Alternatively, a process as described in JP-A-59-218443 and JP-A-61-238056 which comprises heating the light-sensitive material in the presence of a small amount of a solvent, particularly water, to effect development and dye transfer simultaneously or in sequence may be effectively used. The heating temperature for this process is preferably in the range of from 50 °C to a temperature not higher than the boiling point of the solvent. For example, if the solvent is water, the heating temperature is preferably in the range of from 50 °C to 100 °C.

Examples of a solvent which may be used to accelerate development and/or transfer of a diffusible dye to the dye-fixing layer include water and a basic aqueous solution containing an inorganic alkali metal salt or organic base as described with reference to the image formation accelerators. Other useful examples of solvents include a low boiling solvent and a mixed solution made of such a low boiling solvent and water or a basic aqueous solution. Such a solvent may further comprise a surface active agent, fog inhibitor, sparingly soluble metal salt, complexing compound or the like.

These solvents may be incorporated in either or both of the light-sensitive material and the dye-fixing material. The amount of the solvent incorporated in the light-sensitive material and/or dye-fixing material may be small such as not more than the weight of the solvent in a volume corresponding to the maximum swelling volume of the total coated films (particularly, not more than the value obtained by subtracting the weight of the entire coated film(s) from the weight of the solvent in a volume corresponding to the maximum swelling volume of the entire coated film(s)) in the light-sensitive or dye-fixing solvent.

As the process for incorporating the solvent in the light-sensitive layer or dye-fixing layer, those described in JP-A-61-147244 (page 26) can be referenced. Alternatively, the solvent may be incorporated in either or both of the light-sensitive material and the dye-fixing material in a microcapsule form or like form.

In order to accelerate transfer of a dye, a hydrophilic thermal solvent which stays solid at normal temperature but dissolves at an elevated temperature may be incorporated in the light-sensitive material or dye-fixing material. Such a hydrophilic thermal solvent may be incorporated in either or both of the light-sensitive material and the dye-fixing material. The layer in which the solvent is incorporated may be any one of emulsion layer, interlayer, protective layer and dye fixing layer, preferably the dye-fixing layer and/or a layer adjacent thereto.

Examples of such a hydrophilic thermal solvent include ureas, pyridines, amides, sulfonamides, imides, anisoles, oximes and other heterocyclic compounds.

In order to accelerate the transfer of a dye, a high boiling organic solvent may be incorporated in the light-sensitive material and/or dye-fixing material.

Examples of heating processes at development and/or the dye transfer step include processes which comprise bringing the light-sensitive material into contact with a heated block or plate, processes which comprise bringing the light-sensitive material into contact with a heating plate, hot presser, heat roller, halogen lamp heater, infrared or far infrared lamp heater or the like, and processes which comprises passing the light-sensitive material through a high temperature atmosphere. Alternatively, the light-sensitive material or dye-fixing material may be provided with a resistive heating element layer so that it is heated by passing an electric current through the resistive heating element layer. As such a resistive heating element layer there may be used the one described in JP-A-61-145544.

As the pressure conditions and pressure application processes for the lamination of the light-sensitive material and the dye-fixing material, those described in JP-A-61-147244 (p. 27) can be used.

For the photographic processing of the photographic material, any suitable heat developing apparatus may be employed.

Examples of such a heat developing apparatus preferably used in the present invention include those described in JP-A-59-75247, JP-A-59-177547, JP-A-59-181353, JP-A-60-18951, and JP-A-U-62-25944 (the term "JP-A-U" as used herein means an "unexamined published Japanese utility model application").

The present invention will be further described in the following examples, but the present invention should not be construed as being limited thereto.

EXAMPLE 1

Emulsion (I) for the frist layer was prepared as mentioned below.

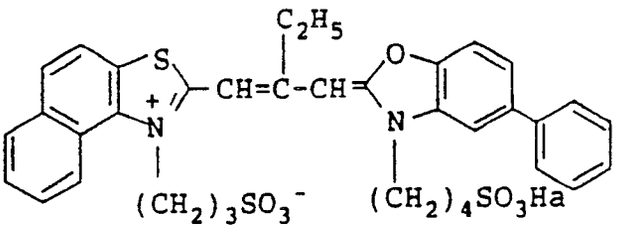
The following Solution (I), Solution (II) and Solution (III) were simultaneously added to a well stirred aqueous gelatin solution (prepared by adding 20 g of gelatin, 1 g of potassium bromide and 0.5 g $OH(CH_2)_2S(CH_2)_2OH$ to 800 ml of water and heated at 50 °C) all at the same flow rate over a period of 30 minutes.

Accordingly, a dye-adsorbed monodispersed silver bromide emulsion having a mean grain size of 0.42 μ was prepared.

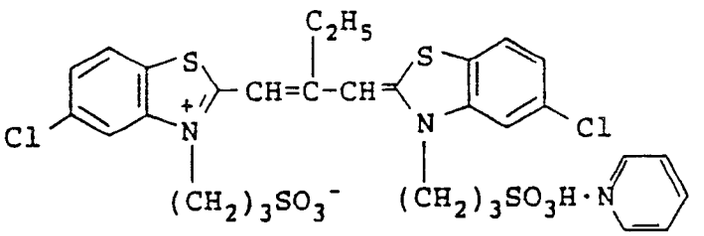
After rinsed with water and desalted, 20 g of lime-processed ossein gelatin was added and the resulting emulsion was adjusted to a pH of 6.4 and pAg of 8.2. Afterwards, this was heated at 60° C, and 9 mg of sodium thiosulfate, 6 ml of 0.01% aqueous solution of chloroauric acid and 190 mg of 4-hydroxy-6-methyl-1,3,3a,7-tetrazaindene were added thereto and chemical sensitization of the emulsion was effected for 45 minutes. The yield of the emulsion was 635 g.

	Solution (I) (Water to make 450 ml)	Solution (II) (Water to make 400 ml)	Solution (III) (Methanol to make 60 ml)
	(g)	(g)	(mg)
$AgNO_3$	100	-	-
KBr	-	70	-
Dye (a)	-	-	40
Dye (b)	-	-	80

Dye (a):



Dye (b):

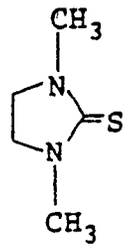


Emulsion (II) for the third layer was prepared as mentioned below.

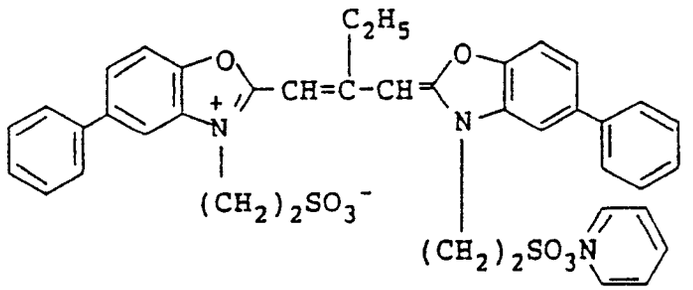
The following Solution (I) and Solution (II) were simultaneously added to a well stirred aqueous gelatin solution (prepared by adding 20 mg of gelatin, 0.30 g of potassium bromide, 6 g sodium chloride and 0.015 g of the following Compound (A) to 730 ml of water and heated at 60.0° C) all at the same flow rate over a period of 60 minutes. After addition of the Solutions (I) and (II), the following Solution (III) (methanol solution containing Sensitizing Dye (c)) was added. Accordingly, a dye-adsorbed monodispersed cubic emulsion having a mean grain size of 0.45 μ was prepared.

After rinsing with water and desalting, 20 g of gelatin was added and the resulting emulsion was adjusted to a pH of 6.4 and pAg of 7.8. Afterwards, this was chemically sensitized at 60° C. The reagents used for the chemical sensitization were 1.6 mg of triethylthiourea and 100 mg of 4-hydroxy-6-methyl-1,3,3a,7-tetrazaindene, and the ripening time was 55 minutes. The yield of the emulsion was 635 g.

Compound (A):



Sensitizing Dye (c):



	Solution (I) (Water to make 400 ml)	Solution (II) (Water to make 400 ml)	Solution (III) (Methanol to make 77 ml)
	(g)	(g)	(mg)
$AgNO_3$	100.0	-	-
KBr	-	56.0	-
NaCl	-	7.2	-
Dye (c)	-	-	0.23

Emulsion (III) for the fifth layer was prepared as mentioned below.

The following Solution (I) and Solution (II) were simultaneously added to a well stirred aqueous gelatin solution (prepared by adding 30 g of gelatin, 3 g of potassium bromide and 0.5 g of $HO(CH_2)_2S(CH_2)_2S(CH_2)_2OH$ to 600 ml of water and heating at 65 °C) over a period of 20 minutes. Afterwards, the following Solution (III) and Solution (IV) were simultaneously added thereto over a period of 30 minutes. After rinsing with water and desalting, 20 g of lime-processed ossein gelatin was added and the resulting emulsion was adjusted to a pH of 6.2 and pAg of 8.5. Afterwards, this was chemically sensitized to its optimum state with sodium thiosulfate, chloroauric acid and 4-hydroxy-6-methyl-1,3,3a-7-tetrazaindene. Accordingly, 600 g of monodispersed octahedral silver iodobromide emulsion having a mean grain size of 0.50 μm was obtained.

	Solution (I) (Water to make 200 ml)	Solution (II) (Water to make 200 ml)	Solution (III) (Water to make 400 ml)	Solution (IV) (Water to make 400 ml)
$AgNO_3$ (g)	30	-	70	-
KBr (g)	-	19	-	49
KI (g)	-	1.5	-	-

The dye providing substance-containing gelatin dispersion was prepared as follows:

20 g of Yellow Dye Providing Substance (1)*, 13.6 g of Electron Donor (1)* and 10 g of High Boiling

Point Organic Solvent (1)* were weighed, and 57 ml of ethyl acetate was added thereto and heated at about 60 °C to give a uniform solution. The resulting solution was stirred together with 110 g of 10% solution of lime-processed gelatin, 65 ml of water and 1.7 g of sodium dodecylbenzenesulfonate and blended, and the resulting mixture was dispersed in a homogenizer at 10,000 rpm for 10 minutes. The resulting dispersion is called "yellow dye providing substance dispersion".

A magenta dye providing substance dispersion and a cyan dye providing substance dispersion were also prepared in the same manner as the yellow dye providing substance dispersion, but using Magenta Dye Providing Substance (2)* and Cyan Dye Providing Substance (3)*, respectively.

Using the above-prepared emulsions and dispersions, a multilayer color light-sensitive material (Sample No. 101) having the layers mentioned below was prepared.

Sixth Layer : Protective Layer	
Gelatin	0.92 (g/m^2 - the same shall apply hereunder)
$Zn(OH_2)$	0.46
Matting Agent (Silica)	0.03
Water-soluble Polymer (1)*	0.02
Surfactant (1)*	0.06
Surfactant (2)*	0.13
Hardening Agent (1)*	0.01

Fifth Layer : Blue-sensitive Emulsion Layer	
Emulsion (III)	0.35 as Ag
Gelatin	0.48
Sensitizing Dye (d)	2.50×10^{-3}
Antifoggant (1)*	5.00×10^{-4}
Yellow Dye Providing Substance (1)	0.41
High Boiling Point Organic Solvent (1)*	0.21
Electron Donor (1)*	0.28
Surfactant (3)*	0.05
Electron Transfer Agent (1)*	0.04
Hardening Agent (1)*	0.004
Water-soluble Polymer (1)*	0.01

Fourth Layer : Interlayer	
Gelatin	0.70
Surfactant (1)*	0.02
Surfactant (3)*	0.01
Surfactant (4)*	0.06
Water-soluble Polymer (1)*	0.02
Reducing Agent (1)*	0.19
Polymer (1)*	0.09
Hardening Agent (1)*	0.008

Third Layer : Green-sensitive Emulsion Layer	
Emulsion (II)	0.21 as Ag
Gelatin	0.30
Antifoggant (2)*	6.4×10^{-4}
Magenta Dye Providing Substance (2)	0.32
High Boiling Point Organic Solvent (1)*	0.16
Electron Donor (1)*	0.12
Surfactant (3)*	0.03
Electron Transfer Agent (1)*	0.04
Hardening Agent (1)*	0.003
Water-soluble Polymer (1)*	0.01

Second Layer : Interlayer	
Gelatin	0.79
Matting Agent (Silica)	0.008
$Zn(OH)_2$	0.46
Surfactant (1)*	0.05
Surfactant (4)*	0.10
Water-soluble Polymer (1)*	0.03
Hardening Agent (1)*	0.009

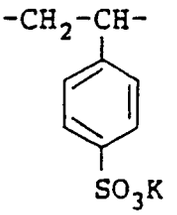
First Layer : Red-sensitive Emulsion Layer	
Emulsion (I)	0.21 as Ag
Gelatin	0.30
Antifoggant (2)*	6.4×10^{-4}
Cyan Dye Providing Substance (9)	0.28
High Boiling Point Organic Solvent (1)*	0.14
Electron Donor (1)*	0.16
Surfactant (3)*	0.03
Electron Transfer Agent (1)*	0.04
Hardening Agent (1)*	0.003
Water-soluble Polymer (1)*	0.01

Support

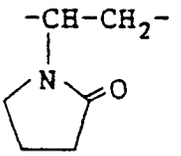
Polyethylene Terephthalate (thickness: 100 μ)

Backing Layer :	
Carbon Black	0.44
Polyester	0.30
Polyvinyl Chloride	0.30

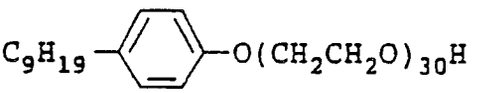
Compounds used in preparing the sample were as follows*:
Water-soluble Polymer (1):



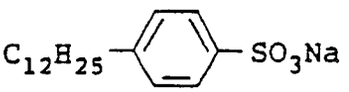
Polymer (1)*:



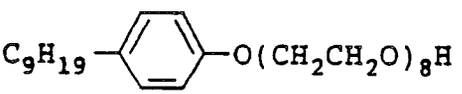
Surfactant (1)*: Aerosol® OT
Surfactant (2)*:



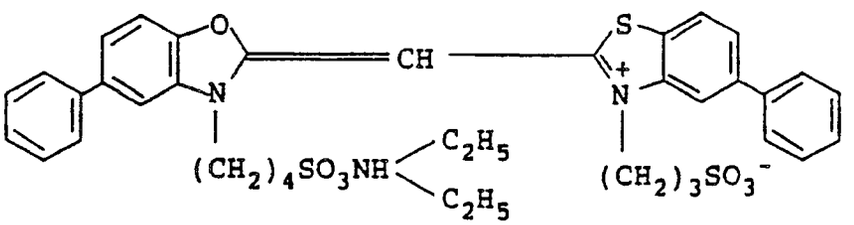
Surfactant (3)*:



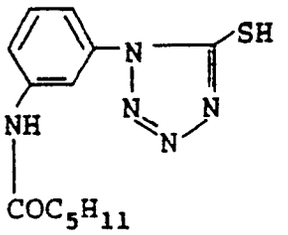
Surfactant (4)*:



Hardening Agent (1)*: 1,2-Bis(vinylsulfonylacetamido)ethane
High Boiling Point Organic Solvent (1)*:
Tricyclohexyl Phosphate
Sensitizing Dye (d)*:



Antifoggant (1)*:



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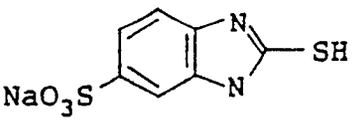
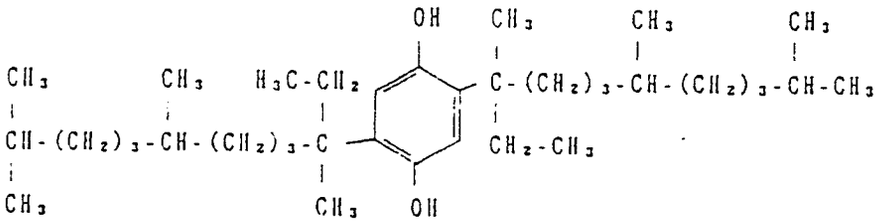
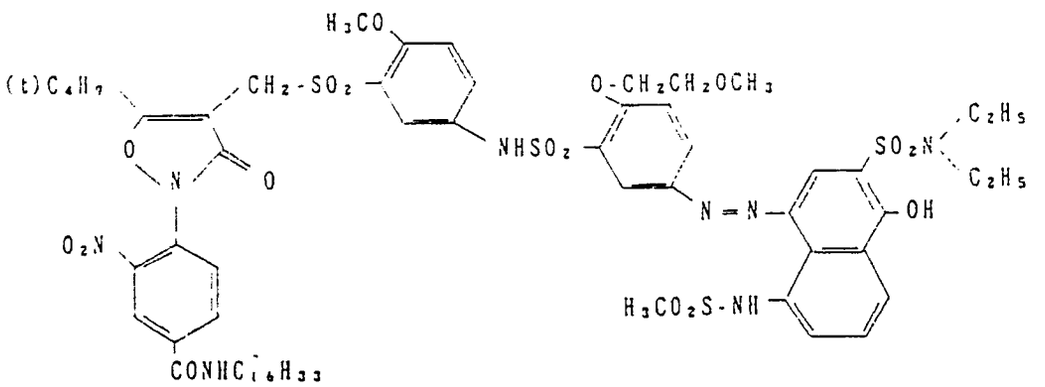


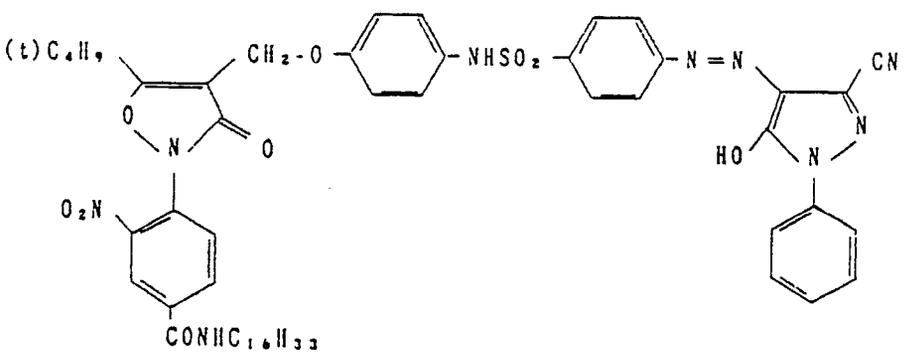
Reducing Agent (1)*:



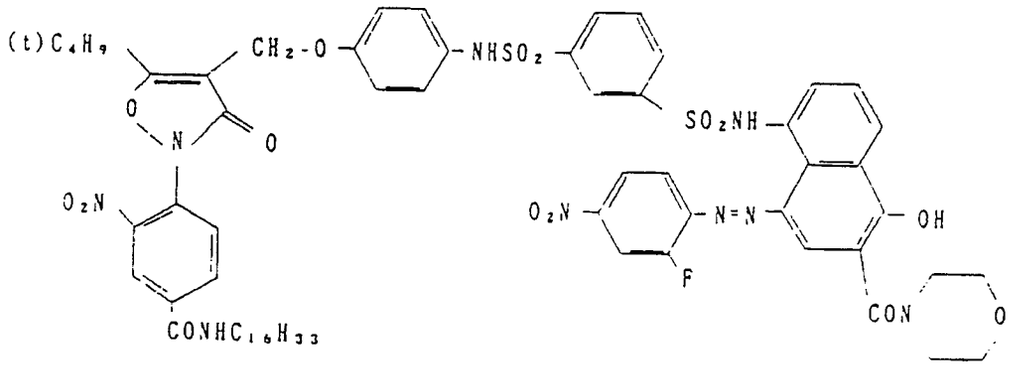
Magenta Dye Providing Substance (2)*:



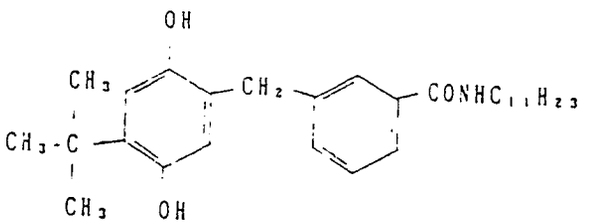
Yellow Dye Providing Substance (1)*:



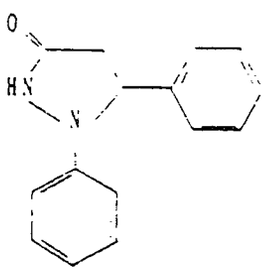
Cyan Dye Providing Substance (3)*:



Electron Donor (1)*:



Electron Transfer Agent (1)*:



Heat-developable light-sensitive materials (Sample Nos. 102 to 106) were prepared in the same manner as Sample No. 101, except that each of the following layers (A) to (E) was provided between the first layer and the support.

Layer (A) for Sample No. 102:	
Gelatin	0.2 (g/m^2 - the same shall apply hereunder)
Surfactant (1)*	0.08
Hardening Agent (1)*	0.002
Water-soluble Polymer (1)*	0.01

Layer (B) for Sample No. 103:	
Gelatin	0.2
Active Charcoal (1)*	0.05
Surfactant (1)*	0.09
Surfactant (4)*	0.003
Surfactant (5)*	0.006
Hardening Agent (1)*	0.002
Water-soluble Polymer (1)*	0.01

Layer (C) for Sample No. 104:	
Gelatin	0.2
Anion Exchange Resin (1)*	0.1
Surfactant (1)*	0.09
Surfactant (4)*	0.006
Surfactant (5)*	0.012
Hardening Agent (1)*	0.002
Water-soluble Polymer (1)*	0.01

Layer (D) for Sample No. 105:	
Gelatin	0.2
Alumina Gel (1)*	0.1
Surfactant (1)*	0.09
Surfactant (4)*	0.006
Surfactant (5)*	0.012
Hardening Agent (1)*	0.002
Water-soluble Polymer (1)*	0.01

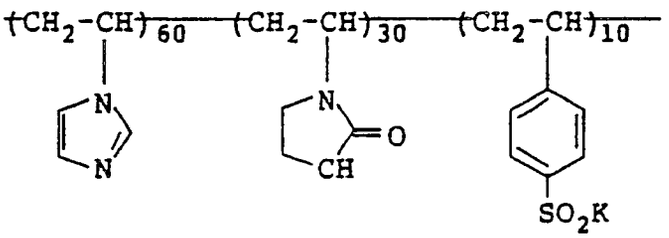
Layer (E) for Sample No. 105:	
Gelatin	0.2
Water-soluble Polymer (4)*	0.15
Surfactant (6)*	0.05
Hardening Agent (1)*	0.002

Next, heat-developable color light-sensitive material (Sample Nos. 107 to 112) were prepared also in the same manner as Sample No. 101, except that the 2nd, 4th and 6th layers were changed to those mentioned in Table 1 below.

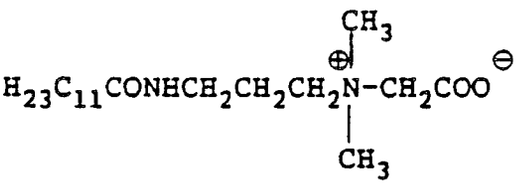
TABLE 1

Sample No.	Layer No.	Additives	Amount added (g/m²)
107	2nd Layer	Active Charcoal (1)*	0.05
		Surfactant (1)*	0.01
		Surfactant (4)*	0.003
		Surfactant (5)*	0.006
108	4th Layer	Same as 2nd layer of No. 107	
109	6th Layer	Same as 2nd layer of No. 107	
110	2nd Layer	Alumina Gel (1)*	0.1
		Surfactant (1)*	0.02
		Surfactant (4)*	0.006
		Surfactant (5)*	0.012
111	4th Layer	Same as 2nd layer of No. 110	
112	6th Layer	Same as 2nd layer of No. 110	

Compounds used in preparing the above-mentioned samples were as follows:
Surfactant (5)*: Demol® N
Water-soluble Polymer (4)*:



Surfactant (6)*:



Active Charcoal (1)*: Active Charcoal manufactured by Wako Pure Chemical Industries, Ltd. (powder)
Anion Exchange Resin (1)*: Diaion® SA-11A
Alumina Gel (1)*: Neutral Active Alumina (manufactured by Wako Pure Chemical Industries, Ltd.: WOELM®)

The active charcoal, anion exchange resin and alumina gel used in Example 1, which were in the form of a solid powder, were formed into the gelatin dispersion, as mentioned below, and added to the corresponding layers.

Preparation of Adsorbent Dispersion:

190 cc of water was added to 6 g of active charcoal, 4 g of gelatin, 0.5 g of Surfactant (1)*, 0.4 g of Surfactant (4)* and 0.7 g of Surfactant (5)* and agitated with a homogenizer at 10000 rpm for 10 minutes. The resulting mixture was transferred to a mill and 200 g of glass beads were added thereto. This was milled at 3000 rpm for 30 minutes. The dispersion thus prepared was called "gelatin dispersion of active charcoal".

Next, a dye-fixing material sample was prepared as mentioned below.

The layers each having the composition mentioned below were coated on a polyethylene-laminated paper support to prepare Dye-Fixing Material Sample (R-1).
Constitution of Dye-Fixing Material (R-1):

Third Layer :	
Gelatin	0.05 (g/m^2 - the same shall apply hereunder)
Matting Agent (Silica)	0.02
Silicone Oil (*1)	0.04
Surfactant (*2)	0.001
Surfactant (*3)	0.02
Surfactant (*4)	0.10
Guanidine Picolinate	0.45
Polymer (*5)	0.24

Second Layer :	
Mordant (*6)	2.35
Polymer (*7)	0.60
Gelatin	1.40
Polymer (*5)	0.21
High Boiling Point Organic Solvent (*8)	1.40
Guanidine Picolinate	1.80
Surfactant (*2)	0.02

First Layer :	
Gelatin	0.45
Surfactant (*4)	0.01
Polymer (*5)	0.04
Hardening Agent (*9)	0.30

Support:

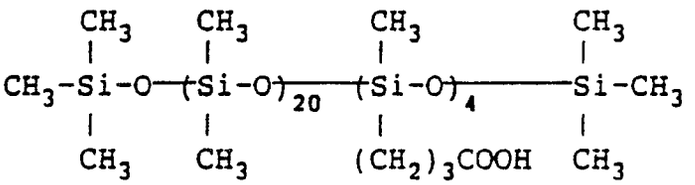
Polyethylene-laminated paper Support (thickness: 170 μ)

First Backing Layer :	
Gelatin	3.25
Hardening Agent (*9)	0.25

Second Backing Layer :	
Gelatin	0.44
Silicone Oil (*1)	0.08
Surfactant (*5)	0.002
Matting Agent (*10)	0.09

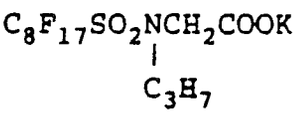
Compounds used for preparing the samples were as follows:

Silicone Oil (*1):

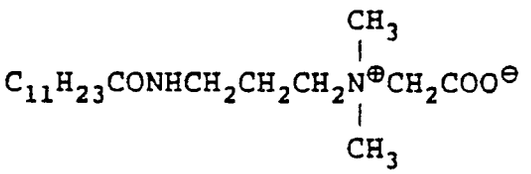


Surfactant (*2): Aerosol® OT

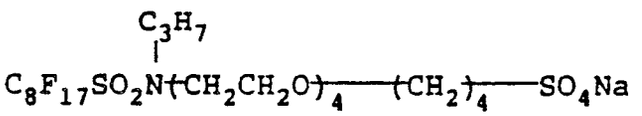
Surfactant (*3):



Surfactant (*4):

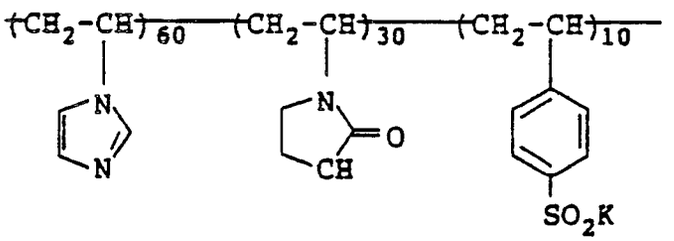


Surfactant (*5):



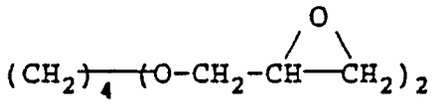
Polymer (*5): Vinyl Alcohol-Sodium Acrylate Copolymer (75/25, by mol)

Polymer (*7): Dextran (m.w.: 70,000) Mordant (*6):



High Boiling Point Organic Solvent (*8):

Reofos® 95
(manufactured by Ajinomoto Co., Inc.)
Hardening Agent (*9):



Matting Agent (*10): Benzoguanamine Resin
(mean grain size 15 μ)

The multilayer color light-sensitive material samples prepared above were exposed with a tungusten lamp of 5000 luxes through a B-G-R-gray color separation filter having a gradually varying color density.

The thus exposed samples were conveyed at linear velocity of 20 mm/sec and water was applied to the emulsion surface in an amount of 15 ml/m^2 with a wire bar, and immediately thereafter, they were attached to the image-receiving material sample with the coated obverse surfaces facing to each other.

Each combined sample was heated with a heat roller whose temperature was so adjusted that the temperature of the water-absorbed surface could be 85 °C, for 15 seconds. Next, the image-receiving material was peeled off, and a sharp and gradually varying image having blue, green, red and gray colors in correspondence to the B-G-R-gray color separation filter used was formed on the image-receiving material.

The maximum density (Dmax) and the minimum density (Dmin) in the gray portion were measured for cyan, magenta and yellow colors, and the results were shown in Table 2 below.

TABLE 2

	Dmax			Dmin		
Sample No.	Cyan	Magenta	Yellow	Cyan	Magenta	Yellow
Comparative						
101	2.10	2.22	2.05	0.18	0.19	0.20
102	2.09	2.20	2.04	0.17	0.18	0.19
Invention						
103	2.09	2.19	2.03	0.12	0.14	0.14
104	2.08	2.21	2.04	0.12	0.14	0.14
105	2.09	2.20	2.03	0.11	0.13	0.14
106	2.09	2.19	2.03	0.13	0.13	0.13
107	2.08	2.18	2.04	0.12	0.13	0.15
108	2.09	2.20	2.03	0.12	0.14	0.14
109	2.10	2.19	2.04	0.11	0.14	0.15
110	2.08	2.19	2.04	0.12	0.13	0.14
111	2.09	2.20	2.04	0.12	0.13	0.14
112	2.08	2.19	2.03	0.11	0.13	0.13

As is obvious from the results in Table 2 above, light-sensitive material sample Nos. 103 to 112 of the present invention formed images with lower Dmin and thus less stain than light-sensitive material sample Nos. 101 and 102.

Next, unexposed light-sensitive materials corresponding to sample Nos. 101 to 112 were stored for 7 days under a temperature of 40 °C and a humidity of 70% and then exposed and developed in the same manner as mentioned above. As a result, it was noted that Samples Nos. 101 and 102 had increased Dmin values of cyan, magenta and yellow each by 0.05, while the increase of the Dmin values of cyan, magenta and yellow each was only 0.01 to 0.02. As a result, it is obvious that light-sensitive material sample Nos. 103 to 112 of the present invention have excellent storage stability.

EXAMPLE 2

Using the same emulsions, dye providing substances, electron donor and electron transfer agent as those used in color light-sensitive material sample No. 101 of Example 1, a multilayer color light-sensitive material (Sample No. 201) having he following layer constitution was prepared.

Unless otherwise specifically indicated, the additives used were same as those used in Sample No. 101.

The organic silver salt emulsion was prepared as follows:

20 g of gelatin and 5.9 g of 4-acetylaminophenylpropiolic acid were dissolved in 1,000 ml of 0.1% aqueous sodium hydroxide solution and 200 ml of ethanol. The resulting solution was stirred at 40 °C. To the solution was added a solution of 4.5 g of silver nitrate dissolved in 200 ml of water over a period of 5 minutes. Next, the excess salts were removed by the well known sedimentation method. Afterwards, the pH was adjusted to 6.3, and 300 g of an organic silver salt dispersion was obtained.

The antifoggant precursor (1)* having the structure mentioned below was added to the dye providing substance in an amount of 0.2 molar time the substance and was formed into an oil dispersion together with the dye providing substance and electron donor, like the method of Example 1.

Layer Constitution of Sample No. 201:

Sixth Layer : Protective Layer	
Gelatin	0.91 (g/m^2 - the same shall apply hereunder)
Matting Agent (Silica)	0.03
Surfactant (1)*	0.06
Surfactant (2)*	0.13
Hardening Agent (1)*	0.01
Base Precursor (1)*	0.30

Fifth Layer : Blue-sensitive Emulsion Layer	
Emulsion (III)	0.30 as Ag
Organic Silver Salt Emulsion	0.25 as Ag
Gelatin	1.00
Antifoggant Precursor (1)*	0.07
Yellow Dye Providing Substance (1)*	0.50
High Boiling Point Organic Solvent (1)*	0.75
Electron Donor (2)*	0.27
Surfactant (3)*	0.05
Electron Transfer Agent (2)*	0.03
Thermal Solvent (1)*	0.20
Hardening Agent (1)*	0.01
Base Precursor (1)*	0.27
Water-soluble Polymer (1)*	0.02

Fourth Layer : Interlayer	
Gelatin	0.75
Reducing Agent (2)*	0.24
Surfactant (1)*	0.02
Surfactant (4)*	0.07
Water-soluble Polymer (1)*	0.02
Hardening Agent (1)*	0.01
Base Precursor (1)*	0.25

Third Layer : Green-sensitive Emulsion Layer	
Emulsion (II)	0.20 as Ag
Organic Silver Salt Emulsion	0.20 as Ag
Gelatin	0.85
Antifoggant Precursor (1)*	0.04
Magenta Dye Providing Substance (2)*	0.37
High Boiling Point Organic Solvent (1)*	0.55
Electron Donor (2)*	0.15
Surfactant (3)*	0.04
Electron Transfer Agent (2)*	0.03
Thermal Solvent (1)*	0.16
Hardening Agent (1)*	0.01
Base Precursor (1)*	0.25
Water-soluble Polymer (1)*	0.02

Second Layer : Interlayer	
Gelatin	0.80
Reducing Agent (2)*	0.24
Surfactant (1)*	0.06
Surfactant (4)*	0.10
Water-soluble Polymer (1)*	0.03
Base Precursor (1)*	0.25
Hardening Agent (1)*	0.01

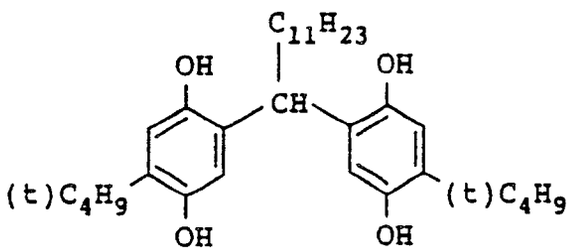
First Layer : Red-sensitive Emulsion Layer	
Emulsion (I)	0.20 as Ag
Organic Silver Salt Emulsion	0.20 as Ag
Gelatin	0.85
Antifoggant Precursor (1)*	0.04
Thermal Solvent (1)*	0.16
Base Precursor (1)*	0.25
Cyan Dye Providing Substance (3)*	0.38
High Boiling Point Organic Solvent (1)*	0.60
Electron Donor (2)*	0.15
Surfactant (3)*	0.04
Electron Transfer Agent (2)*	0.03
Hardening Agent (1)*	0.01
Water-soluble Polymer (1)*	0.02

Support:

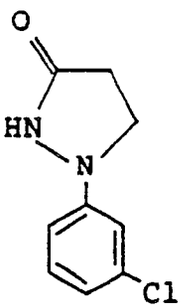
Polyethylene Terephthalate (thickness: 100 μ)

Backing Layer :	
Carbon Black	0.44
Polyester	0.30
Polyvinyl Chloride	0.30

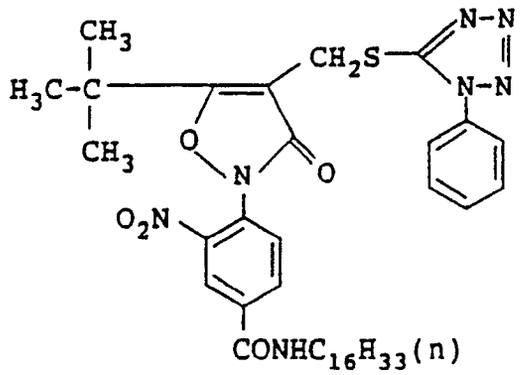
Compounds used above were as follows:
Electron Donor (2)*:



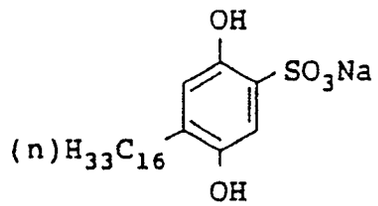
Electron Transfer Agent (2)*:



Antifoggant Precursor (1)*:



Thermal Solvent (1)*: Benzenesulfonamide
Base Precursor (1)*: 4-Chlorophenylsulfonylacetic Acid Guanidine
Reducing Agent (2)*:



Photographic material sample Nos. 202 to 206 were prepared in the same manner as Sample No. 201, except that the additives as indicated in Table 3 below were added.

TABLE 3

Sample No.	Layer	Additives	Amount Added (g/m^2)
202	First Layer	Active Charcoal (1)*	0.05
		Surfactant (1)*	0.01
		Surfactant (4)*	0.003
		Surfactant (5)*	0.006
203	Second Layer	Same as those added to the first layer of No. 202	
204	Sixth Layer	Same as those added to the first layer of No. 202	
205	First, Third and Fifth Layers	Active Charcoal (1)*	0.02
		Surfactant (1)*	0.003
		Surfactant (4)*	0.001
		Surfactant (5)*	0.002
206	Second, Fourth and Sixth Layers	Same as those added to 1st, 3rd and 5th layers of No. 205	

Next, a dye-fixing material (R-2) was prepared as follows:

10 g poly(methyl acrylate-co-N,N,N-trimethyl-N-vinylbenzylammonium chloride) (ratio of methyl acrylate/vinylbenzylammonium chloride = 1/1) was dissolved in 200 ml of water and then uniformly blended with 100 g of 10% lime-processed gelatin. To the resulting mixture was added a hardening agent. The thus prepared composition was coated on a paper support as laminated with polyethylene containing a

dispersion of titanium dioxide to from a wet film having a thickness of 90 μm. This was dried and then used as the dye-fixing material sample (R-2) having a mordant layer.

The previously prepared light-sensitive material samples were exposed in the same manner as Example 1 and then uniformly heated on a heat block heated at 140° C for 30 seconds.

Water was applied on the coated surface of the dye-fixing material sample (R-2) in an amount of 20 ml/m^2, and then the heated light-sensitive material sample was attached thereto with the coated surfaces facing to each other.

Next, the thus combined sample was passed through a laminator heated at 80° C at a linear velocity of 12 mm/sec and then the both materials were peeled off from each other. As a result, the dye-fixing material sample had a positive image with an excellent S/N ratio.

Dmax and Dmin of each color of cyan, magenta and yellow in the gray portion were measured, and the results are shown in Table 4 below.

TABLE 4

	Dmax			Dmin		
Sample No.	Cyan	Magenta	Yellow	Cyan	Magenta	Yellow
Comparative						
201	2.15	2.25	2.10	0.20	0.21	0.23
202	2.13	2.23	2.09	0.19	0.20	0.21
Inventive						
203	2.13	2.22	2.08	0.15	0.15	0.16
204	2.12	2.23	2.09	0.15	0.14	0.15
205	2.12	2.23	2.08	0.14	0.15	0.16
206	2.13	2.23	2.09	0.15	0.15	0.15

As is obvious from the results in Table 4 above, light-sensitive material sample Nos. 203 to 206 of the present invention gave an image with less stain than light-sensitive material sample Nos. 201 and 202.

EXAMPLE 3

The silver halide emulsions for the fifth layer and first layer were prepared as mentioned below.

600 ml of an aqueous solution containing both sodium chloride and potassium chloride and an aqueous silver nitrate solution (formed by dissolving 0.59 mol of silver nitrate in 600 ml of water) were simultaneously added to a well stirred aqueous gelatin solution (containing 20 g of gelatin and 3 g of sodium chloride in 1,000 ml of water and heated at 75° C) all at the same flow rate over a period of 40 minutes. Accordingly, a monodispersed cubic silver chlorobromide emulsion (bromine content: 50 mol%) having a mean grain size of 0.40 μm was prepared.

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

Next, the silver halide emulsion for the third layer was prepared as mentioned below.

600 ml of an aqueous solution containing both sodium chloride and potassium bromide and an aqueous silver nitrate solution (prepared by dissolving 0.59 mol of silver nitrate in 600 ml of water) were simultaneously added to a well stirred aqueous gelatin solution (containing 20 g of gelatin and 3 g of sodium chloride in 1,000 ml of water and heated at 75° C) all at the same flow rate over a period of 40 minutes. Accordingly, a monodispersed cubic silver chlorobromide emulsion (bromine content: 80 mol%) having a mean grain size of 0.35 μm was prepared.

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

The silver benzotriazole emulsion was prepared as mentioned below.

28 g of gelatin and 13.2 g of benzotriazole were dissolved in 300 ml of water. The resulting solution was sitrred at 40° C. To the solution was added a solution of 17 g of silver nitrate dissolved in 100 ml of water over a period of 2 minutes.

The resulting silver benzotriazole emulsion was adjusted to the determined pH and the excess salts were removed therefrom by sedimentation. Afterwards, the pH was adjusted to 6.30, and 400 g of the intended silver benzotriazole emulsion was obtained.

The silver acetylene emulsion was prepared as mentioned below.

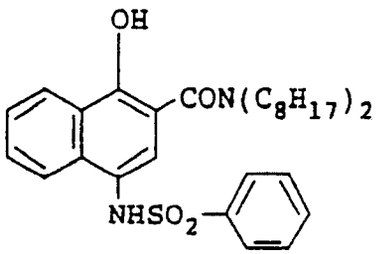
20 g of gelatin and 4.6 g of 4-acetylaminophenylacetylene were dissolved in 1,000 ml of water and 200 ml of ethanol. The resulting solution was stirred at 40° C. To the solution was added a solution of 4.5 g of silver nitrate dissolved in 200 ml of water over a period of 5 minutes. The pH of the resulting dispersion was adjusted and the excess salts were removed by sedimentation. Afterwards, the pH was adjusted to 6.3 and 300 g of the intended silver acetylene dispersion was obtained.

Next, the gelatin dispersion of dye providing substance was prepared as mentioned below.

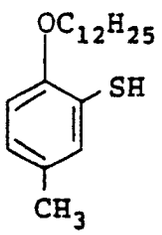
5 g of Yellow Dye Providing Substance (3)*, 0.2 g of Auxiliary Developing Agent (a), 0.2 g of Antifoggant (b), 0.5 of 2-ethylhexyl succinate sodium sulfonate as surfactant and 2.5 g of triisononyl phosphate were weighed and 30 ml of ethyl acetate was added thereto and heated at about 60° C to obtain a uniform solution. The resulting solution was stirred together with 100 g of 3% solution of lime-processed gelatin and then dispersed with a homogenizer at 10,000 rpm for 10 minutes. The resulting dispersion is called "yellow dye providing substance dispersion".

Compounds used above were as follows:

Auxiliary Developing Agent (a):



Antifoggant (b):



A magenta dye providing substance dispersion was prepared in the same manner as above, except that Magenta Dye Providing Substance (5)* was used and 2.5 g of tricresyl phosphate was used as the high boiling point solvent.

A cyan dye providing substance dispersion was also prepared in the same manner as that preparing the yellow dye providing substance dispersion except that Cyan Dye Providing Substance (6)* was used.

Using the thus prepared components, a multilayer heat-developable light-sensitive material having the layer constitution mentioned below was prepared. This is called Sample No. 301. Sixth Layer:

Gelatin	800 mg/m^2
Hardening Agent (*3)	16 mg/m^2
Silica (*5)	100 mg/m^2
Zinc Hydroxide	300 mg/m^2

Fifth Layer: Green-sensitive Emulsion Layer

Silver Chlorobromide Emulsion (Br-content: 50 mol%)	400 mg/m^2 as Ag
Silver Benzotriazole Emulsion	20 mg/m^2 as Ag
Sensitizing Dye (D-1)	10^6 mol/m^2
Hardening Agent (*3)	16 mg/m^2
Yellow Dye Providing Substance (4)*	400 mg/m^2
Gelatin	1400 mg/m^2
High Boiling Point Organic Solvent (*4)	200 mg/m^2
Surfactant (*2)	100 mg/m^2

Fourth Layer: Interlayer

Gelatin	900 mg/m^2
Hardening Agent (*3)	18 mg/m^2
Zinc Hydroxide	300 mg/m^2

Third Layer: Red-sensitive Emulsion Layer

Silver Chlorobromide Emulsion (Br-content: 80 mol%)	300 mg/m^2 as Ag
Silver Acetylene Emulsion	60 mg/m^2 as Ag

Silver Benzotriazole Emulsion	20 mg/m^2 as Ag
Sensitizing Dye (D-2)	8×10^{-7} mol/m^2
Hardening Agent (*3)	19 mg/m^2
Magenta Dye Providing Substance (5)*	400 mg/m^2
Gelatin	800 mg/m^2
High Boiling Point Organic Solvent (*1)	200 mg/m^2
Surfactant (*2)	100 mg/m^2

Second Layer: Interlayer

Gelatin	800 mg/m^2
Hardening Agent (*3)	16 mg/m^2
Zinc Hydroxide	300 mg/m^2

First Layer: Infrared-sensitive Emulsion Layer

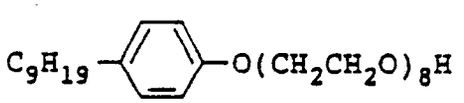
Silver Chlorobromide Emulsion (Br-content: 50 mol%)	300 mg/m^2 as Ag
Silver Acetylene Emulsion	25 mg/m^2
Silver Benzotriazole Emulsion	50 mg/m^2
Sensitizing Dye (D-3)	10^{-8} mol/m^2
Hardening Agent (*3)	16 mg/m^2
Cyan Dye Providing Substance (6)*	300 mg/m^2
Gelatin	600 mg/m^2
High Boiling Point Organic Solvent (*4)	150 mg/m^2
Surfactant (*2)	100 mg/m^2

Support (*1):

Compounds used in the above were as follows:

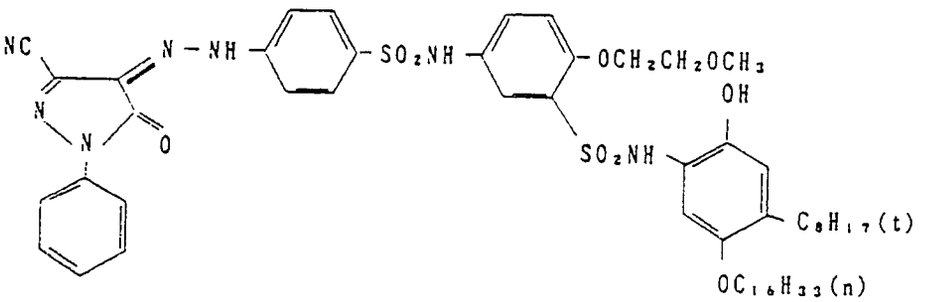
(*1): Polyethylene Terephthalate (thickness: 180 μm)

(*2):

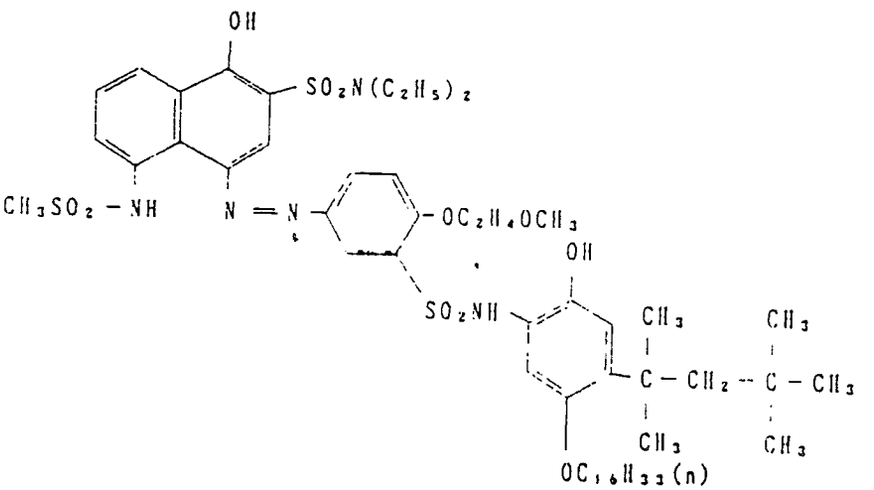


(*3): 1,2-Bis(vinylsulfonylacetamido)ethane
(*4): (iso-$C_9H_{19}O)_3P=O$
(*5): Silica 4 μm Dye Providing Substances:

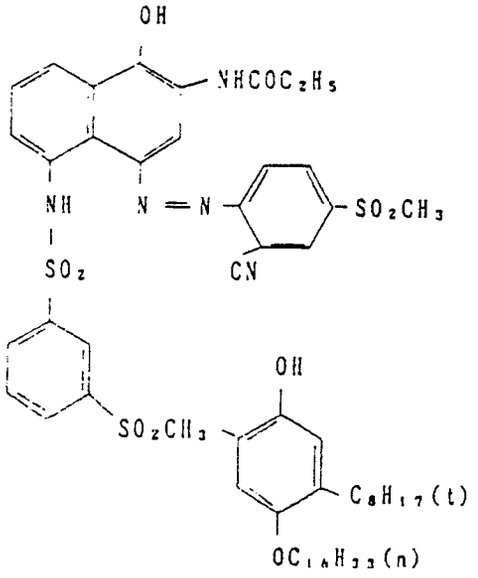
(4)*



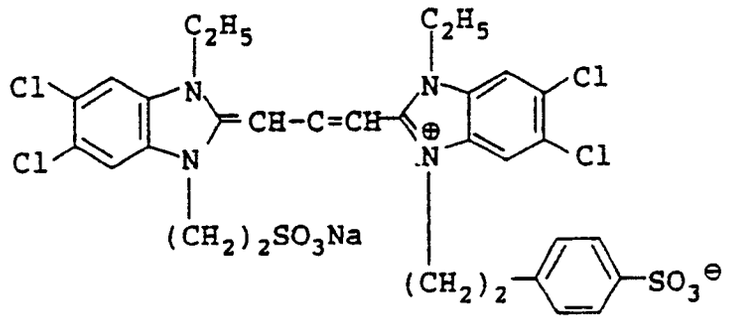
(5)*



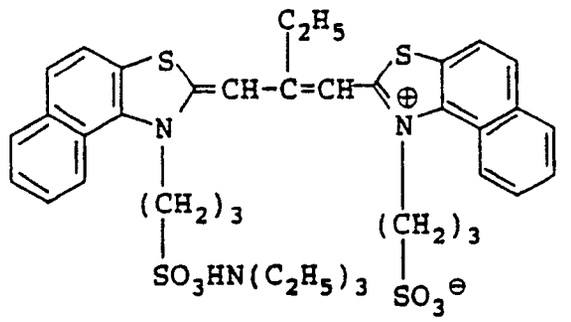
(6)*



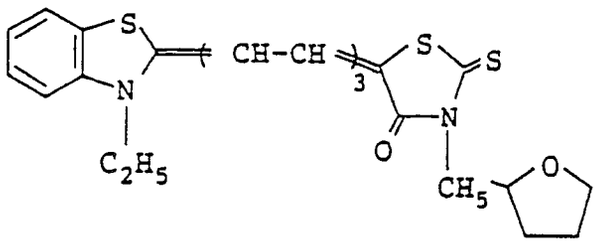
(D-1)



(D-2)



(D-3)



Next, light-sensitive material sample Nos. 302 to 307 were prepared in the same manner as Sample No. 301, except that the layers (A) to (E) as mentioned in Example 1 were additionally coated in the manner as indicated in Table 5 below.

TABLE 5

Sample No.	301	302	303	304	305	306	307
Photographic Layer	As mentioned above	Same as No. 301	Same as No. 301	Same as No. 301	Same as No. 301	Same as No. 301	Same as No. 301
Subbing Layer (1)	-	(A)	(A)	(B)	(A)	(A)	(A)
Subbing Layer (2)	-	-	(A)	-	(B)	(C)	(E)
	Support	Support	Support	Support	Support	Support	Support

The thus prepared light-sensitive material sample Nos. 301 to 307 were exposed with a tungusten lamp of 500 luxes through a G-R-IR three color separation filter having a continuously varying color density for one second. (The filter was composed of 500 to 600 nm band pass filter for G, 600 to 700 band pass filter for R and filter of passing 700 nm or more for IR.)

Water was applied to the emulsion surface of each of the thus exposed heat-developing light-sensitive material samples in an amount of 12 ml/m^2 with a wire bar, and the material was attached to the dye-fixing material (R-1) with the coated surfaces facing to each other.

The thus combined material was heated for 30 seconds with a heat roller whose temperature was so adjusted that the temperature of the water-absorbed layer could be 88 or 98 °C, and then the dye-fixing material was peeled off from the light-sensitive material. As a result, a sharp image with yellow, magenta and cyan colors corresponding to G, R and IR of the three color separation filter, respectively, was formed on the dye-fixing material.

Dmax and Dmin of the respective colors were measured, and the results were shown in Table 6 below.

TABLE 6

	Dmax			Dmin		
Sample No.	Cyan	Magenta	Yellow	Cyan	Magenta	Yellow
Comparative						
301	2.30	2.20	2.02	0.13	0.11	0.11
302	2.31	2.20	2.01	0.13	0.11	0.11
303	2.30	2.21	2.01	0.12	0.11	0.11
Invention						
304	2.30	2.19	2.01	0.09	0.08	0.08
305	2.31	2.20	2.02	0.08	0.08	0.08
306	2.29	2.20	2.01	0.09	0.08	0.08
307	2.30	2.19	2.02	0.08	0.08	0.08

As is obvious from the results in Table 6 above, light-sensitive material sample Nos. 304 to 307 of the present invention gave an image with a lower Dmin than the light-sensitive material samples Nos. 301 to 303.

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.

Claims

1. A heat-developable color light-sensitive material comprising a support having provided thereon a light-sensitive silver halide, a binder, and a dye providing compound capable of releasing or forming a diffusible dye in correspondence or reverse correspondence with reaction of reducing the silver halide into silver, said light-sensitive material having a hydrophilic binder layer containing an adsorbent substance capable of adsorbing a color substance formed during the step of processing the light-sensitive material for forming an image therewith.

2. The heat-developable color light-sensitive material as in claim 1, in which the adsorbent substance is a solid granular adsorbent selected from the group consisting of active charcoal, carbon black, cation or anion exchange resins, silica gel, aluminosilica gel and active alumina.

3. The heat-developable color light-sensitive material as in claim 2, in which the solid granular adsorbent is in the form of an aqueous dispersion.

4. The heat-developable color light-sensitive material as in claim 1, in which the adsorbent substance is a mordant polymer.

5. The heat-developable color light-sensitive material as in claim 1, in which the amount of the adsorbent in the material is from 1 mg/m^2 to 2 g/m^2.

6. The heat-developable color light-sensitive material as in claim 5, which the amount of the adsorbent substance in the material is from 10 mg/m^2 to 500 mg/m^2.

7. A heat-developable color light-sensitive material as in claim 1, wherein the adsorbent substance is provided in an amount sufficient to adsorb any color substances which are unnecessary for forming images and thus prevent formation of stain without substantially interfering with formation of the image.

8. A heat-developable color light-sensitive material as in claim 1, wherein the adsorbent substance and dye providing compound are provided in separate layers, and the layer containing the adsorbent substance is adjacent the dye providing compound containing layer.

9. A heat-developable color light-sensitive material as in claim 1, wherein the adsorbent substance and dye providing compound are provided in separate layers, and the layer containing the adsorbent substance is in a layer further from the support than the dye providing compound containing layer.

10. A method of forming an image with a heat-developable color light-sensitive material as set forth in claim 1, wherein the material further comprises a dye-fixing layer and wherein the material is heated during of after imagewise exposure thereof to release or form a diffusible dye whereupon the dye is transferred to a dye-fixing layer different from the hydrophilic binder layer containing the adsorbent substance.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 89 11 4289

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X,Y	DE-A-2 905 652 (CIBA-GEIGY) * Claims; pages 6-11 *	1-10	G 03 C 8/40
X,Y	FR-A-1 469 348 (KODAK) * Whole document *	1-10	
X,Y	EP-A-0 190 054 (KONISHIROKU) * Page 9, line 24 - page 10, line 9; page 11, lines 2-4; page 54, lines 6-13; page 56, lines 12-16 *	1-10	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

G 03 G 8
B 41 M 5
G 03 C 1

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	11-09-1989	MAGRIZOS S.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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