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(54) **Aqueous dispersion containing titanium oxide and color diffusion-transfer photographic film unit**

(57) An aqueous dispersion that comprises titanium oxide of an average primary particle size of 1 to 45 nm, a polyanionic compound and/or a condensed phosphate, and a polyhydric alcohol. A color diffusion-transfer photographic film unit, which comprises an image-receiving element, which comprises, on a support, a layer having a neutralizing function, an image-receiving layer, and a peel layer, in this order, a light-sensitive element, which comprises, on a support having a light-shielding layer, at least one silver halide emulsion layer combined with at least one dye-image-forming com-

pound, and an alkaline processing composition to be developed between the image-receiving element and the light-sensitive element, such that an image is obtained by subjecting to exposure to light, processing by developing the alkaline processing composition between the elements, and peeling the image-receiving element from the light-sensitive element, wherein the image-receiving element comprises a titanium oxide-containing layer formed by coating a coating solution containing the aqueous dispersion on the support.

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Description**FIELD OF THE INVENTION**

[0001] The present invention relates to a color diffusion-transfer photographic film unit, and specifically, to a peel-apart-type photographic film unit, in which the image-receiving element is peeled from the light-sensitive element after processing. Further, the present invention relates to a light-sensitive material that exhibits excellent light-fastness, small dependence of image density fluctuation on peeling time, small image haze or stain due to processing solution remaining in the image-receiving element at the time of peeling, and excellent surface gloss. Still further, the present invention relates to a titanium oxide-containing aqueous dispersion that can be used to manufacture the above-mentioned photographic film unit, and which has improved dispersibility and stability with the lapse of time.

BACKGROUND OF THE INVENTION

[0002] A polyanionic compound, a condensed phosphate, or the like is known as a dispersing agent in an aqueous dispersion of a metal oxide. As the amount of such a compound to be used is increased, the dispersing speed becomes faster, and the final degree of fineness of the dispersion becomes smaller. However, when fine titanium oxide of particle diameters ranging from 5 to 100 nm is dispersed using the above-mentioned dispersing agent, a rise in viscosity was observed with the lapse of time after the formation of the dispersion, although the dispersing speed became faster. This rise in viscosity causes various problems and impairs process stability when the dispersion is used. To realize an industrially stable process using the titanium oxide fine-particles, demand has existed for a titanium oxide fine-particle-aqueous dispersion having an improved degree of dispersion and sufficient stability with the lapse of time.

[0003] Heretofore, a color diffusion-transfer photographic process using an azo dye image-forming substance, in which an image-receiving element and a light-sensitive element are united in such a way that a diffusive azo dye different from the image-forming substance itself is formed, after development using a viscous alkaline solution to be developed between the image-receiving element and the light-sensitive element, is well known. In this photographic process, also well known is a peel-apart system, in which the viscous solution is developed between the elements, and the elements are peeled from each other after development/transfer, so that an image is obtained by the peeling-off. The dye-providing compounds described in U. S. Patent No. 3,928,312 are known as dye-releasing compounds for use in this transfer system.

[0004] To immobilize the anionic dye after it is released, it is known to use a polymer containing a quaternary ammonium salt, as described, for example, in U.S. Patent Nos. 3,958,995, 3,898,088, as a mordant in the image-receiving layer of the image-receiving element. In addition, polymers having a tertiary imidazole ring in the side chain, as described in U.S. Patent Nos. 4,115,124, 4,282,305, and 4,273,853, are known to improve the fastness to light of the immobilized dyes. Further, for example, copolymers of a tertiary imidazole, as described in JP-B-4-17418 ("JP-B" means examined Japanese patent publication) and J-P-A-8-62803 ("JP-A" means unexamined published Japanese patent application); copolymers having a quaternary ammonium salt group and a tertiary imidazole group, as described in JP-A-60-60643, are known to enhance mordanting performance and stability to light of the dyes. Still further, JP-A-10-142765 discloses examples of peel-apart-type photographic film units that use a mordant containing an imidazole group. Further, it is known that a polymer containing a pyridine ring in the side chain is used as a mordant.

[0005] These polymeric mordants have been developed to increase the power to hold the anionic dyes coming in by transfer, and to enhance the stability of the dyes to light. However, in the peel-apart system, in which a viscous alkaline solution is developed, the above-mentioned polymer containing a quaternary ammonium salt, and the polymer containing a pyridine ring, are the only polymeric mordants that have been put to practical use.

[0006] Although the above-mentioned techniques described in JP-A-10-142765 and the like have alleviated the haze, stain, and other problems to some extent, the film physical properties after peeling, and at the time of peeling, are still unsatisfactory, and further improvement in this regard is required.

[0007] On the other hand, the improvement of stability against light fading by using fine-particles of titanium oxide is disclosed in JP-A-6-118591. However, the particle diameters of the titanium oxide used in the examples in JP-A-6-118591 were 50 nm or more, and studies conducted later have revealed that the use of titanium oxide particles having particle diameters falling in the above-mentioned range presents the problems of insufficient transparency and reduced image density. Besides this optical influence, it has also been found that, in a peel-apart-type instant photograph, the titanium oxide-containing layer constitutes a diffusion pathway of the image-forming dyes, and therefore the titanium oxide physically delays diffusion of the dyes, to thereby reduce the image density. Also in connection with particle diameters of the titanium oxide, particle diameters thereof falling in the range of about 50 nm or more were found to cause a conspicuous reduction in image density. The aforementioned JP-A-6-118591 does not disclose any method for producing fine-particles of titanium oxide that exerts no influence on photographic density. According to JP-A-6-118591, titanium oxide is preferably dispersed and used in a hydrophobic binder system. However, in the case of an

instant color photograph, the image-forming dyes are soluble in water, and these dyes are entirely non-diffusive in the hydrophobic binder described in JP-A-6-118591, then satisfactory photographs are not formed. Therefore, JP-A-6-118591 provides no information suggestive of an instant color photograph.

[0008] As a result of further studies, the present inventor has found that the use of a dispersion containing titanium oxide having an average primary particle diameter of 1 to 45 nm, remarkably improves, for example, stain prevention in image and light-fastness of an image, film physical properties. However, there was demand in the stability of such a dispersion and further improvement in photographic image qualities.

SUMMARY OF THE INVENTION

[0009] Accordingly, an object of the present invention is to provide a titanium oxide-containing aqueous dispersion whose dispersibility and stability with the lapse of time are improved. Another object of the present invention is to provide a peel-apart-type color diffusion-transfer film unit having improved stain prevention, light-fastness, and film physical properties.

[0010] Other and further objects, features, and advantages of the invention will appear more fully from the following description.

DETAILED DESCRIPTION OF THE INVENTION

[0011] According to the present invention, there are provided the following means:

(1) An aqueous dispersion, comprising titanium oxide having an average primary particle size of 1 to 45 nm, a polyanionic compound and/or a condensed phosphate, and a polyhydric alcohol.

(2) The aqueous dispersion according to item (1), wherein the polyanionic compound is a polyacrylic acid salt or a polymethacrylic acid salt.

(3) The aqueous dispersion according to item (1) or (2), wherein the polyhydric alcohol is glycerin or ethylene glycol.

(4) A color diffusion-transfer photographic film unit, comprising an image-receiving element, which has, on a support, a layer having a neutralizing function, an image-receiving layer, and a peel layer, in this order; a light-sensitive element, which has, on a support having a light-shielding layer, at least one silver halide emulsion layer combined with at least one dye-image-forming compound; and an alkaline processing composition to be developed between the image-receiving element and the light-sensitive element; such that an image is obtained by the steps of subjecting to exposure to light, processing by developing the alkaline processing composition between the elements, and peeling the image-receiving element from the light-sensitive element;

wherein the image-receiving element comprises a titanium oxide-containing layer formed by coating a coating solution containing the aqueous dispersion of item (1), (2), or (3) on the support.

(5) The color diffusion-transfer photographic film unit according to item (4), wherein the titanium oxide-containing layer in the image-receiving element is positioned in the image-receiving layer and/or as an overlayer of the image-receiving layer (opposite side to its support).

[0012] The specific constitution of the present invention is explained in detail below.

[0013] First, the titanium oxide-containing aqueous dispersion of the present invention is explained in detail.

[0014] For the manufacture of the titanium oxide that can be used in the present invention, many methods can be utilized. These methods include a neutralizing hydrolysis of a titanium salt, a neutralization of sodium titanate, hydrolysis of a titanium alkoxide, and gas phase decomposition of a titanium alkoxide.

[0015] More specifically, according to the neutralizing hydrolysis of a titanium salt, the manufacturing process comprises the steps of hydrolysis of titanium tetrachloride, firing, pulverization followed by particle size regulation, surface treatment, washing, drying, and final pulverization. According to the neutralization of sodium titanate, the manufacturing process comprises the steps of hydrolysis of sodium titanate, alkali-leaching treatment followed by acid-leaching treatment, and surface treatment. Therefore, the manufacturing process does not include a firing step. And, the manufacturing process that does not include a firing step is defined as a wet process.

[0016] The titanium oxide usable in the present invention may be one that is manufactured by a firing process or by a wet process, and the titanium oxide by either process can be selected according to purposes to use. Generally, the titanium oxide by a wet process is easy to disperse, while the titanium oxide by a firing process is characterized by better light resistance.

[0017] The average primary particle size of the titanium oxide is 1 to 45 nm, preferably 3 to 40 nm, and more preferably 5 to 30 nm. In the case where the particle is not spherical, the particle whose diameter for minor axis has a value falling within the above-mentioned range is preferable.

[0018] Preferably, the titanium oxide for use in the present invention is one that has undergone a surface treatment

with an inorganic surface-treating agent or an organic surface-treating agent. Preferred examples of the inorganic surface-treating agent include aluminum oxide, zirconium oxide, silicon oxide, and zinc oxide. Examples of the organic surface-treating agent include siloxane, stearic acid, and trimethylolpropane. The amount of the treating agent to be used is preferably 3 to 45% (by mass), more preferably 5 to 35%, to the titanium oxide. As the amount of the treating agent to be used is increased, properties such as dispersibility are improved, but the absorption of ultraviolet light diminishes and the light stability aimed at is impaired because the amount of the titanium oxide becomes relatively smaller. Therefore, it is preferable to appropriately select the proportion of the titanium oxide in such a way that makes the above-mentioned two performances compatible with each other.

[0019] When the aqueous dispersion of the present invention is used in a color diffusion-transfer photographic film unit, it is preferable that the titanium oxide is used in an amount of 0.01 to 20 g/m². As the amount to be used is increased, the absorption of ultraviolet light becomes larger. However, the drawback that is encountered as the amount to be used is increased is that the photographic density is slightly lowered. Therefore, it is preferable to properly select the amount. The amount of the titanium oxide to be used is preferably 0.02 to 10 g/m² and more preferably 0.05 to 2 g/m².

[0020] The titanium oxide described above may be a commercially available one. For example, the titanium oxide may be selected from TTO-51, 55, S, M, D, and F series (trade names, manufactured by Ishihara Sangyo Kaisha Ltd.) and can be used in the present invention.

[0021] The aqueous dispersion containing titanium oxide of the present invention may further contain other components such as the components that may be incorporated in the titanium oxide-containing layer of the color diffusion-transfer photographic film unit of the present invention described later.

[0022] Titanium oxide may be made into a dispersion by dispersing the solid particles. The amount of water to be used is preferably 0.67 to 32, more preferably 19 to 1, times the amount by mass of titanium oxide. The dispersing agent to be used is a polyanionic compound and/or condensed phosphate.

[0023] Specific examples of the polyanionic compound that can be used in the present invention include polyacrylic acid salts (e.g., sodium polyacrylate), polymethacrylic acid salts (e.g., sodium polymethacrylate), polymaleic acid salts (e.g., sodium polymaleate), copolymers of an acrylic acid salt (e.g., sodium acrylate) and methyl acrylate, copolymers of maleic acid and methyl vinyl ether, carboxymethyl cellulose, carboxyethyl cellulose, and carboxyl-modified polyvinyl alcohol. Preferably, the polyanionic compound is a polyacrylic acid salt or a polymethacrylic acid salt. Examples of the condensed phosphate include sodium hexametaphosphate, sodium tripolyphosphate, sodium pyrophosphate, and sodium orthophosphate. Besides, surface-active agent in common use (e.g., sodium dodecylbenzenesulfonate and polyoxyethylene nonyl phenyl ether), water-soluble polymers (e.g., polyvinyl alcohol, polyvinylpyrrolidone, hydroxymethyl cellulose, and polysaccharide), and others may also be used together with the polyanionic compounds and/or condensed phosphates. The amount of the polyanionic compound and/or condensed phosphate to be used is preferably within the range of 0.5 to 50% by mass, to the amount of titanium oxide. As the amount of the polyanionic compound and/or condensed phosphate to be used is increased, the ultraviolet-light-shielding effect is decreased because the proportion of titanium oxide diminishes substantially. On the other hand, if the amount is too small, the dispersion stability cannot be secured. Although the amount varies depending on the desired degree of dispersion and desired state of dispersion, the amount of the polyanionic compound and/or condensed phosphate to be used is more preferably 1 to 30% by mass and most preferably 3 to 25% by mass.

[0024] In the present invention, a polyhydric alcohol, such as glycol as a dihydric alcohol, a trihydric alcohol, pentitol as a pentahydric alcohol, or hexitol as a hexahydric alcohol, is used for the prevention of the coagulation of titanium oxide after being dispersed. Among polyhydric alcohols, an alcohol, which has a relatively small molecular weight and a high hydrophilicity, is preferred. And, glycerin or ethylene glycol is preferably used. The polyhydric alcohol may be added at the time when the titanium oxide is dispersed, or alternatively, the polyhydric alcohol may be added after the titanium oxide is dispersed. The amount of the polyhydric alcohol to be used is preferably 1 to 100% by mass, more preferably 5 to 50% by mass, and most preferably 10 to 30% by mass, to the amount of the titanium oxide.

[0025] For dispersing the titanium oxide, any disperser generally usable for dispersing solid particles may be used. And, examples of the disperser that can be used include a dissolver, a ball mill, a paint shaker, a sand grinder, a horizontal disperser for medium using dispersing media (commercialized under such names as DYNO-Mill, EIGER MILL, etc.), a kneader, an ultrasonic disperser, and a roll mill.

[0026] Next, the color diffusion-transfer photographic film unit of the present invention is explained below.

[0027] The color diffusion-transfer photographic film unit of the present invention includes in the image-receiving element thereof a titanium oxide-containing layer which is formed by a coating solution containing an aqueous dispersion comprising the titanium oxide of the present invention. The titanium oxide-containing layer may be a single layer or may be in two or more layers. The titanium oxide-containing layer is preferably disposed as a layer in the image-receiving layer and/or as an overlayer of the image-receiving layer (namely, a layer which is farther from the support side than the image-receiving layer is).

[0028] In the photographic film unit of the present invention, the titanium oxide-containing layer and/or image-receiving layer may contain fine titanium oxide and, if necessary, an ultraviolet-light absorbing agent of an organic substance,

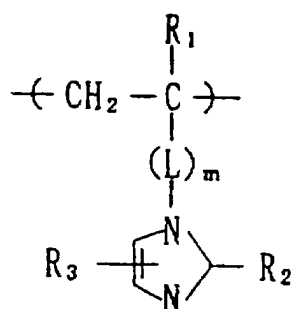
such as a hydroxyarylbenzotriazole compound, a benzoxazole compound, a hydroxyaryltriazine compound, a benzophenone compound, an cinnamic ester compound, or a butadiene compound. For such reason as the slightness of coloring in yellow by high pH upon completion of image formation, a hydroxyarylbenzotriazole compound and a hydroxyaryltriazine compound are particularly preferred.

[0029] Next, the mordant that is used in the photographic film unit of the present invention is explained in detail below.

[0030] The mordant that is used in the photographic film unit of the present invention may be added singly or together with a hydrophilic binder such as gelatin or polyvinyl alcohol into the image-receiving layer of the image-receiving element. The mordant is a polymer designed to immobilize diffusive dyes produced image-wise.

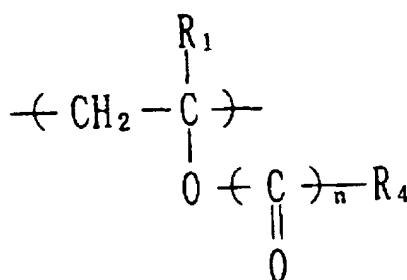
[0031] Preferable as the mordant is a polymer that contains, as a constituent element, a repeating unit represented by the following formula (I) and at least one of the repeating units selected from the group consisting of the formula (II), the formula (III), the formula (IV), and the formula (V).

Formula (I)



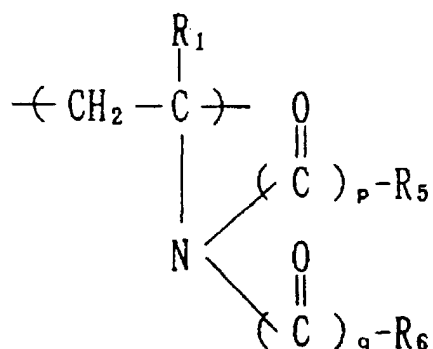
(In the formula (I), R_1 , R_2 , and R_3 each represents a hydrogen atom or an alkyl group having 1 to 6 carbon atoms. L represents a bivalent linking group having 1 to 20 carbon atoms. m is 0 or 1.)

Formula (II)



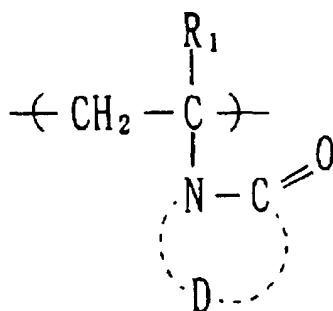
(In the formula (II), R_1 has the same meaning as R_1 in the formula (I). R_4 represents an alkyl group, an alkoxy group, an aryl group, or an aralkyl group. n is 0 or 1.)

Formula (III)



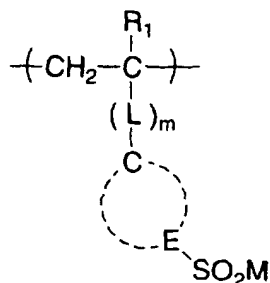
(In the formula (III), R_1 has the same meaning as R_1 in the formula (I). R_5 and R_6 each represents a hydrogen atom, an alkyl group, an alkoxy group, an aryl group, or an aralkyl group. p and q are each 0 or 1.)

Formula (IV)



(In the formula (IV), R_1 has the same meaning as R_1 in the formula (I). D represents a bivalent linking group necessary for forming a 5- to 7-membered ring together with a nitrogen atom and a carbonyl group.)

Formula (V)



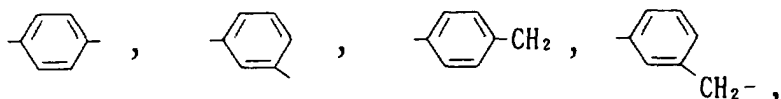
(In the formula (V), R_1 , L , and m have the same meanings, respectively, as those in the formula (I). E represents a bivalent linking group necessary for forming a 5- to 7-membered ring and M represents a hydrogen atom or an alkali metal element.)

[0032] The polymeric mordant for use in the present invention may contain two or more repeating units included in different formulae selected from the formula (II), the formula (III), the formula (IV), and the formula (V). Alternatively,

the polymeric mordant for use in the present invention may contain two or more repeating units included in one formula selected from the formulae listed above.

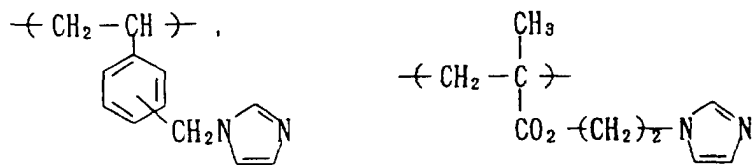
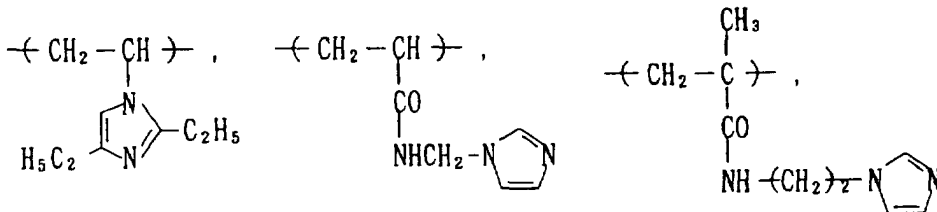
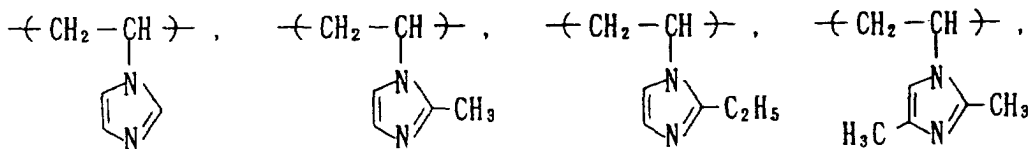
[0033] In the formula (I), R_1 , R_2 , and R_3 each represents a hydrogen atom or a lower alkyl group having 1 to 6 carbon atoms. Examples of the lower alkyl group include methyl, ethyl, n-propyl, n-butyl, n-amyl, and n-hexyl groups. R_1 , R_2 , and R_3 are particularly preferably a hydrogen atom, a methyl group, or an ethyl group, respectively.

[0034] L represents a bivalent linking group having 1 to 20 carbon atoms. Example of the group represented by L include alkylene groups (e.g., methylene, ethylene, trimethylene, and hexamethylene groups), phenylene groups (e.g., o-, p-, or m-phenylene groups), arylenealkylene groups, $-\text{CO}_2-$, $-\text{CO}_2\text{-R}_{23}-$ (where R_{23} represents an alkylene group, a phenylene group, or an arylenealkylene group), $-\text{CONH-R}_{23}-$ (where R_{23} represents the same groups as above), and $-\text{CON}(\text{R}_{21})\text{-R}_{23}$ (where R_{21} represents the same group as R_1 ; and R_{23} represents the same groups as above R_{23}). The following groups are particularly preferable.



$-\text{CO}_2-$, $-\text{CONH-}$, $-\text{CO}_2\text{-CH}_2\text{-CH}_2-$, $-\text{CO}_2\text{-CH}_2\text{-CH}_2\text{-CH}_2-$, $-\text{CONH-CH}_2-$, $-\text{CONH-CH}_2\text{-CH}_2-$, $-\text{CONH-CH}_2\text{-CH}_2\text{-CH}_2-$

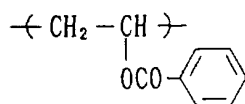
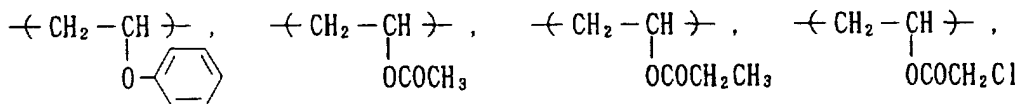
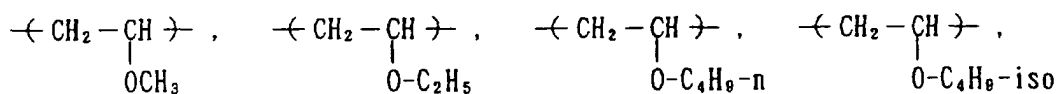
[0035] Preferred specific examples of the repeating unit represented by the formula (I) are shown below.



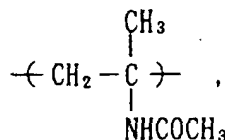
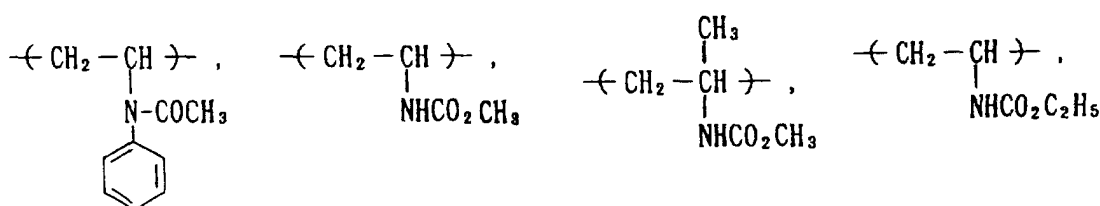
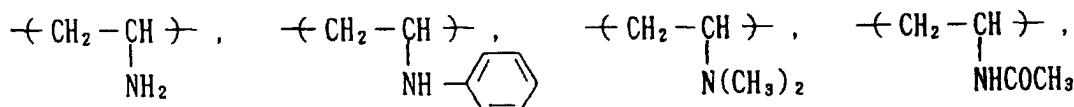
[0036] In the formulae (II) and (III), R_4 , R_5 , and R_6 each represents an alkyl group (preferably an alkyl group having 1 to 6 carbon atoms, for example, an unsubstituted alkyl group (methyl group, ethyl group, n-propyl group, n-butyl group, iso-butyl group, n-amyl group, hexyl group, n-nonyl group, n-decyl group, n-dodecyl group, and the like), and a substituted alkyl group (methoxyethyl group, 3-cyanopropyl group, ethoxycarbonyl group, acetoxyethyl group, hydroxyethyl group, 2-butenyl group, and the like)), an alkoxy group (methoxy group, ethoxy group, and the like), an aryl group (preferably an aryl group having 6 to 30 carbon atoms, for example, phenyl group, tolyl group, naphthyl group, and the like), or an aralkyl group (preferably an aralkyl group having 7 to 30 carbon atoms, for example, an unsubstituted aralkyl group (benzyl group, phenethyl group, diphenylmethyl group, naphthylmethyl group, and the like), and a substituted aralkyl group (4-methylbenzyl group, 4-isopropylbenzyl group, 4-methoxybenzyl group, 4-(4-methoxyphenyl)benzyl group, 3-chlorobenzyl group, and the like)). Among these groups, for example, a methyl group, ethyl

group, n-butyl group, iso-butyl group, phenyl group, or benzyl group are particularly preferable. R₅ and R₆ each represent a hydrogen atom besides the groups listed above and a hydrogen atom is particularly preferred in some cases.

[0037] Preferred specific examples of the repeating unit represented by the formula (II) are shown below.



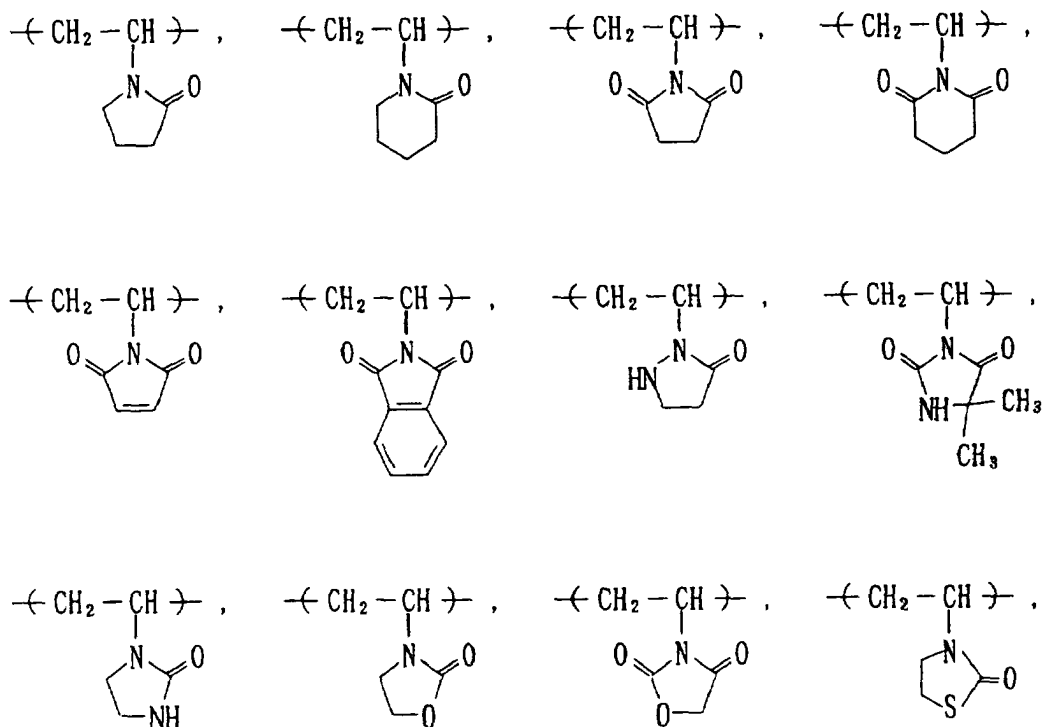
[0038] Examples of the repeating unit represented by the formula (III) include the repeating units having a structure formed by the polymerization of the N-vinyl compounds described in "Gosei Kobunshi III", pages 1 to 51, edited by Murahashi, Imoto, and Tani, Asakura Shoten, 1971. Preferred specific examples of the repeating unit represented by the formula (III) are shown below.



[0039] In the formula (IV), D represents a bivalent linking group necessary for forming a 5- to 7-membered ring together with a nitrogen atom and a carbonyl group. Examples of the repeating unit represented by the formula (IV) include the repeating units having a structure formed by the polymerization of the N-vinyl compounds described in "Gosei Kobunshi III" mentioned above. Examples of the linking group D include a bivalent linking group made up of

carbon atoms (e.g., $-\text{CH}_2\text{CH}_2\text{CH}_2-$, $-\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2-$, $-\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2-$, $-\text{C}(=\text{O})-\text{CH}_2\text{CH}_2-$, $-\text{C}(=\text{O})-\text{CH}_2\text{CH}_2\text{CH}_2-$, and the like), a bivalent linking group made up of carbon and nitrogen atoms (e.g., $-\text{NHCH}_2\text{CH}_2-$, $-\text{C}(=\text{O})-\text{NH}-\text{C}(\text{CH}_3)_2-$, $-\text{C}(=\text{O})-\text{NHCH}_2\text{CH}_2-$, and the like), a bivalent linking group made up of carbon and oxygen atoms (e.g., $-\text{OCH}_2\text{CH}_2-$, $-\text{C}(=\text{O})-\text{OCH}_2\text{CH}_2-$, $-\text{C}(=\text{O})-\text{O}-\text{C}(\text{CH}_3)_2-$, and the like), and a bivalent linking group made up of carbon and sulfur atoms (e.g., $-\text{SCH}_2\text{CH}_2-$, $-\text{C}(=\text{O})-\text{S}-\text{CH}_2\text{CH}_2-$, and the like). Particularly preferred is a bivalent linking group made up of carbon and nitrogen atoms.

[0040] Preferred specific examples of the repeating unit represented by the formula (IV) are shown below.



[0041] In the formula (V), the linking group E necessary for forming a 5- to 7-membered ring is preferably one that forms a benzene ring. M is preferably hydrogen, potassium, or sodium.

[0042] In the polymeric mordant that can be used in the photographic film unit of the present invention, the repeating unit represented by the formula (I) occupies preferably 10 to 98 mole %, more preferably 40 to 90 mole %, of the total repeating units. The repeating unit represented by the formula (II), (III), (IV), or (V) occupies preferably 2 to 60 mole %, more preferably 3 to 50 mole %, of the total repeating units. It is also preferable that the mordant contains a repeating unit other than the repeating unit listed above and the proportion of the other repeating unit is preferably 40 mole % or less of the total repeating units.

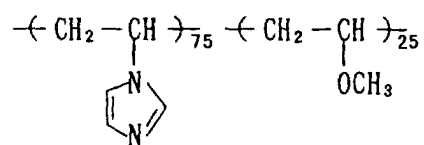
[0043] Among the repeating units represented by the formula (II), (III), or (IV), the repeating units selected from the formula (IV) are particularly preferable.

[0044] Besides, the terminals of these polymers are not particularly limited, and the terminals may be a hydrogen atom, an alkyl group, and the like.

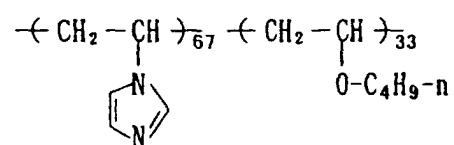
[0045] The molecular weight of the polymeric mordant for use in the photographic film unit of the present invention is preferably 5×10^3 to 1×10^7 . If the molecular weight is too small, the polymer becomes easily mobile, whereas, if the molecular weight is too large, coating of the mordant on an image-receiving material may be hindered. The molecular weight of the polymeric mordant is more preferably 1×10^4 to 2×10^6 .

[0046] Preferred examples of the polymeric mordant for use in the photographic film unit of the present invention are given below. The terminals of these polymers are not particularly limited, and the terminals may be a hydrogen atom, an alkyl group, and the like.

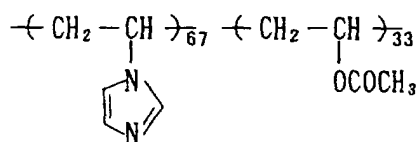
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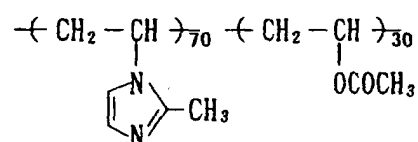
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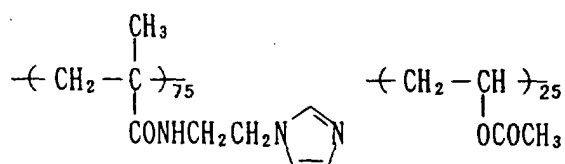
P - 3



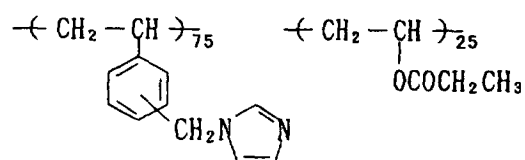
P - 4



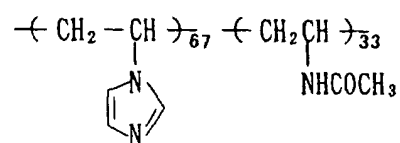
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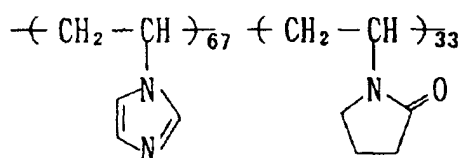
P - 6

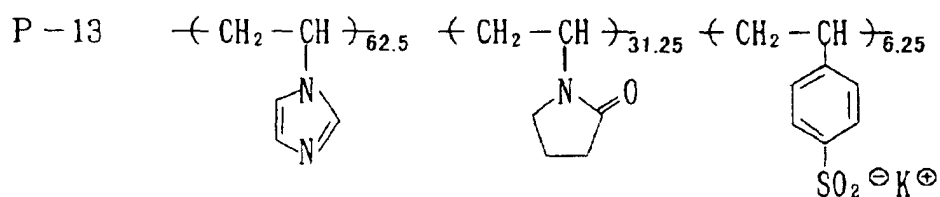
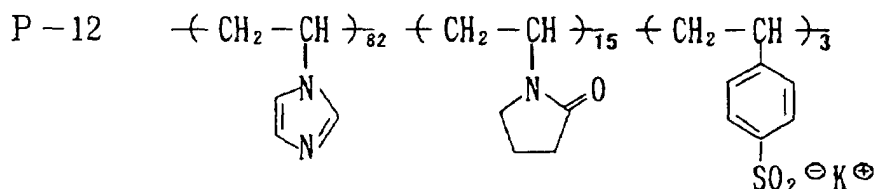
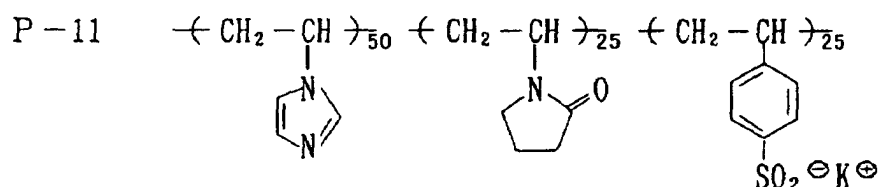
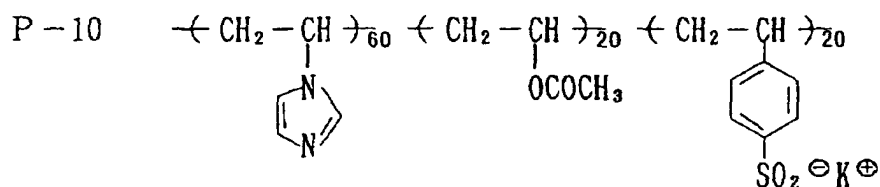
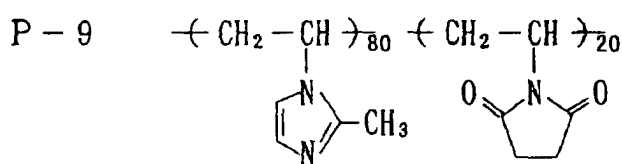


P - 7



P - 8





[0047] The above-mentioned polymeric mordants are described, in JP-B-4-17418 and the like and other compounds can be synthesized according to the method described in this patent literature or the like.

[0048] Surface active agents such as anionic dispersing agents, e.g., alkylphenoxyethoxysulfonates, alkylbenzenesulfonates, alkylphenoxysulfonates, alkylsulfuric ester salts, alkylsulfosuccinates, sodium oleylmethyltauride, naphthalenesulfonic acid/formaldehyde condensation polymerization products, polyacrylic acids, polymethacrylic acids, maleic acid/acrylic acid copolymers, carboxymethyl cellulose, and cellulose sulfates; nonionic dispersing agents, e.g., polyoxyethylene alkyl ethers, sorbitan fatty acid esters, and polyoxyethylenesorbitan fatty acid esters; cationic dispersing agents; and betaine-type dispersing agents can be used as coating aids in the present invention.

[0049] In the photographic film unit of the present invention, the ratio by mass of the coating aid to be used to the

polymeric mordant is preferably 0.01 to 0.5 and more preferably 0.1 to 0.3.

[0050] In the present invention, the method of dispersing the polymeric mordant is not particularly limited and known methods can be employed. For example, the polymeric mordant is used exclusively with gelatin (including a derivative thereof) or is used with a combination of gelatin and other binder in a mordanting layer of the image-receiving material. A hydrophilic binder can be used as this binder. Examples of the hydrophilic binder other than gelatin are typically transparent or translucent hydrophilic colloids which include naturally occurring materials such as polysaccharides, e. g., cellulose derivatives, starch, and gum arabic, and synthetic polymers such as polyvinylpyrrolidone, acrylamide polymers, and water-soluble polyvinyl compounds of polyvinyl alcohol.

[0051] In the present invention, the ratio of the polymeric mordant/binder and the amount to be coated of the polymeric mordant can be easily determined by those skilled in the art based on the amount of the dyes to be mordanted and kind or composition of the polymeric mordant. Preferably, the ratio of the polymeric mordant/binder is 20/80 to 90/10 (by mass). The amount to be coated of the polymeric mordant is preferably 0.2 to 15 g/m² and more preferably 0.5 to 8 g/m².

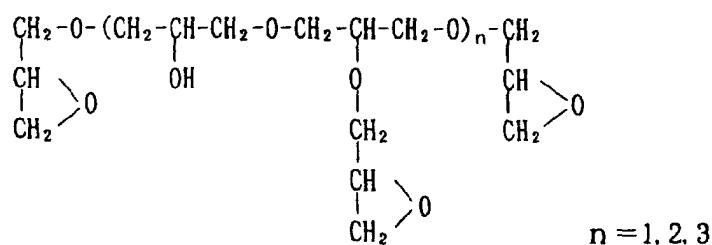
[0052] The layer containing the polymeric mordant can be formed by an ordinary coating method and the drying can also be performed by an ordinary manner (i.e., solidification of the gelatin film at a low temperature followed by gradual removal of water at 30 to 50°C). However, in order to enhance the effect of the present invention, it is preferable to dry the layer immediately after being coated at a high temperature of 80 to 120°C.

[0053] A common hardener (such as aldehyde, vinylsulfone, epoxy, or an active halogen compound) can be used in the layer containing the polymeric mordant. The amount of the hardener to be used in the present invention is preferably 0.01 to 15% by mass, more preferably 0.1 to 5% by mass, to the amount of gelatin in the mordant layer.

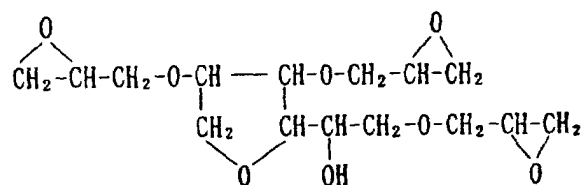
[0054] Next, an epoxy group-containing hardener, a vinylsulfone-containing hardener, an aldehyde-containing hardener that can be used in the photographic film unit of the present invention are explained below. The purpose of using these compounds is to cause a crosslink between the polymeric mordants themselves, between the polymeric mordant and a binder such as gelatin, and/or between the binders themselves such as gelatin so that the water resistance and film physical properties of the layer containing the polymeric mordant become satisfactory.

[0055] Preferred examples of the epoxy-based hardener that can be used in photographic film unit of the present invention are shown below.

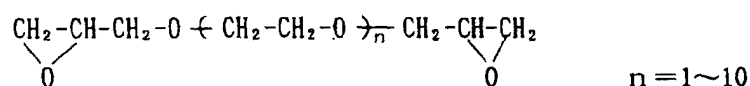
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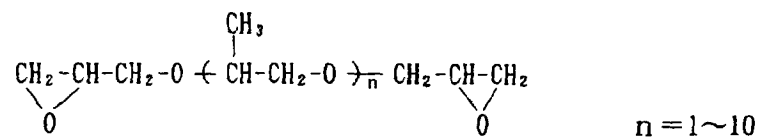
VIII-2



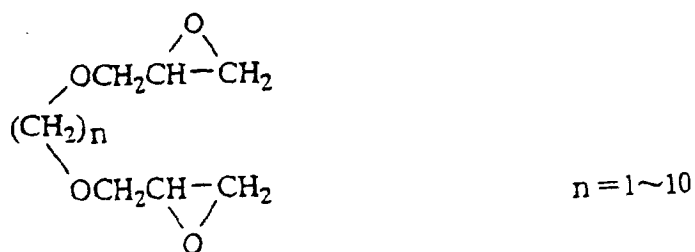
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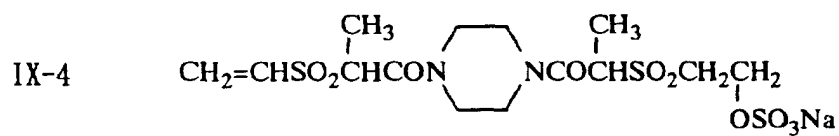
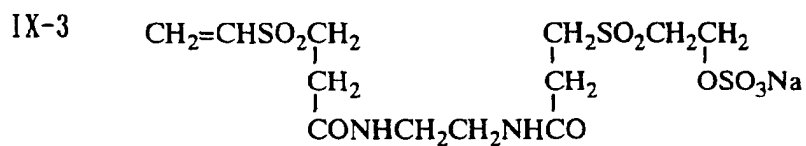
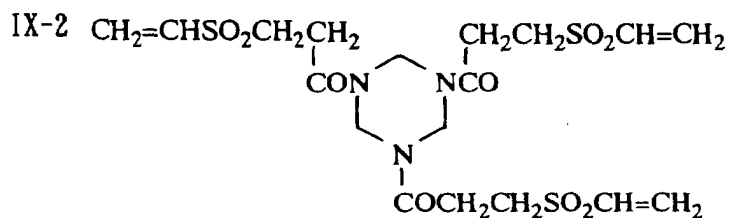
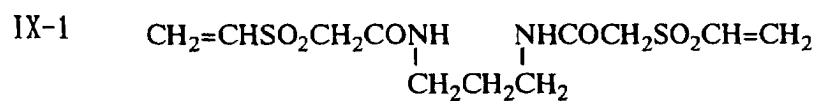
VIII-4

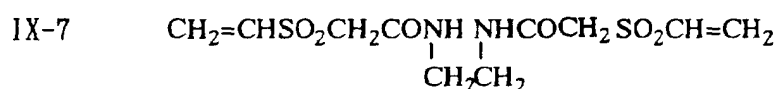
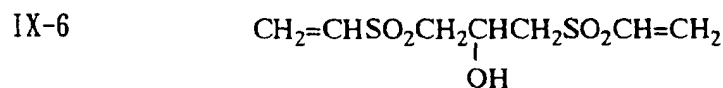
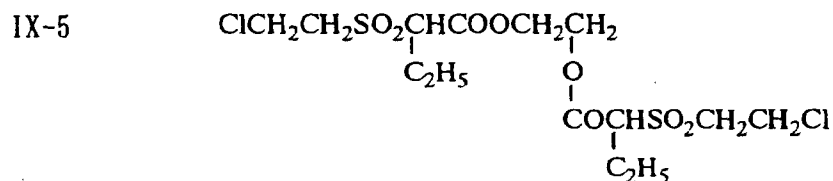


VIII-5



[0056] Specific examples of the vinylsulfone-based hardener include the following substances.





[0057] The amount (or the total amount of the hardeners if two or more hardeners are used together) of the hardener to be used in the photographic film unit of the present invention is preferably 0.01 to 30% by mass, more preferably 0.1 to 15% by mass, to the amount of gelatin in the mordant layer.

[0058] In the present invention, it is preferable to use hydrophobic particles in the image-receiving element, because the use of the hydrophobic particles improves the adhesive properties of the surface of the photographic material. Particularly useful as the hydrophobic particles are matt agents which roughen the surface. Examples of the matt agent include particles of polymethyl methacrylate, particles of a methyl methacrylate/methacrylic acid copolymer, particles of silica, particles of strontium barium sulfate, and a non-light-sensitive silver halide grain. Although a fluorine-containing surfactant, a silicone compound, a liquid paraffin, or the like can be a surface modifier that chemically changes the surface properties, a matt agent, which physically modifies the surface properties, provides more desirable effects in the present invention. The larger the particle diameters of a matt agent is, the more preferable it is. In particular, a matt agent having particle diameters larger than the thickness of the image-receiving layer to which the matt agent is to be added is preferable. Preferable amounts of the matt agent to be added vary depending on, for example, the material, particle diameter of the matt agent to be used. If the amount of the matt agent to be added is too large, haze and feel of touch become inferior and undesirable effects such as rough surface feel are brought about although the adhesive properties mentioned above is improved. For these reasons, a preferable amount of the matt agent to be used is in the range of 0.003 to 0.10 g/m².

[0059] In the present invention, the hydrophobic particles may also be added to the titanium oxide-containing layer formed by using the coating solution containing the aqueous dispersions of the present invention and to the peel layer besides the image-receiving layer. In the photographic film unit of the present invention, the thickness of the image-receiving layer is preferably 2 to 15 μm and more preferably 4 to 8 μm.

[0060] The constituent elements included in the photographic film unit of the present invention are explained in order below.

I. Light-sensitive element

A) Support

[0061] As the support of the light-sensitive element for use in the present invention, any one of smooth supports, which are usually used for photographic light-sensitive materials, may be used. For example, paper, cellulose acetate, polystyrene, polyethylene terephthalate, polycarbonate, and the like is used. The support is preferably provided with an undercoat layer. The support preferably contains a minute amount of a dye or pigment such as titanium oxide in general, to prevent light-piping.

[0062] The thickness of the support is generally 50 to 350 μm, preferably 60 to 210 μm, and more preferably 70 to 150 μm.

[0063] A curl-balancing layer, or an oxygen-shielding layer as described in JP-A-56-78833 may be applied to the

backside of the support according to the need.

B) Light-shielding layer

[0064] A light-shielding layer containing a light-shielding agent and a hydrophilic binder is disposed between the support and the light-sensitive layer.

[0065] As the light-shielding agent, any material having a light-shielding function can be used, however, carbon black is preferably used. Decomposable dyes described in U.S. Patent No. 4,615,966 may also be used.

[0066] As the binder used to coat the light-shielding agent, any binder may be used as far as it can disperse carbon black, and, a gelatin is preferable.

[0067] As raw materials of carbon black, those produced by an arbitrary method, such as a channel method, thermal method, and furnace method, as described in, for example, Donnel Voet "Carbon Black" Marcel Dekker, Inc (1976), may be used. Although no particular limitation is imposed on the size of a carbon black particle, those having a particle size of 30 to 180 μm are preferable. The amount of a black pigment to be added as the light-shielding agent may be controlled corresponding to the sensitivity of the light-sensitive material to be shielded, however, the amount is preferably 5 to 10 in terms of optical density.

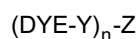
C) Light-sensitive layer

[0068] In the present invention, a light-sensitive layer comprising of a silver halide emulsion layer combined with a dye-image-forming substance is disposed above the aforementioned light-shielding layer. Its structural elements will be hereinafter explained.

(1) Dye-image-forming substance

[0069] The dye image-forming substance used in the present invention is a nondiffusion compound that releases a diffusive dye (this may be a dye precursor), or a compound that is changed in its diffusibility, in association with silver development, and it is described in "The Theory of the Photographic Process", Macmillan, the Fourth edition. These compounds each may be represented by the following formula (X):

formula (X)



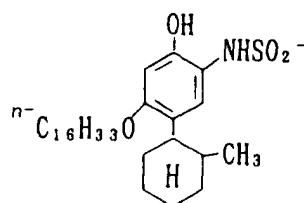
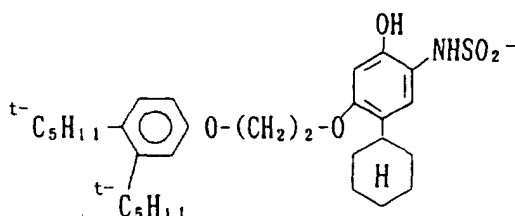
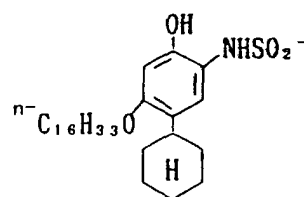
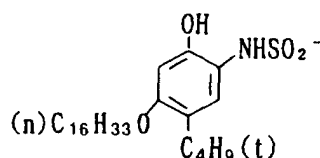
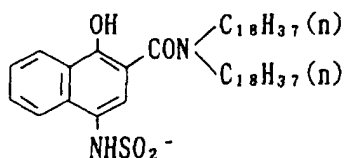
wherein DYE represents a dye group, a dye group that is temporarily short-waved, or a dye-precursor group, Y represents a simple bond or a linking group, Z represents a group having a property to produce a difference in diffusibility between the compounds represented by $(\text{DYE-Y})_n\text{-Z}$, or to release a DYE to produce a difference in diffusibility between the released DYE and the $(\text{DYE-Y})_n\text{-Z}$, corresponding to or inversely corresponding to a light-sensitive silver salt having a latent image image-wise; and, n is 1 or 2, in which two (DYE-Y) groups may be the same or different when n is 2.

[0070] Depending on the function of the Z group, these compounds are roughly classified into negative type compounds that are changed to a diffusible one in a silver developed section, and positive type compounds that are changed to a diffusible one in an undeveloped section.

[0071] Given as specific examples of the negative type Z include those oxidized and cleft to release a diffusible dye as a result of development.

[0072] Specific examples of Z are described, for example, in U.S. Patents No. 3,928,312, No. 3,993,638, No. 4,076,529, No. 4,152,153, No. 4,055,428, No. 4,053,312, No. 4,198,235, No. 4,179,291, No. 4,149,892, No. 3,844,785, No. 3,443,943, No. 3,751,406, No. 3,443,939, No. 3,443,940, No. 3,628,952, No. 3,980,479, No. 4,183,753, No. 4,142,891, No. 4,278,750, No. 4,139,379, No. 4,218,368, No. 3,421,964, No. 4,199,355, No. 4,199,354, No. 4,135,929, No. 4,336,322 and No. 4,139,389, JP-A-53-50736, JP-A-51-104343, JP-A-54-130122, JP-A-53-110827, JP-A-56-12642, JP-A-56-16131, JP-A-57-4043, JP-A-57-650, JP-A-57-20735, JP-A-53-69033, JP-A-54-130927, JP-A-56-164342 and JP-A-57-119345.

[0073] Examples of the particularly preferable group among Z of the negative type dye-releasable redox compounds include N-substituted sulfamoyl groups (the N-substituents include groups derived from aromatic hydrocarbon rings and heterocycles). Examples of typical groups of Z are shown below, but not limited to the following groups.



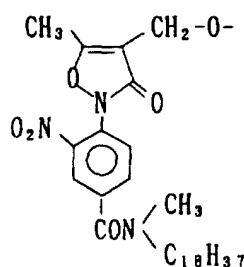
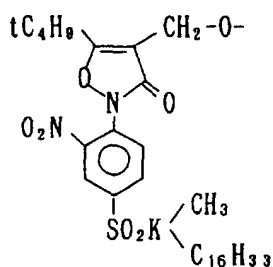
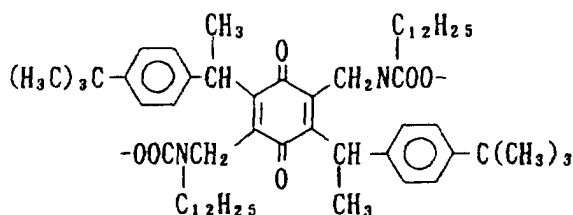
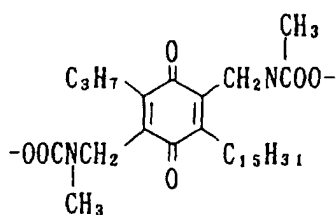
[0074] The positive type compounds are described in "Angew. Chem. Int. Ed. Engl., 22, 191 (1982)".

[0075] As specific examples of the positive type compounds, compounds (dye developing agents) that are diffusible at the start in an alkaline condition and are oxidized by development to become non-diffusible, are given. Typical examples of Z useful for compounds of this type are given in U.S. Patent No. 2,983,606.

[0076] Another type is those that release a diffusible dye by, for example, self-ring-closing in an alkaline condition, but that substantially stop the release of the dye when being oxidized along with development. Specific examples of Z having such a function are described, for example, in U.S. Patent No. 3,980,479, JP-A-53-69033, JP-A-54-130927 and U.S. Patents No. 3,421,964 and No. 4,199,355.

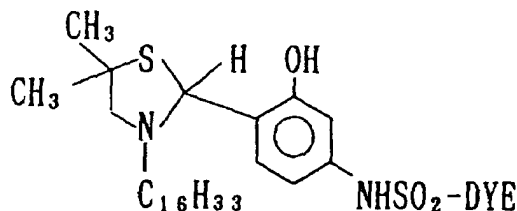
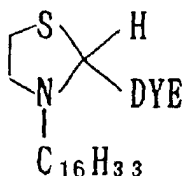
[0077] A further type includes those that themselves do not release any dye but release a dye when being reduced. Compounds of this type are used in combination with an electron-donor, thereby they can release a diffusible dye image-wise by the reaction with the remainder electron-donor oxidized image-wise by silver development. Examples of atomic groups having such a function are described, for example, in U.S. Patents No. 4,183,753, No. 4,142,891, No. 4,278,750, No. 4,139,379 and No. 4,218,368, JP-A-53-110827, U.S. Patents No. 4,278,750, No. 4,356,249 and No. 4,358,525, JP-A-53-110827, JP-A-54-130927, JP-A-56-164342, Published Technical report ("Kokai-Giho") 87-6199, and EP-A-220,746(A2).

[0078] Specific examples of the above are shown below, but not limited to the following groups.



[0079] When a compound of this type is used, preferably it is used in combination with an anti-diffusible electron-donating compound (well-known as an ED compound) or a precursor thereof. Examples of the ED compound are described, for example, in U.S. Patents No. 4,263,393 and No. 4,278,750 and JP-A-56-138736.

[0080] As specific examples of further another type of dye-image-forming substance, the following compounds may also be used.



(In the formula, DYE represents the same meaning dyes or precursors thereof as the above-mentioned dyes or precursors thereof.)

[0081] The details of this dye-image-forming substance are described in U.S. Patents No. 3,719,489 and No. 4,098,783.

[0082] On the other hand, specific examples of the dye represented by the formula, "DYE", are described in the following literatures.

Examples of yellow dyes:

[0083] Those described in U.S. Patents No. 3,597,200, No. 3,309,199, No. 4,013,633, No. 4,245,028, No. 4,156,609, No. 4,139,383, No. 4,195,992, No. 4,148,641, No. 4,148,643, No. 4,336,322; JP-A-51-114930, JP-A-56-71072; Research Disclosures No. 17630 (1978), No. 16475 (1977).

Examples of magenta dyes:

[0084] Those described in U.S. Patents No. 3,453,107, No. 3,544,545, No. 3,932,380, No. 3,931,144, No. 3,932,308, No. 3,954,476, No. 4,233,237, No. 4,255,509, No. 4,250,246, No. 4,142,891, No. 4,207,104, No. 4,287,292; JP-A-52-106727, JP-A-53-23628, JP-A-55-36804, JP-A-56-73057, JP-A-56-71060, JP-A-55-134.

Examples of cyan dyes:

[0085] Those described in U.S. Patents No. 3,482,972, No. 3,929,760, No. 4,013,635, No. 4,268,625, No. 4,171,220, No. 4,242,435, No. 4,142,891, No. 4,195,994, No. 4,147,544, No. 4,148,642; U.K. Patent No. 1,551,138; JP-A-54-99431, JP-A-52-8827, JP-A-53-47823, JP-A-53-143323, JP-A-54-99431, JP-A-56-71061; European Patents (EP) No. 53,037, No. 53,040; Research Disclosures No. 17,630 (1978), No. 16,475 (1977).

[0086] These compounds can be dispersed using the method described in JP-A-62-215,272, pp.144-146. In these dispersions, the compound described in JP-A-62-215,272, pp.137-144 may be contained.

(2) Silver halide emulsion

[0087] The silver halide emulsion used in the present invention may be either a negative type emulsion, which forms a latent image mainly on the surface of a silver halide grain, or an internal latent image type direct positive emulsion, which forms a latent image inside of a silver halide grain.

[0088] Examples of the internal latent image type direct positive emulsion include a so-called "conversion type" emulsion, which is produced by making use of a difference in the solubility between silver halides, and a "core/shell type" emulsion produced by coating at least the light-sensitive site of an internal core particle of a silver halide with an external shell of a silver halide, wherein the internal core particle is doped with a metal ion, chemically sensitized or provided with the both treatments, and other emulsions. These emulsions are described in U.S. Patents No. 2,592,250 and No. 3,206,313, U.K. Patent No. 1,027,146, U.S. Patents No. 3,761,276, No. 3,935,014, No. 3,447,927, No. 2,297,875, No. 2,563,785, No. 3,551,662, No. 4,395,478, West Germany Patent No. 2,728,108, U.S. Patent No. 4,431,730, and the like.

[0089] When an internal latent image-type direct positive emulsion is used, it is necessary to provide surface fog nuclei by use of light or a nucleating agent after image-wise exposure.

[0090] Examples of the nucleating agent to be used for the above-mentioned purpose include hydrazines described in U. S. Patent Nos. 2,563,785 and 2,588,982; hydrazines and hydrazones described in U. S. Patent No. 3,227,552; heterocyclic quaternary salt compounds described in U. K. Patent No. 1,283,835, JP-A-52-69613, U. S. Patent Nos. 3,615,615, 3,719,494, 3,734,738, 4,094,683, 4,115,122, and others; sensitizing dyes having a substituent capable of nucleation in the dye molecule described in U.S. Patent No. 3,718,470; thiourea linkage-type acylhydrazine-based compounds described in U.S. Patent Nos. 4,030,925, 4,031,127, 4,245,037, 4,255,511, 4,266,013, and 4,276,364, U. K. Patent No. 2,012,443, and others; and acylhydrazine-based compounds combined together by using a thioamide ring or a heterocyclic group, such as triazole or tetrazole, as an adsorbing group, which described in U.S. Patent Nos. 4,080,270, 4,278,748, U.K. Patent No. 2,011,391B, and the like.

[0091] In the present invention, a spectral sensitizing dye may be used in combination with these negative type and internal latent image type direct positive emulsion. Specific examples of the spectral sensitizing dye are described in JP-A-59-180550, JP-A-60-140335, Research Disclosure (RD) No. 17029, U.S. Patent No. 1,846,300, U.S. Patent No. 2,078,233, U.S. Patent No. 2,089,129, U.S. Patent No. 2,165,338, U.S. Patent No. 2,231,658, U.S. Patent No. 2,917,516, U.S. Patent No. 3,352,857, U.S. Patent No. 3,411,916, U.S. Patent No. 2,295,276, U.S. Patent No. 2,481,698, U.S. Patent No. 2,688,545, U.S. Patent No. 2,921,067, U.S. Patent No. 3,282,933, U.S. Patent No. 3,397,060, U.S. Patent No. 3,660,103, U.S. Patent No. 3,335,010, U.S. Patent No. 3,352,680, U.S. Patent No. 3,384,486, U.S. Patent No. 3,623,881, U.S. Patent No. 3,718,470, U.S. Patent No. 4,025,349, and the like.

(3) Structure of the light-sensitive layer

[0092] To reproduce a natural color by a subtractive color process, a light-sensitive layer that comprises at least two combinations of the emulsion, which is spectrally sensitized by the above spectral sensitizing dye, and the aforementioned dye-image-forming substance, which donates a dye having selective spectral absorption in the same wavelength range as the emulsion, is used. The emulsion and the dye-image-forming substance may be coated such that they are overlapped as separate layers, or may be coated as one layer by mixing them. When the dye image-forming substance has absorption in the spectral sensitive range of the emulsion combined therewith, in the condition that the dye-image-forming substance is applied, the separate layer system is preferable. Also, the emulsion layer may consist of a plurality of emulsion layers having different sensitivities, and further an optional layer may be formed between the emulsion layer and the dye-image-forming substance layer. For example, a layer containing a nucleating development accelerator as described in JP-A-60-173541, or a bulkhead layer as described in JP-B-60-15267, is formed to raise the density of a color image, and also a reflecting layer may be formed to improve the sensitivity of the light-sensitive element.

[0093] The reflecting layer is preferably a layer containing a white pigment and a hydrophilic binder. The white pigment is preferably titanium oxide and the hydrophilic binder is preferably a gelatin. The amount of titanium oxide to be applied is generally 0.1 g/m² to 8 g/m², and preferably 0.2 g/m² to 4 g/m². Examples of the reflecting layer are described in JP-A-60-91354.

[0094] In a preferable multilayer structure, a combination unit of a blue-sensitive emulsion, a combination unit of a green-sensitive emulsion, and a combination unit of a red-sensitive emulsion are arranged in order, from the exposure side.

[0095] Arbitrary layers may be provided as required between each emulsion layer unit. Particularly, intermediate layers are preferably formed to prevent an undesirable influence of the effect due to the development of a certain emulsion layer, on other emulsion layer unit.

[0096] When a developing agent is used in combination with a nondiffusive dye-image-forming substance, the intermediate layer preferably contains a nondiffusive reducing agent so as to prevent the diffusion of the oxidized form of the developing agent. Specific examples of the nondiffusive reducing agent include nondiffusive hydroquinone, sulfonamidephenol, sulfonamidenaphthol, and the like. More specific examples are described in JP-A-50-21249, JP-A-50-23813, JP-A-49-106329, and JP-A-49-129535, U.S. Patent Nos. 2,336,327, 2,360,290, 2,403,721, 2,544,640, 2,732,300, 2,782,659, 2,937,086, 3,637,393, and 3,700,453, U. K. Patent No. 557,750, JP-A-57-24941 and JP-A-58-21249; and others. The methods of dispersing these substances are described in JP-A-60-238831 and JP-B-60-18978.

[0097] When a compound that releases a diffusive dye by a silver ion as described in JP-B-55-7576 is used, it is preferable that the intermediate layer contains a compound which supplements the silver ion.

[0098] As necessary, an irradiation-preventing layer, a layer containing a UV absorbing agent, a protective layer, and the like are also formed in the present invention.

II. Image-receiving element

A) Support

[0099] In the present invention, a support for the image-receiving element needs to be able to withstand the processing temperature. Generally, examples of the support include paper and a synthetic polymer (film). Specific examples of the support include polyethylene terephthalate, polycarbonate, polyvinyl chloride, polystyrene, polypropylene, polyimide, and cellulose (e.g., triacetylcellulose) as well as films thereof containing a pigment such as titanium oxide. Additional examples of the support include film-process synthetic paper made from polypropylene or the like, mixed paper made from a pulp of a synthetic resin such as polyethylene and a natural pulp, Yankee paper, baryta paper, coated paper (cast-coated paper in particular), metals, clothes, glasses, and the like. The materials listed above may be used singly or the support may be composed of any of these materials whose one side or both sides are coated or laminated with a synthetic polymer such as polyethylene. Further, polyethylene containing carbon black kneaded therein may be inserted between sheets of paper to thereby provide a light-shielding effect. Besides, the supports described in JP-A-62-253159, pages 29 to 31, may also be used. The surface of these supports may be coated with an antistatic agent comprising a hydrophilic binder and a semiconducting metal oxide, such as alumina sol or tin oxide, carbon black, or the like.

B) Peel layer

[0100] In the present invention, a peel layer, which is to be peeled off in any position of the image-receiving element inside the unit after processing, is provided. Therefore, the peel layer needs to be easily peeled off after the processing.

[0101] As the raw materials of the peeling layer, those described in, for instance, JP-A-47-8237, JP-A-59-220727, JP-A-59-229555, JP-A-49-4653, U.S. Patents No. 3,220,835 and No. 4,359,518, JP-A-49-4334, JP-A-56-65133, JP-A-45-24075 and U.S. Patents No. 3,227,550, No. 2,759,825, No. 4,401,746 and No. 4,366,227, and the like may be used. As one specific example of the raw material, water-soluble (or alkali-soluble) cellulose derivatives may be given. Examples of the cellulose derivative include hydroxyethyl cellulose, cellulose acetate phthalate, plasticized methyl cellulose, ethyl cellulose, cellulose nitrate, and carboxymethyl cellulose. Other examples include a variety of natural polymers, for example, alginic acid, pectin, gum arabic, and the like. Also, various modified gelatins, for example, an acetylated gelatin, a phthalated gelatin, and the like may be used. Further, as other examples, water-soluble synthetic polymers can be mentioned. Examples are polyvinyl alcohols, polyacrylates, polymethylmethacrylates, polybutylmethacrylates, or copolymers of these compounds, and the like.

[0102] The peeling layer may be a single layer or one made of a plurality of layers as described in JP-A-59-220727, JP-A-60-60642, or the like.

[0103] It is desirable that the color diffusion-transfer light-sensitive material in the present invention is provided with a material having a neutralizing function between the support and the light-sensitive layer, or between the support and the image-receiving layer, or on the image-receiving element.

C) Layer having a neutralizing function

[0104] The layer having a neutralizing function for use in the present invention is a layer containing an acidic substance in an amount enough to neutralize an alkali delivered from processing compositions, and may be one having a multilayer structure comprising a neutralizing rate-controlling layer (timing layer), an adhesion-reinforced layer, and the like, according to the need. A preferable acidic substance is a substance that contains an acidic group having a pKa of 9 or less (or a precursor group providing such acidic group by hydrolysis). More preferable acidic substance may include higher fatty acids, such as oleic acid as described in U.S. Patent No. 2,983,606; and polymers of acrylic acids, methacrylic acids, or maleic acid, and its partial esters or acid anhydrides as disclosed in U.S. Patent No. 3,362,819; copolymers of an acrylic acid and an acrylate as disclosed in French Patent No. 2,290,699; and latex type acidic polymers as disclosed in U.S. Patent No. 4,139,383 or Research Disclosure No. 16102 (1977).

[0105] Besides the above compounds, acidic substances as disclosed in U.S. Patent No. 4,088,493, JP-A-52-153739, JP-A-53-1023, JP-A-53-4540, JP-A-53-4541, JP-A-53-4542, and the like may be given as examples.

[0106] Specific examples of the acidic polymer include a copolymer of a vinyl monomer, such as, ethylene, vinyl acetate and vinyl methyl ether, with malic acid anhydride and its n-butylester, copolymer of butylacrylate and acrylic acid, cellulose, acetate hydrogen phthalate, and the like.

[0107] The aforementioned polymer acid may be used by mixing with a hydrophilic polymer. Examples of such a polymer include a polyacrylamide, polymethylpyrrolidone, polyvinyl alcohol (including partially saponified products), carboxymethyl cellulose, hydroxymethyl cellulose, hydroxyethyl cellulose, polymethyl vinyl ether, and the like. Among these compounds, polyvinyl alcohol is preferable.

[0108] Also, a polymer other than hydrophilic polymers such as cellulose acetate may be mixed with the above polymer acid.

[0109] The amount of the polymer acid to be applied is controlled corresponding to the amount of an alkali developed between the light-sensitive element and the image-receiving element. The equivalent ratio of the polymer acid to the alkali per unit area is preferably 0.9 to 2.0. When the amount of the polymer acid is excessively small, the hue of a transferred dye is changed, and stains are produced on a white background portion; whereas when the amount is excessive, this brings about disadvantages such as a change in the hue and reduced light resistance. A more preferable equivalent ratio is 1.0 to 1.3. The quality of photographs is also lowered if the amount of the hydrophilic polymer is excessively large or small. The mass ratio of the hydrophilic polymer to the polymer acid is generally 0.1 to 10, and preferably 0.3 to 3.0.

[0110] Additives may be incorporated in the layer having a neutralizing function in the present invention, for various purposes. For example, a hardener well-known to a person skilled in the art may be added for the purpose of promoting film hardening of this layer, and a polyvalent hydroxyl compound such as a polyethylene glycol, polypropylene glycol, or glycerol may be added for the purpose of improving the brittleness of the film. In addition, an antioxidant, fluorescent whitening agent, development inhibitor or its precursor, and the like may be added.

[0111] As the timing layer to be combined with the neutralizing layer, a polymer that reduces alkali-permeability, such as a gelatin, polyvinyl alcohol, partially acetalized polyvinyl alcohol, cellulose acetate, or partially hydrolyzed polyvinyl acetate; latex polymer, which is produced by the copolymerization with a small amount of a hydrophilic comonomer such as an acrylic acid monomer, and which raises an active energy for the permeation of an alkali; and polymer having a lactone ring are useful.

[0112] Among these polymers, cellulose acetates used for a timing layer as disclosed in JP-A-54-136328, and U.S. Patents No. 4,267,262, No. 4,009,030, No. 4,029,849, and the like; latex polymers, which are produced by the copolymerization of a small amount of a hydrophilic comonomer such as an acrylic acid, as disclosed in JP-A-54-128335, JP-A-56-69629, JP-A-57-6843 and U.S. Patents No. 4,056,394, No. 4,061,496, No. 4,199,362, No. 4,250,243, No. 4,256,827, No. 4,268,604, and the like; polymers having a lactone ring as disclosed in U.S. patent No. 4,229,516; and besides, polymers as disclosed in JP-A-56-25735, JP-A-56-97346, JP-A-57-6842, European Patent (EP) No. 31,957A1, EP No. 37,724A1 and EP No. 48,412A1, and the like are particularly useful.

[0113] In addition to the above, those described in the following references may also be used.

[0114] U.S. Patent No. 3,421,893, U.S. Patent No. 3,455,686, U.S. Patent No. 3,575,701, U.S. Patent No. 3,778,265, U.S. Patent No. 3,785,815, U.S. Patent No. 3,847,615, U.S. Patent No. 4,088,493, U.S. Patent No. 4,123,275, U.S. Patent No. 4,148,653, U.S. Patent No. 4,201,587, U.S. Patent No. 4,288,523, U.S. Patent No. 4,297,431, West Germany Patent Application (OLS) No. 1,622,936, Ibid. 2,162,277, Research Disclosure 15162, No. 151 (1976).

[0115] As the timing layer using these raw materials, a single layer or combinations of two or more layers may be used.

[0116] To the timing layer made of each of these raw materials, a development inhibitor and/or its precursor as disclosed in, for example, U.S. Patent No. 4,009,029, West Germany Patent Application (OLS) No. 2,913,164, OLS No. 3,014,672, JP-A-54-155837, JP-A-55-138745 and the like, and further, a hydroquinone precursor as disclosed in U.S. Patent No. 4,201,578, and other useful photographic additives or their precursors may be incorporated.

[0117] Moreover, as the layer having a neutralizing function, to provide an auxiliary neutralizing layer as described in JP-A-63-168648 and JP-A-63-168649 has an effect in view of reducing a change of transferred density due to aging after processing.

D) Image-receiving layer

[0118] A layer containing the aforementioned polymeric mordant is effectively used.

E) Others

[0119] Other than the layer having a neutralizing function, a backing layer, an intermediate layer, and the like, may be provided as layers having auxiliary functions.

[0120] The back layer is provided to control curling, and to impart lubricity or a function of light shielding.

III. Alkali processing composition

[0121] The processing composition for use in the present invention is designed for being developed uniformly between the light-sensitive element and the image-receiving element after exposure of the light-sensitive element so that the development of the light-sensitive layer is performed. For this, the composition contains an alkali, a viscosity-enhancing agent, a developing agent, further a development accelerator and development inhibitor for controlling development, an antioxidant for preventing the deterioration of a developing agent, and the like.

[0122] The alkali is those sufficient to make the pH in a range from 12 to 14. Examples of the alkali include hydroxides of alkali metals (e.g., sodium hydroxide, potassium hydroxide, and lithium hydroxide), phosphates of alkali metals (e.g., potassium phosphate), guanidines and hydroxides of quaternary amines (e.g., tetramethylammonium hydroxide). Among these compounds, potassium hydroxide and sodium hydroxide are preferable.

[0123] The viscosity-enhancing agent is required to develop the processing solution uniformly, and to maintain the adhesion between the light-sensitive layer and the cover sheet. For example, as the viscosity-enhancing agent, an alkali metal salt of polyvinyl alcohol, hydroxyethyl cellulose or carboxymethyl cellulose, is used and preferably hydroxyethyl cellulose or sodium carboxymethyl cellulose is used.

[0124] As a preferable developing agent, any one of those which cross-oxidize dye-image-forming substances and produce substantially no stains even if it is oxidized, may be used. These developing agents may be used either singly or in combinations of two or more, and they can be used in the form of precursors. These developing agents may be contained in a proper layer of the light-sensitive element, or in an alkaline processing solution. As specific examples, aminophenols and pyrazolidinones can be given. Among these compounds, pyrazolidinones are preferable because of decreased occurrence of stains.

[0125] Given as examples of these pyrazolidinones are 1-phenyl-3-pyrazolidinone, 1-p-tolyl-4,4-dihydroxymethyl-3-pyrazolidinone, 1-(3'-methyl-phenyl)-4-methyl-4-hydroxymethyl-3-pyrazolidinone, 1-phenyl-4-methyl-4-hydroxymethyl-3-pyrazolidinone, 1-p-tolyl-4-methyl-4-hydroxymethyl-3-pyrazolidinone, and the like.

[0126] Also, the alkali solution composition is preferably transferred on the light-sensitive material, in a developed thickness (the amount of the processing solution per m², after the processing solution is transferred) of 20 to 200 μm.

[0127] Further, processing temperature in the case of processing the light-sensitive material in this invention is preferably 0 to 50 °C, and more preferably 0 to 40 °C.

[0128] Any one of the light-sensitive element, the image-receiving element, and the alkali processing composition may contain a development accelerator described on pp. 72-91, a hardener described on pp. 146-155, a surface active agent described on pp. 201-210, a fluorine-containing compound described on pp. 210-222, a viscosity-enhancing agent on pp. 225-227, an antistatic agent described on pp. 227-230, a polymer latex described on pp. 230-239, a matt agent described on page 240, and the like, in JP-A-62-215272.

[0129] The aqueous dispersion containing titanium oxide of the present invention does not increase its viscosity because it contains fine titanium oxide at a high dispersion stability and gelation on standing is prevented. Therefore, it can be suitably used for the manufacture of a color diffusion-transfer photographic film unit or the like and can contribute to stable manufacture process thereof.

[0130] The color diffusion-transfer photographic film units of the present invention using the above-mentioned aqueous dispersion can be manufactured in an industrially stable process. In addition, they present excellent effects that light fading is inhibited, dependence of image density on time for peeling is lessened, haze on an image is reduced, stain on an image is reduced, the surface gloss is good, and light-fastness is good, and/or film physical properties is good.

[0131] The present invention will be explained in more detail by way of the following examples, which are not intended to be limiting of the present invention. In this connection, "part" means part by mass, unless otherwise specified.

EXAMPLES

Example 1

[0132] A mixture, which comprised 35 parts of titanium oxide having an average primary particle diameter of 10 nm, 5.2 parts of sodium polyacrylate as a dispersant (trade name: POIZ-530, manufactured by Kao Corporation), 10.5 parts of glycerin as a coagulation-preventing agent, and 49.3 parts of water, was dispersed for 20 minutes at 3000 revolutions/minute by means of a dissolver (manufactured by Tokushu Kika Kogyo Co., Ltd.). After that, the mixture was passed through a horizontal sand grinder 4 times at 3000 revolutions/minute. In this way, a dispersion A was obtained.

[0133] A dispersion B was prepared in the same manner as in the preparation of the dispersion A, except that the dispersant was changed to sodium hexametaphosphate. A dispersion C was prepared in the same manner as in the preparation of the dispersion A, except that ethylene glycol was used in place of glycerin. Further, a dispersion D (for comparison) was prepared in the same manner as in the preparation of the dispersion A, except that glycerin as a coagulation-preventing agent was omitted. Further, a dispersion E (for comparison) was prepared in the same manner as in the preparation of the dispersion A, except that sodium polyacrylate was omitted. Still further, a dispersion F (for comparison) was prepared in the same manner as in the preparation of the dispersion B, except that glycerin was omitted. These dispersions were stored for one month at room temperature. Viscosity increase was not observed at all in the dispersions A, B, and C of the present invention, whereas the viscosity of the dispersion D increased conspicuously from 10 mPaS to 300 mPaS. As for the dispersion E for comparison, the viscosity rose during dispersing operation and the dispersing operation was impossible. As for the dispersion F for comparison, the dispersibility was

poor and rise in the viscosity was observed.

Example 2

[0134] The following layer structure was coated on a support of 100- μm -thick transparent polyethylene terephthalate film, to produce a light-sensitive element (101).

Back layer side:

(a) A light-shielding layer containing 6.0 g/m² of carbon black and 2.0 g/m² of a gelatin.

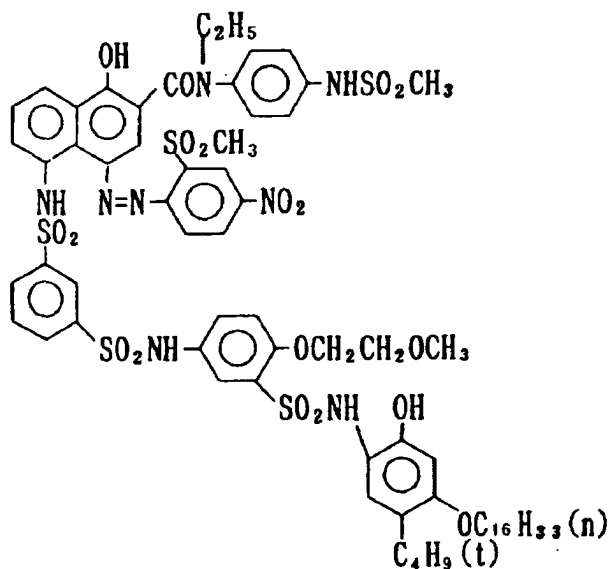
(b) A protective layer containing 0.5 g/m² of a gelatin.

Emulsion layer side:

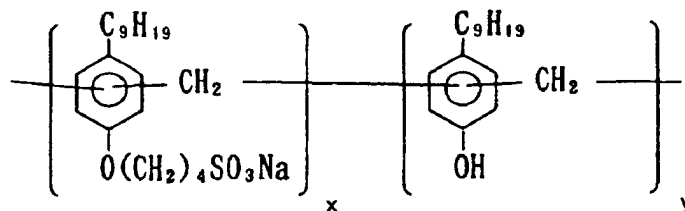
(1) A layer containing 3.7 g/m² of titanium dioxide and 0.5 g/m² of a gelatin.

(2) A color material layer containing 0.46 g/m² of the following cyan dye-releasing redox compound, 0.07 g/m² of tricyclohexyl phosphate, 0.05 g/m² of the following dispersion aid (A), 0.06 g/m² of the following dispersion aid (B), and 0.5 g/m² of a gelatin.

Cyan dye-releasing redox compound

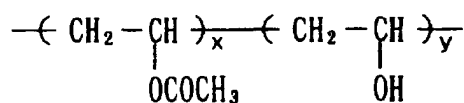


Dispersion aid (A)



$x:y=4:6$

Dispersion aid (B)



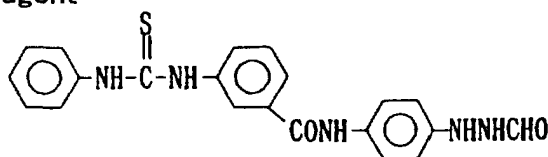
$$x:y=12:88$$

(Average molecular weight 100,000)

(3) A layer containing 0.5 g/m² of a gelatin.

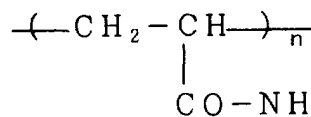
(4) A red-sensitive emulsion layer containing a red-sensitive internal latent image type direct positive silver bromide emulsion (average grain size: 0.65 μm, 0.11 g/m² as the amount of silver), 0.3 g/m² of a gelatin, 0.003 g/m² of the following nucleating agent, and 0.02 g/m² of 2-sulfo-5-n-pentadecylhydroquinone sodium salt.

Nucleating agent



(5) A red-sensitive emulsion layer containing a red-sensitive internal latent image type direct positive silver bromide emulsion (average grain size: 0.98 μm, 0.23 g/m² as the amount of silver), 0.4 g/m² of a gelatin, 0.04 g/m² of 2-sulfo-5-n-pentadecylhydroquinone sodium salt, and 0.005 mg/m² of the same nucleating agent as that of the layer (4).

(6) A color-mixing prevention layer containing 0.61 g/m² of 2,5-di-t-pentadecylhydroquinone, 0.33 g/m² of the following polymer dispersant, and 0.3 g/m² of a gelatin.

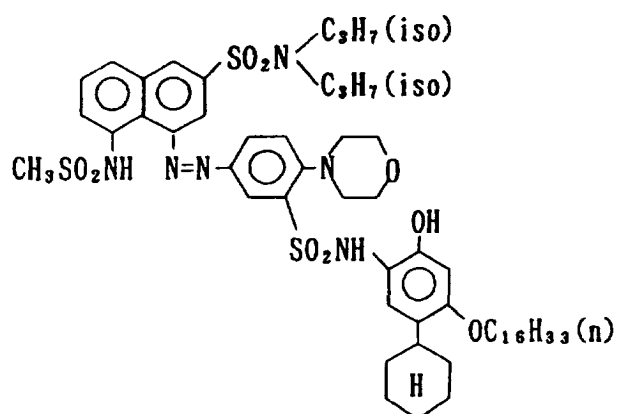


(Molecular weight 300,000)

(7) An intermediate layer containing 0.2 g/m² of a gelatin.

(8) A color material layer containing 0.46 g/m² of the following magenta dye-releasing redox compound, 0.04 g/m² of the same dispersion aid (A) as that of the layer (2), and 0.07 g/m² of the same dispersion aid (B) as that of the layer (2), and 0.7 g/m² of a gelatin.

Magenta dye-releasing redox compound



(9) A green-sensitive emulsion layer containing a green-sensitive internal latent image type direct positive silver bromide emulsion (average grain size: 0.65 μm , 0.11 g/m² as the amount of silver), 0.2 g/m² of a gelatin, 0.005 mg/m² of the same nucleating agent as that of the layer (4), and 0.02 g/m² of 2-sulfo-5-n-pentadecylhydroquinone sodium salt.

(10) A green-sensitive emulsion layer containing a green-sensitive internal latent image type direct positive silver bromide emulsion (average grain size: 0.98 μm , 0.26 g/m² as the amount of silver), 0.6 g/m² of a gelatin, 0.004 mg/m² of the same nucleating agent as that of the layer (4), and 0.04 g/m² of 2-sulfo-5-n-pentadecylhydroquinone sodium salt.

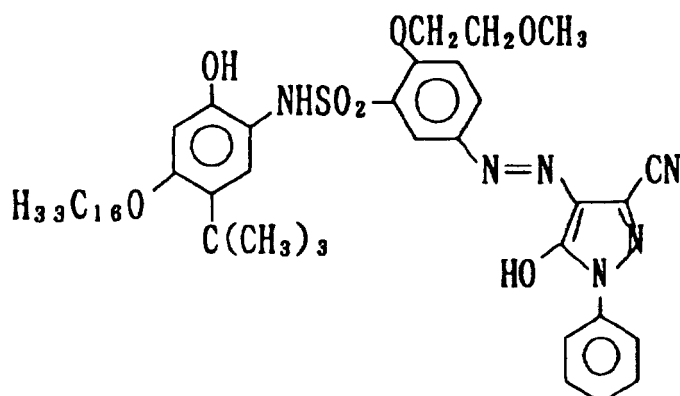
(11) A color-mixing prevention layer containing 0.91 g/m² of 2,5-di-t-pentadecylhydroquinone, 0.29 g/m² of the following polymer dispersant, and 0.4 g/m² of a gelatin.



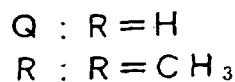
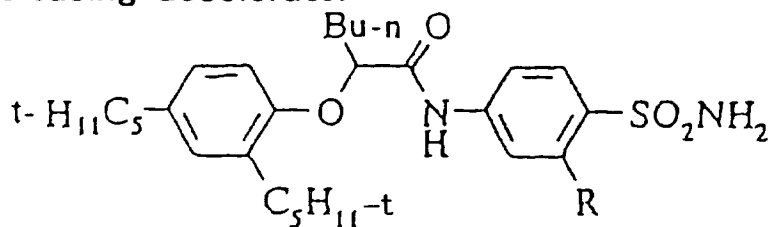
(12) The same layer as the layer (7).

(13) A color material layer containing 0.53 g/m² of a yellow dye-releasing redox compound having the following structure, 0.16 g/m² of tricyclohexyl phosphate, 0.05 g/m² of the same dispersion aid (A) as that of the layer (2), and 0.03 g/m² of the same dispersion aid (B) as that of the layer (2), 0.035 g/m² of the following dye-releasing accelerator (Q), 0.018 g/m² of the following dye-releasing accelerator (R), and 0.5 g/m² of a gelatin.

Yellow dye-releasing redox compound

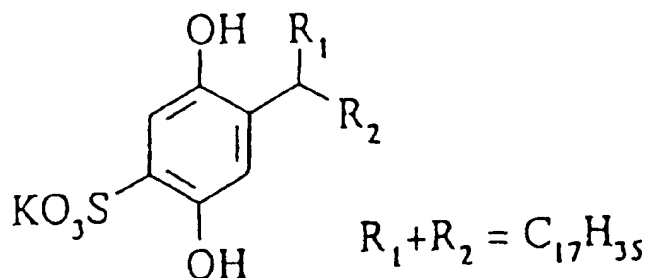


Dye-releasing accelerator



(14) A blue-sensitive emulsion layer containing a blue-sensitive internal latent image type direct positive silver bromide emulsion (average grain size: 0.65 μm , 0.15 g/m² as the amount of silver), 0.2 g/m² of a gelatin, 0.006 mg/m² of the same nucleating agent as that of the layer (4), 0.0014 g/m² of the following compound (S), and 0.01 g/m² of 2-sulfo-5-n-pentadecylhydroquinone sodium salt.

Compound (S)



(15) A blue-sensitive emulsion layer containing a blue-sensitive internal latent image type direct positive silver bromide emulsion (average grain size: 0.98 μm , 0.23 g/m² as the amount of silver), 0.3 g/m² of a gelatin, 0.005 mg/m² of the same nucleating agent as that of the layer (4), and 0.01 g/m² of 2-sulfo-5-n-pentadecylhydroquinone sodium salt.

(16) A ultraviolet absorbing layer containing 0.12 g/m² of each of the following ultraviolet absorbers (A) and (B),

10

15



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30

35



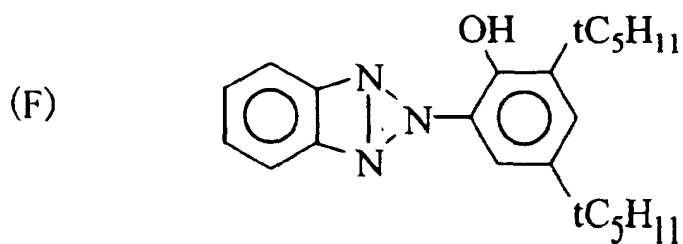
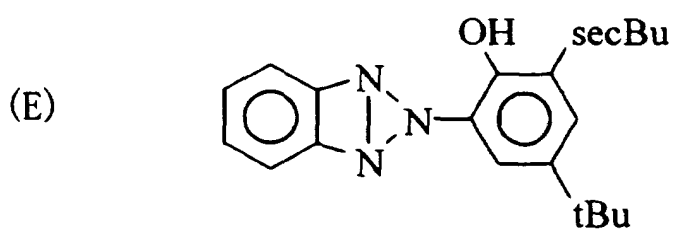
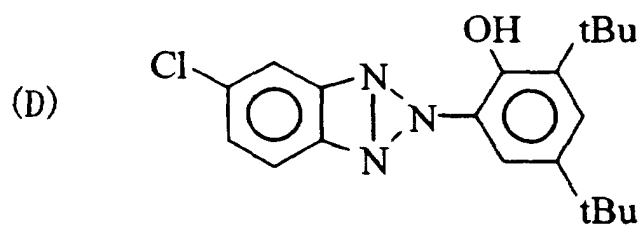
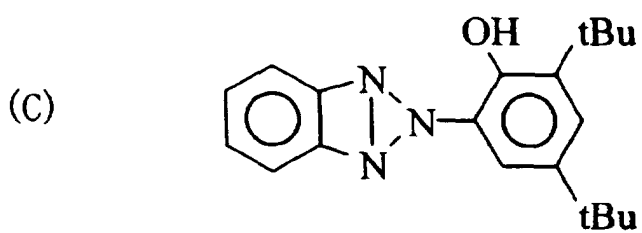
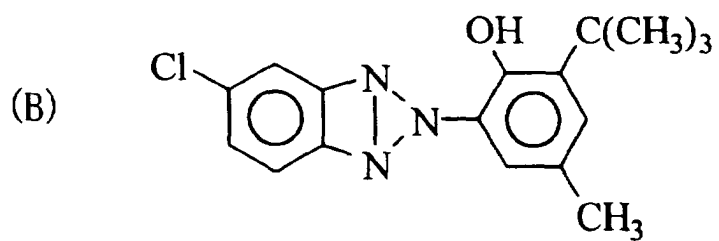
45



- 55

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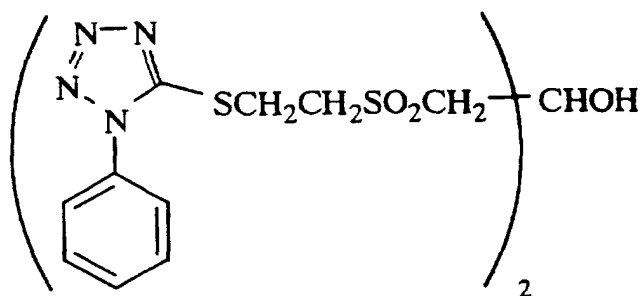
m² of the following compound (E), and 0.40 g/m² of the following compound (F).



(In the formulae, Bu represents a butyl group.)

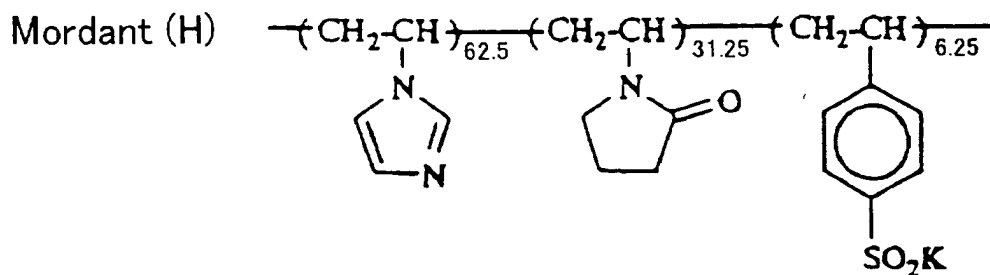
(2) A timing layer containing 5.3 g/m² of diacetyl cellulose (degree of acetylation: 51.3%), 0.16 g/m² of a styrene/maleic anhydride copolymer (mol ratio: 1:1, average molecular weight: 10,000), and 0.35 g/m² of the following compound (G).

Compound (G)

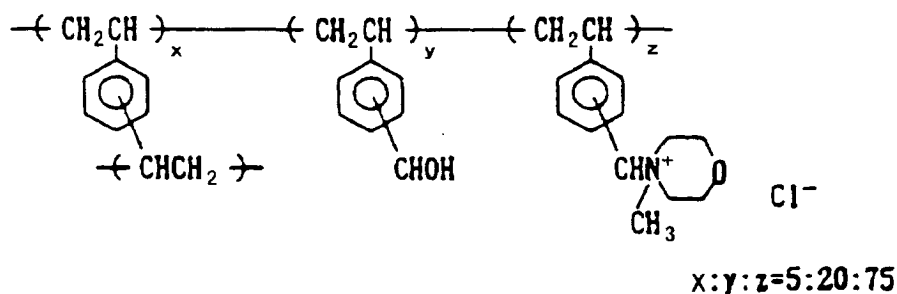


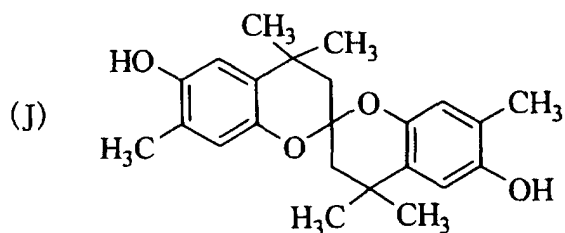
(3) A timing layer containing 0.05 g/m² of a polymer latex (one produced by way of emulsion-polymerization of styrene/butyl acrylate/N-methylolacrylamide, in a ratio by mass of 49.7/42.3/8), and 0.05 g/m² of a polymer latex (one produced by way of emulsion-polymerization of methylmethacrylate/acrylic acid/N-methylolacrylamide, in a ratio by mass of 93/3/4).

(4) A mordant layer containing 3.0 g/m² of the following mordant (H), 0.6 g/m² of the following mordant (I), 0.05 g/m² of the following anti-fading agent (J), 0.2 g/m² of the following hardener (K), 0.10 g/m² of the following hardener (L), and 2.8 g/m² of a gelatin.

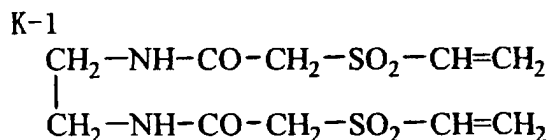


Mordant (I)

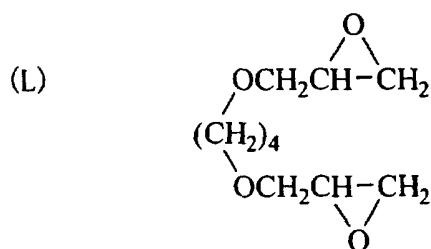
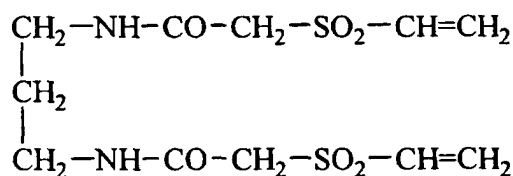




Hardener (K) A mixture in 3:1 (mass ratio) of K-1 and K-2

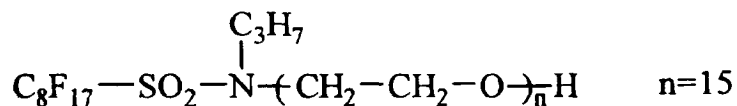


K-2



(5) A titanium oxide layer which was formed by the coating solution containing the titanium oxide dispersion A as an example of the present invention prepared in Example 1 and which contained 0.6 g/m² of titanium oxide, 0.5 g/m² of gelatin, and 0.01 g/m² of the following surface active agent (M).

Surface active agent (M)



(6) A peeling layer containing 0.04 g/m² of an acrylic acid/butylmethacrylate copolymer (mol ratio: 85:15, average molecular weight: 100,000).

[0136] Moreover, each of 1 g of a processing solution having the following composition was filled in a pod made of an aluminum foil, on which vinyl chloride was laminated, under a nitrogen atmosphere, to produce an alkali processing

composition.

Hydroxyethyl cellulose	42 g
Zinc nitrate•6H ₂ O	0.9 g
5-Methylbenzotriazole	5.4 g
Benzyl alcohol	3.4 ml
Titanium dioxide	1.2 g
Aluminum nitrate•9H ₂ O	15 g
Potassium sulfite	1.0 g
1-Phenyl-4-hydroxy-4-hydroxymethyl-3-pyrazolidone	13.0 g
Potassium hydroxide	63 g
Water	854 ml

[0137] Image-receiving elements (102) to (106) were prepared in the same manner as in the preparation of the image-receiving element (101), except that the titanium oxide dispersion A was replaced with the dispersions B to F in Example 1, respectively.

[0138] Further, an image-receiving element (107) was prepared in the same manner as in the preparation of the image-receiving element (101), except that the dispersion was omitted.

[0139] Then, the light-sensitive element (101) was exposed image-wise and thereafter put together with the image-receiving elements (101) to (107), respectively, and processed such that an alkali processing composition was developed at a thickness of 60 μm between the light-sensitive element and image-receiving element.

[0140] The processing was carried out at 25°C. 90 seconds after the processing, the image-receiving element was peeled from the light-sensitive element. After the image-receiving element was irradiated with xenon light at 85,000 lux for 3 days under a condition of 30°C - 40%RH atmosphere, the residual rate of magenta density (by taking the density before irradiation to be as 1.0) was measured. The maximum density was measured using a Fuji automatic recording densitometer (manufactured by Fuji Photo Film Co., Ltd.). Likewise, 10 minutes after the processing, the image-receiving element was peeled from the light-sensitive element, and thus the maximum density by peeling after 90 seconds and the maximum density by peeling after 10 minutes were measured. The difference between the maximum densities was used as an indicator of dependence on time for peeling of the maximum density. A smaller difference is preferable from the standpoint of obtaining an image of the same quality independent on the time when the image-receiving element is peeled off.

[0141] Further, the image-receiving element that was peeled off 90 seconds after the processing was allowed to stand under a condition of 80°C and 20%RH for one week. After that, the change in surface condition (cracking) was inspected.

[0142] Dependence on time for peeling of maximum density, resistance to light fading (light-fastness), haze, and cracking, which were obtained as results of the above-described tests, are shown in Table 1. In the columns of haze and cracking, ○: means good, △: means slightly bad, and × : means bad.

Table 1

Image-receiving element No.	Dispersion of titanium oxide	Difference in maximum density between peeling after 10 minutes and peeling after 90 seconds	Haze	Light-fastness: density retention of magenta D=1	Cracking after one week at 80°C and 20%RH
101 (This invention)	A	0.15	○	0.83	○
102 (This invention)	B	0.16	○	0.81	○
103 (This invention)	C	0.13	○	0.81	○
104 (Comparative example)	D	0.19	△	0.81	×
105 (Comparative example)	E	0.15	×	0.69	○
106 (Comparative example)	F	0.17	△	0.79	×
107 (Comparative example)	-	0.39	○	0.65	○

[0143] From the results of Table 1, it can be seen that the use of the image-receiving elements 101 to 103 (examples according to the present invention) brings about quite small dependence on time for peeling, good surface gloss (good with less haze), and highly improved resistance to light-fading. As shown in Example 1, the dispersions A to C inhibit gelation with the lapse of time and, in addition, enable the stable manufacture of the photographic film unit and improve the performances of the film unit.

[0144] Further, even if the peeling was made 5 minutes after the processing and 10 minutes after the processing instead of 90 seconds after the processing, the improvement of haze and cracking resistance was confirmed in the examples of the present invention.

[0145] Contrary to the above, the use of the image-receiving elements 104 and 106 as comparative examples, brought about cracking and occurrence of haze. In the case where the image-receiving element 105 as a comparative example was used, haze occurrence was conspicuously and light-fastness was also poor. In the case where the image-receiving element 107 as a comparative example was used, the fluctuation in photographic property (maximum density) depending on difference of time for peeling was conspicuously and light-fastness was particularly poor.

Example 3

[0146] An image-receiving element (108) was prepared in the same manner as in the preparation of the image-receiving element (101), except that the same amount of the dispersion A of titanium oxide of the present invention was incorporated into the mordanting layer and titanium oxide was omitted from the titanium oxide layer. The light-fading of the image-receiving element (108) was assessed in the same manner as in Example 2 and 0.78 was obtained as a result. The result reveals that the titanium oxide is effective even if it is incorporated into the image-receiving layer.

Example 4

[0147] A light-sensitive element (402) was prepared by coating the following layer structure on a 90 μm -thick opaque polyethylene terephthalate film as a support.

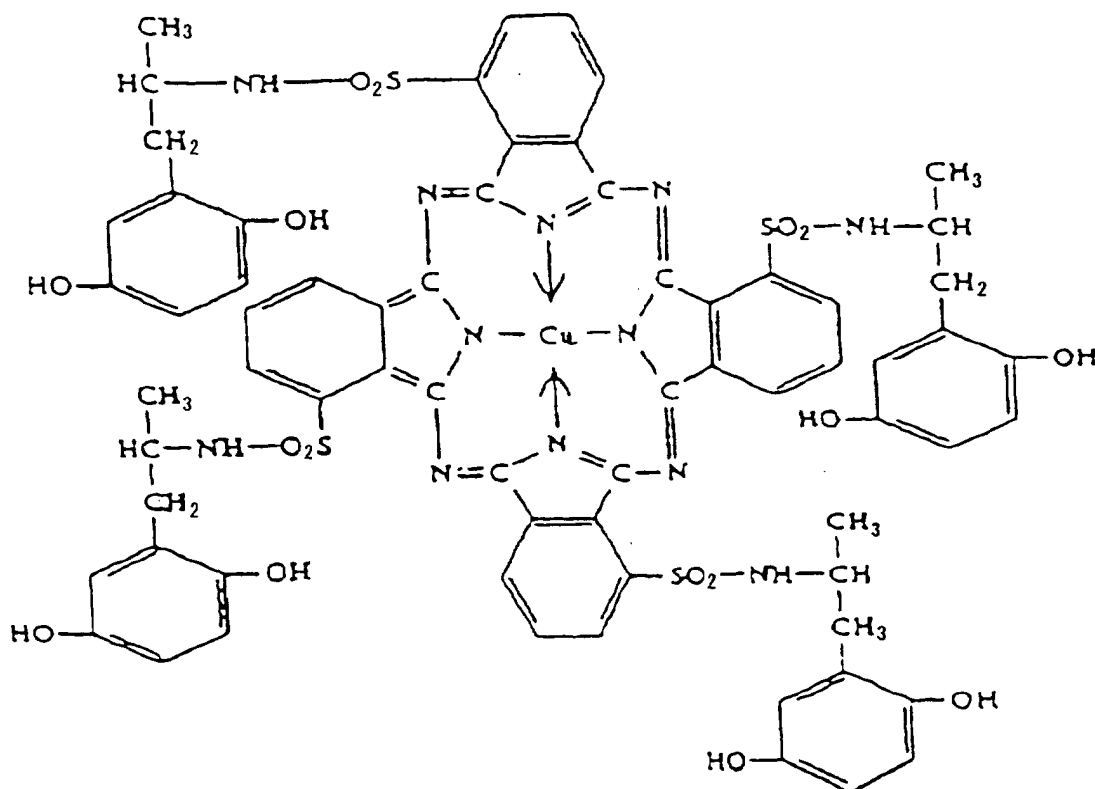
1. Undercoat layer

[0148] cellulose sulfate • sodium salt (amount to be coated: 19 mg/m^2)

2. Cyan dye developer layer

[0149] The layer contained a cyan dye developer (960 mg/m^2), gelatin (540 mg/m^2), cellulose sulfate • sodium salt (12 mg/m^2), and phenylnorbornenylhydroquinone (245 mg/m^2).

Cyan dye developing agent



3. Red-sensitive silver iodobromide emulsion layer

[0150] The layer contained silver iodobromide emulsion grains having an average particle diameter of 0.6 μm and a silver iodide content of 1 mole % (780 mg/m²), silver iodobromide emulsion grains having an average particle diameter of 1.5 μm and a silver iodide content of 3 mole % (420 mg/m²), and polyvinyl hydrogenphthalate (18 mg/m²).

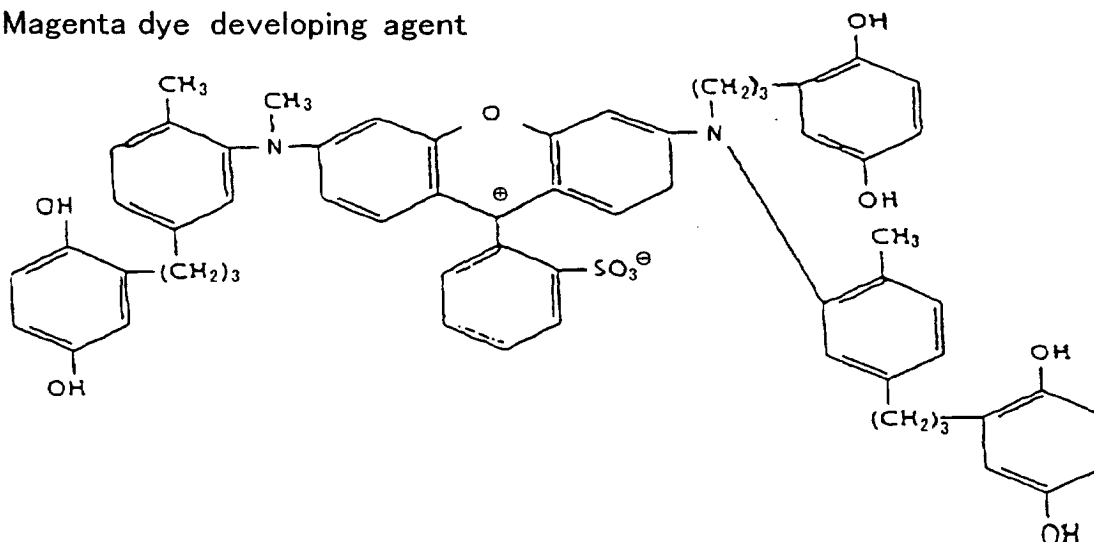
4. Intermediate layer 1

[0151] The layer contained copolymer of a butyl acrylate/diacetone acrylamide/methacrylic acid/styrene/acrylic acid (2325 mg/m²), polyacrylamide (97 mg/m²), hydantoin hardener (124 mg/m²), and succindialdehyde (3 mg/m²).

5. Magenta dye developer layer

[0152] The layer contained a magenta dye developer (455 mg/m²), gelatin (298 mg/m²), 2-phenylbenzimidazole (234 mg/m²), phthalocyanine blue dye (14 mg/m²), and cellulose sulfate • sodium salt (12 mg/m²).

Magenta dye developing agent



6. Intermediate layer 2

[0153] The layer contained a carboxylated styrene/butadiene latex (Dow 620 latex: 250 mg/m²), gelatin (83 mg/m²), and polyvinyl hydrogenphthalate (2 mg/m²).

7. Green-sensitive silver iodobromide emulsion layer

[0154] The layer contained silver iodobromide emulsion grains having an average particle diameter of 0.6 μm and a silver iodide content of 1 mole % (540 mg/m²), silver iodobromide emulsion grains having an average particle diameter of 1.3 μm and a silver iodide content of 3 mole % (360 mg/m²), gelatin (418 mg/m²), and polyvinyl hydrogenphthalate (23 mg/m²).

8. Intermediate layer 3

[0155] The layer contained phenylnorbornenylhydroquinone (263 mg/m²), gelatin (131 mg/m²), and cellulose sulfate • sodium salt (4 mg/m²).

9. Intermediate layer 4

[0156] The layer contained copolymer of a butyl acrylate/diacetone acrylamide/methacrylic acid/styrene/acrylic acid (1448 mg/m²), polyacrylamide (76 mg/m²), and succindialdehyde (4 mg/m²).

10. Scavenger layer

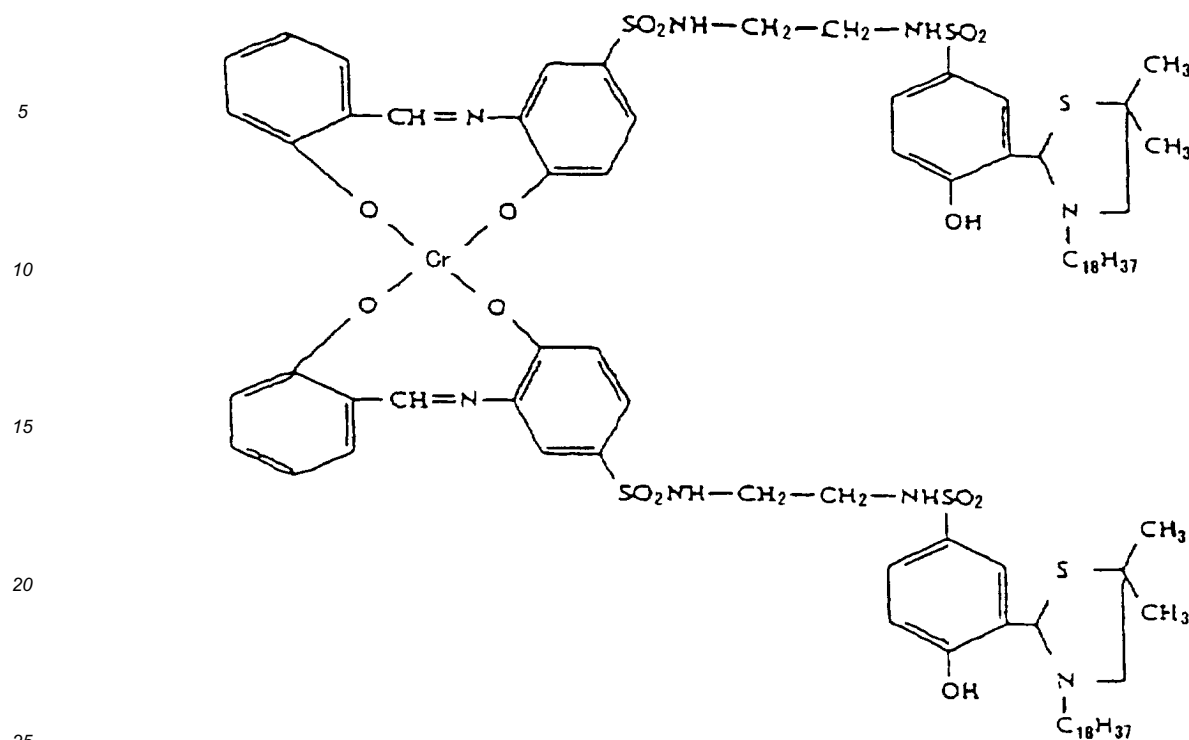
[0157] The layer contained 1-octadecyl-4,4-dimethyl-2-{2-hydroxy-5-N-(7-caprolactamide)sulfonamide}thiazolidine (1000 mg/m²), gelatin (405 mg/m²), cellulose sulfate • sodium salt (12 mg/m²), and quinacridone red- ζ (7 mg/m²).

11. Yellow filter layer

[0158] The layer contained benzidine yellow (241 mg/m²), gelatin (68 mg/m²), cellulose sulfate • sodium salt (3 mg/m²).

12. Yellow dye-releasing layer

[0159] The layer contained a yellow dye-releasing compound (1257 mg/m²), gelatin (503 mg/m²), cellulose sulfate • sodium salt (20 mg/m²).



13. Intermediate layer 5

[0160] The layer contained a phenyl, t-butylhydroquinone (450 mg/m²), 5-t-butyl-2,3-bis{(1-phenyl-1H-tetrazole-5-yl)thio}-1,4-benzenediol-bis{(2-methanesulfonyl-ethyl)carbamate} (100 mg/m²), gelatin (250 mg/m²), and polyvinyl hydrogenphthalate (33 mg/m²).

14. Blue-sensitive silver iodobromide emulsion layer

[0161] The layer contained silver iodobromide emulsion grains having an average particle diameter of 1.3 μm and a silver iodide content of 1 mole % (37 mg/m²), silver iodobromide emulsion grains having an average particle diameter of 1.6 μm and a silver iodide content of 3 mole % (208 mg/m²), gelatin (78 mg/m²), and polyvinyl hydrogenphthalate (7 mg/m²).

15. UV filter layer

[0162] The layer contained Tinuvin (manufactured by Ciba-Geigy Corp., 500 mg/m²), benzidine yellow (220 mg/m²), gelatin (310 mg/m²), and cellulose sulfate • sodium salt (23 mg/m²).

16. Protective layer

[0163] The layer contained gelatin (300 mg/m²) and polyvinyl hydrogenphthalate (9 mg/m²).

[0164] Next, an image-receiving element (401) was prepared by coating the following layers on a 160 μm-thick opaque polyethylene-clad paper as a support.

1. Neutralizing layer

[0165] The layer contained a 9:11 by mass mixture (22219 mg/m²) of a polymer A and a polymer B.
 Polymer A: copolymer of a methyl vinyl ether/maleic anhydride (GANTREZ S-97, manufactured by GAF Corp.)
 Polymer B: copolymer latex of a vinyl acetate/ethylene (AIRFLEX 465, manufactured by Air Products Co.)

2. Timing layer

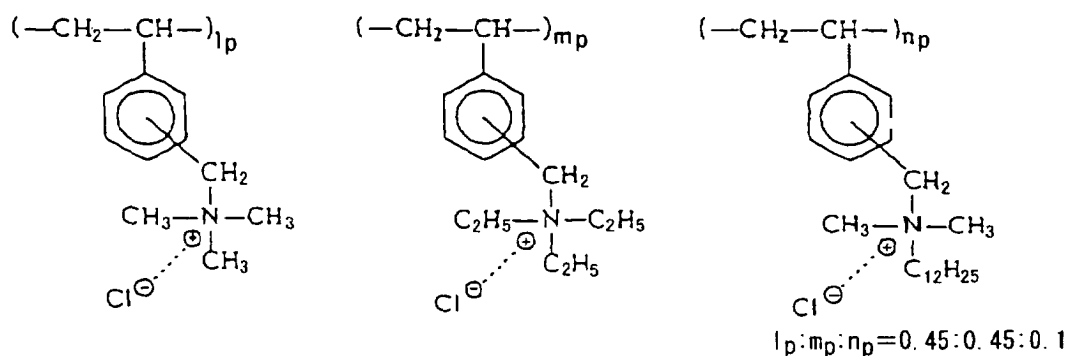
[0166] The layer contained a 1:3 by mass mixture (2691 mg/m²) of Hycar 26349 (manufactured by B. F. Goodrich Co.) and a polymer C.

Polymer C: a copolymer of polyvinyl alcohol graft-copolymerized with diacetone alcohol and acrylamide (ratio by mass of the three components: 1:8.2:1.1)

3. Image-receiving layer

[0167] The layer contained a 2:1:1 by mass mixture (3983 mg/m²) of a polymer D having the following structural formula, very highly hydrophilized polyvinyl alcohol (AIRVOL 165, manufactured by Air Products Co.), and butanediol.

Polymer D;



4. Peel layer

[0168] The layer contained polyacrylic acid (162 mg/m²).

[0169] Next, an alkaline processing composition (401) composed of the components shown in Table 2 was prepared.

Table 2

Component	Added amount
Sodium hydroxide	7.25g
N-butyl-a-picolinium bromide	1.79g
1-methylimidazole	0.24g
1,2,4-triazole	0.30g
Hypoxanthine	0.82g
PMT(phenylmercaptotetrazole)	0.0005g
6-benzylaminopurine	0.025g
2-(methylamino)ethanol	2.3×10^{-3} mol
Guanine	0.12g
Boric acid	0.71g
5-amino-1-pentanol	1.6×10^{-2} mol
Hydroxyethyl cellulose	2.49g
Sodium p-toluenesulfinate	0.41g
Titanium dioxide	0.16g

Table 2 (continued)

Component	Added amount
6-methyluracil	0.45g
Water to make	100g

[0170] Next, the light-sensitive element (402) was exposed image-wise and thereafter put together with any one of the image-receiving elements (101) to (107), respectively, and the alkaline processing composition (401) was developed at a thickness of 60 μm between the two elements. After that, the assessment was conducted in the same manner as in Example 2. It was found that the use of the image-receiving elements 101 to 103 of the examples according to the present invention led to quite small density difference between peeling after 90 seconds and peeling after 10 minutes; brought about neither haze nor cracking under a dry condition; and led to highly improved resistance to light-fading, as in Example 2.

[0171] Having described our invention as related to the present embodiments, it is our intention that the invention not be limited by any of the details of the description, unless otherwise specified, but rather be construed broadly within its spirit and scope as set out in the accompanying claims.

Claims

1. An aqueous dispersion, comprising titanium oxide having an average primary particle size of 1 to 45 nm, a polyanionic compound and/or a condensed phosphate, and a polyhydric alcohol.
2. The aqueous dispersion as claimed in claim 1, wherein the polyanionic compound is a polyacrylic acid salt or a polymethacrylic acid salt.
3. The aqueous dispersion as claimed in claim 1 or 2, wherein the polyhydric alcohol is glycerin or ethylene glycol.
4. The aqueous dispersion as claimed in claim 1, wherein the titanium oxide is being subjected to a surface treatment with at least one inorganic or organic surface-treating agent selected from the group consisting of aluminum oxide, zirconium oxide, silicon oxide, zinc oxide, siloxane, stearic acid, and trimethylolpropane.
5. The aqueous dispersion as claimed in claim 1, wherein the condensed phosphate is at least one selected from the group consisting of sodium hexametaphosphate, sodium tripolyphosphate, sodium pyrophosphate, and sodium orthophosphate.
6. The aqueous dispersion as claimed in claim 1, wherein the amount of the polyanionic compound and/or the condensed phosphate to be used is within the range of 0.5 to 50% by mass, to the amount of titanium oxide.
7. The aqueous dispersion as claimed in claim 1, wherein the amount of the polyhydric alcohol to be used is 1 to 100% by mass, to the amount of the titanium oxide.
8. A color diffusion-transfer photographic film unit, comprising an image-receiving element, which has, on a support, a layer having a neutralizing function, an image-receiving layer, and a peel layer, in this order; a light-sensitive element, which has, on a support having a light-shielding layer, at least one silver halide emulsion layer combined with at least one dye-image-forming compound; and an alkaline processing composition to be developed between the image-receiving element and the light-sensitive element; such that an image is obtained by the steps of subjecting to exposure to light, processing by developing the alkaline processing composition between the elements, and peeling the image-receiving element from the light-sensitive element; wherein the image-receiving element comprises a titanium oxide-containing layer formed by coating a coating solution containing the aqueous dispersion of claim 1, 2, or 3, on the support.
9. The color diffusion-transfer photographic film unit as claimed in claim 8, wherein the titanium oxide-containing layer in the image-receiving element is positioned in the image-receiving layer and/or as an overlayer of the image-receiving layer (opposite side to its support).
10. The color diffusion-transfer photographic film unit as claimed in claim 8, wherein the titanium oxide is contained

in an amount of 0.01 to 20 g/m².

11. The color diffusion-transfer photographic film unit as claimed in claim 8, wherein the titanium oxide-containing layer and/or the image-receiving layer contain an ultraviolet-light absorbing agent.

12. The color diffusion-transfer photographic film unit as claimed in claim 11, wherein the ultraviolet-light absorbing agent is a hydroxyarylbenzotriazole compound or a hydroxyaryltriazine compound.