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Ciurca, Jr.

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[54] **PHOTOGRAPHIC ELEMENTS CONTAINING IODOSO OR IODOXY OXIDANTS**

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[52] **U.S. Cl.** ..... **96/77**; 96/3; 96/29 D; 96/54; 96/55; 96/76 R; 96/95; 96/99; 96/100; 96/119 R

[51] **Int. Cl.**[2] .. **G03C 1/40**; G03C 1/48; G03C 1/10; G03C 1/40

[58] **Field of Search**.... 96/95, 76 R, 3, 29 D, 119 R, 96/77, 55, 54, 60 R, 99, 100; 428/411

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2,105,274	1/1938	Steigmann	96/95
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3,384,484	5/1968	Schranz et al.	96/77
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3,698,897	10/1972	Gompf et al.	96/77

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[57] **ABSTRACT**

Iodoso compounds and iodoxy compounds are useful as oxidants in photographic elements or film units.

23 Claims, No Drawings

PHOTOGRAPHIC ELEMENTS CONTAINING IODOSO OR IODOXY OXIDANTS

This invention relates to the art of photography and particularly to photographic elements, such as color diffusion transfer elements, employing oxidizing agents.

Color diffusion transfer processes generally involve the use of a photographic element comprising a support, at least one silver halide emulsion, and an image dye-providing material which is contained in or contiguous said layer. After exposure, such a photographic element is treated with an alkaline processing solution to effect imagewise discrimination in the element. As is well-known in the art, the dye-providing material can be initially immobile or initially mobile in the processing solution. Upon alkaline processing of an initially immobile dye-providing material, a mobile dye or dye precursor can be released imagewise or the material can be imagewise rendered mobile. If the material is initially mobile, the processing solution typically renders the material insoluble (and thus immobile) in an imagewise fashion. Whether initially mobile or immobile, upon treatment with a processing solution the dye-providing material typically is oxidized under alkaline conditions, thereby producing imagewise discrimination in the element.

Exemplary color diffusion transfer processes are those using developing agents as disclosed in U.S. Pat. Nos. 2,698,798 and 2,559,643 wherein a latent silver halide image is developed with a color-developing agent. As development proceeds, the color-developing agent reduces the exposed silver halide to metallic silver and the color-developing agent which is oxidized as a function of development forms an immobile species while the unoxidized color-developing agent is free to migrate to a receiving element. After migration, the color-developing agent in the receiver is oxidized. The oxidized developing agent then self-couples or couples with a color coupler to form a positive dye image.

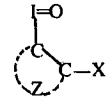
A more recent example of a photographic process in which oxidation causes formation of an image dye is described in copending Lestina and Bush, U.S. Ser. No. 308,869 filed Nov. 22, 1972, and entitled "Photographic Elements Containing Oxichromic Compounds" now U.S. Pat. No. 3,880,658 issued Apr. 29, 1975. Those oxichromic compounds are ones which undergo chromogenic oxidation to form a new chromophore. Useful materials of that type are oxichromic compounds which contain a developing moiety and an oxichromic moiety and have the general formula D—(OC), wherein D— is a group which is a silver halide developer such as a hydroquinone moiety and (OC) is a moiety which undergoes chromogenic oxidation to form an image dye. These oxichromic compounds are particularly useful in an image-transfer unit format in which the respective initially diffusible oxichromic compounds or the initially nondiffusible compounds are used in combination with the appropriate silver halide emulsions.

In order to achieve optimum results when using such oxichromic compounds, it is desirable to have an oxidant which has no substantial absorption in the visible spectrum (i.e., colorless) and which can be easily incorporated in a photographic element with good stability. The oxidative conversion of oxichromic compounds or of other color-providing materials is necessary in order to achieve color image formation. Accordingly, there is a continuing need in the art for materials which exhibit suitable oxidation capability.

I have found a class of oxidants well-suited for use in color diffusion transfer color elements and in any other photographic element in which an oxidant is a necessary or desirable ingredient. When used in photographic elements containing certain oxichromic compounds, the oxidant readily oxidizes the oxichromic moiety.

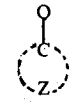
Generally, the photographic elements of this invention comprise a support and at least one layer thereon containing an iodoso compound or an iodoxy compound of the formula R—Q wherein Q is an iodoso group which contains an iodine atom and an oxygen atom or Q is an iodoxy group including iodoxy derivatives, i.e., such as iodoxy diacetates, and R is a carbocyclic or heterocyclic group containing from 5–7 carbon atoms in the cyclic moiety and wherein the iodine atom of Q is covalently bonded to a carbon atom in said cyclic group. Preferably, R comprises an aromatic group covalently bonded through a carbon atom to the iodine atom in Q. These iodoso and iodoxy compounds can be incorporated in photographic elements as oxidants with reduced danger of explosion which is associated with closely related compounds such as periodates, and with better control of where oxidation occurs during processing.

In one highly preferred embodiment, the photographic elements of this invention contain iodoso compounds of the formula:



wherein X is a carboxylic acid group, a sulfonic acid group and the like, and Z represents a group containing the atoms necessary to form a 5- to 7-membered ring with the remainder of said atoms of said formula.

In another highly preferred embodiment, the photographic elements of this invention contain iodoxy compounds having the formula:



wherein Q represents an iodoxy group which can be the group —I—O_2 or is preferably an iodoxy derivative, for example, an iodoxy diacetate such as an iodoxy ethyl diacetate, an iodoxy propyl diacetate, an iodoxy methyl diacetate, an iodoxy maleate and the like, and Z represents a group containing the atoms necessary to form a 5- to 7-membered carbocyclic or heterocyclic ring with the carbon atom as shown in the formula.

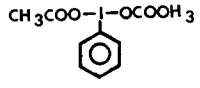
In one highly preferred embodiment of this invention, the iodoso compound or iodoxy compound contain a group thereon which is sufficiently large to render the compound substantially nondiffusible in the photographic element. Typically, ballast groups which are useful are aliphatic groups containing at least 8 carbon atoms.

The iodoso compounds and iodoxy compounds which give particularly good results in the practice of

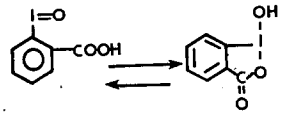
this invention can be characterized in terms of their polarographic halfwave potentials, i.e., their oxidation or reduction potentials as determined by polarography. Cathodic measurements of the reduction potential can be made with a solution of the iodoso compound or iodoxy compound, typically in a basic solvent such as potassium hydroxide, using a dropping mercury electrode with the polarographic halfwave potential for the most positive wave being designated E_c. In each measurement, the reference electrode is a standard calomel electrode. Electrochemical measurements of this type are known in the art and are described in *New Instrumental Methods in Electrochemistry*, by Delahay, Interscience Publishers, New York, New York, 1954; *Polarography*, by Kolthoff and Lingane, 2nd Ed., Interscience Publishers, New York, New York, 1952; *Analytical Chemistry*, 36, 2426 (1964) by Elving; and *Analytical Chemistry*, 30, 1576 (1958) by Adams. Plus and minus signs are according to IUPAC (International Union of Pure and Applied Chemistry), Stockholm Convention, 1953. Useful compounds should have a polarographic reduction potential which is more positive than the polarographic oxidation potential of the ingredients to be oxidized. In general, useful compounds include those having a polarographic reduction potential more positive than about −0.5 v. Typical iodoso compounds or iodoxy compounds for use in oxichromic processes, as described by Lestina and Bush in U.S. Ser. No. 308,869 mentioned above, are those having a reduction potential, E_c, between about −0.1 and −0.5 v.

Typical useful iodoso compounds are as follows:

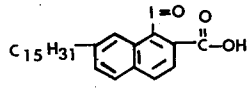
Compound 1



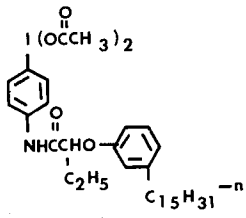
Compound 2



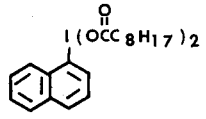
Compound 3



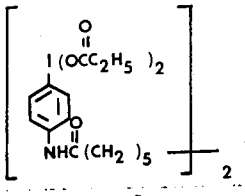
Compound 4



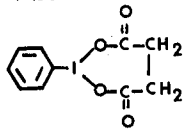
Compound 5



Compound 6



Compound 7



The iodoso and iodoxy compounds can generally be prepared by methods known in the art. Generally, the iodoxyarylene diester compounds can be prepared by taking the respective iodoxyarylene dichlorides prepared according to *Organic Synthesis*, Vol. 22, John Wiley and Sons, 1942, pp. 69–72, and reacting them with the appropriate acid to yield the diester as described in *J. Chem. Society*, 1970, pp. 862–864. The iodoxy compounds containing the iodine atom in a heterocyclic ring can also be prepared as described in the latter publication.

The oxidants described herein can be used in a wide variety of photographic elements or in photographic film units.

In certain embodiments, the oxidants can be used in photographic elements or film units to provide an oxidant for the synthesis of image dyes. The oxidants can be used to generate oxidized color-developing agent which then reacts with a color coupler to form the image dye. Additionally, these compounds can be used to oxidize a compound directly to an image dye as in the case of leuco indoanilines, leuco indophenols, leuco triarylmethanes and other dye precursors.

In one embodiment, the present oxidants are useful in color diffusion transfer processes such as those in which unreacted color formers in undeveloped or partially developed areas of a photographic element diffuse imagewise, after color development of the exposed layers, to a receiving layer in which the color formers react with oxidized color developer to produce an imagewise distribution of dye. By including a useful oxidant in the receiving layer or having it in association therewith, dyes are formed imagewise in that element as a result of the interreaction of the oxidant, color developer and diffused color former. Processes of this type are described further in British Pat. No. 926,462 dated May 15, 1963, incorporated herein by reference.

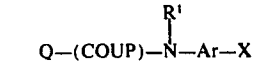
Examples of processes in which an image is formed upon oxidation of transferred color developer and color coupler are described in U.S. Pat. Nos. 2,559,293 and 2,698,798, incorporated herein by reference. Similarly, the present oxidants can be used in imaging processes based on leuco anthraquinones and other dye precursors which produce dyes when oxidized, or processes based on developers which self-couple upon oxidation, thereby producing dyes. Processes of these latter types are described further in U.S. Pat. Nos. 2,892,710 and 2,698,798, respectively, both incorporated herein by reference. Likewise, the described oxidants have utility in color diffusion transfer processes using a leuco developing agent, as discussed in U.S. Pat. Nos. 2,992,105 and 2,909,430, incorporated herein by reference.

In another embodiment, the oxidants can be used to oxidize the developer portion of a dye developer (i.e., a compound which contains a silver halide developing moiety and a separate moiety which contains the chromophore of an image dye). As mentioned above, the oxidants selected must have an oxidation potential sufficient to oxidize the developer portion of the molecule, such as the hydroquinone portion. In this embodiment, the oxidant can function to immobilize the dye developer, such as when it diffuses to the receiver layer, by forming the quinone, quinonimide, etc., of the developer moiety which is generally quite insoluble in an alkaline processing solution.

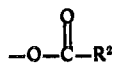
In still other embodiments, a photographic element containing an oxidant can be treated to form an image-

wise distribution of the oxidant. The photographic element can then be contacted with a material which will undergo oxidation to produce an image record in the photographic element. Also, the photographic element containing the imagewise distribution of oxidant can be treated to effect diffusion of the oxidant to an adjacent layer wherein it can oxidize materials to produce an image record. In one example of this embodiment, a photographic element containing a silver halide emulsion and an adjacent layer containing a nondiffusible iodoso or iodoxy oxidant can be developed with a silver halide developer. Where silver halide is not developed, the oxidant will be reduced. The element can then be contacted with a solution of color coupler and color developer to react with the remaining imagewise distribution of the described oxidant and produce an image dye.

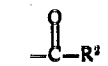
The oxidants of this invention are particularly well-suited for use as oxidants in photographic elements or film units which contain an oxichromic compound of the type described in copending Lestina and Bush, U.S. Ser. No. 308,869, mentioned above and incorporated herein by reference. Preferred oxichromic compounds are those which undergo chromogenic oxidation to form a photographic image dye. In one embodiment, the oxidants of this invention are incorporated into photographic elements containing oxichromic compounds of the formula:



wherein (COUP) is a photographic color coupler linked to the nitrogen atom through a carbon atom at the coupling position, such as a phenolic coupler, a pyrazolone coupler, a pyrazolotriazole coupler, couplers having open-chain ketomethylene groups and the like; Ar is an arylene group containing from 6 to 20 carbon atoms, including substituted and unsubstituted arylene groups, fused-ring arylene groups and the like; X can be an amino group, including substituted amines, an hydroxyl group or the group:

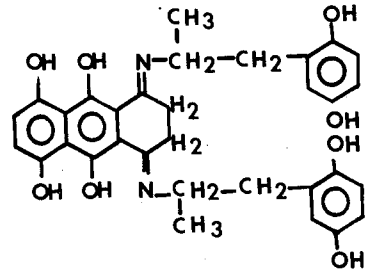


in which R^2 is a group containing from 1 to 12 carbon atoms, which can be an alkyl group, an aryl group, including a substituted alkyl group, a substituted aryl group and the like; R^1 is a hydrogen atom or the group:



in which R^2 is as defined above and is preferably a polyhalogenated alkyl group; and Q is a group which is 1) a silver halide developing agent which is preferably an aromatic group polysubstituted with hydroxy, amino or substituted amino groups or 2) an oxidizable releasing group (i.e., a group which can be oxidized to facilitate subsequent release of a group or a group which can be oxidized to prevent the normal release of a group under the processing conditions). When Q is a silver halide developing agent, the resultant compound preferably is initially mobile. When Q is an oxidizable releasing group, the resultant compound preferably is initially immobile.

In still another embodiment, the oxidants of this invention can be used in photographic elements where leuco compounds are employed which provide anthraquinone dyes upon oxidation. The leuco compounds can be of the type mentioned in U.S. Pat. No. 2,892,710 issued June 30, 1959, or they can also be improved compounds such as leuco anthraquinone compounds attached to hydroquinone moieties, for example, the compound:



Typically, the present oxidants are used in either the processing fluid or the image-receiving layer of a diffusion transfer film unit employing other image dye-providing materials mentioned above. The image-transfer film units can be any of those described in the following patents, all incorporated herein by reference: U.S. Pat. Nos. 2,543,181, 2,983,606, 3,227,550, 3,227,552, 3,415,644, 3,415,645, 3,415,646 and 3,635,707, Canadian Patent No. 674,082, and Belgian Patent Nos. 757,959 and 757,960, both issued Apr. 23, 1971.

When used in the processing fluid of various color diffusion transfer film units, the iodoso compounds or iodoxy compounds are typically present in solution in a concentration of about 0.01 to about 0.1 molar. When not contained in the processing fluid, the present oxidants are coated in at least one layer which typically contains a binder such as gelatin, poly(vinyl alcohol), etc. Of course, the oxidants described herein can also be one of several ingredients as a given layer. For example, when used in color diffusion transfer units, the described oxidant can be contained in a mordant layer. In general, the iodoso compounds or iodoxy compounds are coated at a coverage of about 40 to 500 mg./ft.^{2}. In preferred embodiments, the iodoso compounds and iodoxy compounds are used in image-transfer film units which are designed to be processed with a single processing solution, and the resulting positive image is viewed through a transparent support against an opaque background, preferably where all of the silver halide recording layers and the image-receiving layer remain laminated between two dimensionally stable supports after processing.

A suitable image-transfer film unit in which the present oxidants are useful typically comprises:

1. a photosensitive element comprising a support having thereon at least one layer containing a silver halide emulsion having associated therewith an image dye-providing material and preferably at least three of said layers wherein one layer contains a blue-sensitive silver halide emulsion, one layer contains a green-sensitive silver halide emulsion, and one layer contains a red-sensitive silver halide emulsion;

2. an image-receiving layer which can be located on a separate support superposed or adapted to be superposed on said photosensitive element or, preferably, which can be positioned in the photosensitive element on the same support adjacent the photosensitive silver halide emulsion layers; and

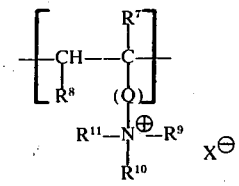
3. means containing an alkaline processing composition adapted to discharge its contents within said film unit. Where the receiver layer is coated on the same support with the photosensitive silver halide layers, the support is preferably a transparent support, an opaque layer is preferably positioned between the image-receiving layer and the photosensitive silver halide layer, and the alkaline processing composition preferably contains an opacifying substance such as carbon of pH-indicator dye which is discharged into the film unit between a dimensionally stable support or cover sheet and the photosensitive element. In certain embodiments, the cover sheet can be superposed or adapted to be superposed on the photosensitive element. The image-receiving layer can be coated on the cover sheet. In certain preferred embodiments where the image-receiving layer is located in the photosensitive element, a neutralizing layer is located on the cover sheet.

The means for containing the alkaline processing solution can be any means known in the art for this purpose, including rupturable containers positioned at the point of desired discharge of its contents into the film unit and adapted to be passed between a pair of juxtaposed rollers to effect discharge of the contents into the film unit, frangible containers positioned over or within the photosensitive element, hypodermic syringes, and the like.

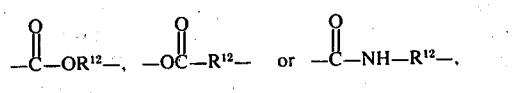
The silver halide emulsions useful in my invention are well-known to those skilled in the art and are described in *Product Licensing Index*, Vol. 92, December, 1971, publication 9232, p. 107, par. I, "Emulsion types"; they may be chemically and spectrally sensitized as described on p. 107, par. III, "Chemical sensitization", and pp. 108–109, par. XV, "Spectral sensitization", of the above article; they can be protected against the production of fog and can be stabilized against loss of sensitivity during keeping by employing the materials described on p. 107, par. V, "Antifoggants and stabilizers", of the above article; they can contain development modifiers, hardeners and coating aids as described on pp. 107–108, par. IV, "Development modifiers", par. VII, "Hardeners", and par. XII, "Coating aids", of the above article; they and other layers in the photographic elements used in this invention can contain plasticizers, vehicles and filter dyes described on p. 108, par. XI, "Plasticizers and lubricants", and par. VIII, "Vehicles" , and p. 109, par. XVI, "Absorbing and filter dyes", of the above article; they and other layers in the photographic elements used in this invention may contain addenda which are incorporated by using the procedures described on p. 109, par. XVII, "Methods of addition", of the above article; and they can be coated by using the various techniques described on p. 109, par. XVIII, "Coating procedures", of the above article; the disclosures of all of which are hereby incorporated by reference.

Any material can be employed as the image-receiving layer in this invention as long as the desired function of mordanting or otherwise fixing the dye images will be obtained. The particular material chosen will, of course, depend upon the dye to be mordanted. If acid dyes are to be mordanted, the image-receiving layer can contain basic polymeric mordants such as polymers of amino guanidine derivatives of vinyl methyl ketone such as described in Minsk, U.S. Pat. No. 2,882,156 issued Apr. 14, 1959, and basic polymeric mordants such as described in Cohen et al, U.S. Pat. No. 3,709,690 issued Jan. 9, 1973.

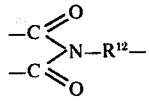
Additional mordants include cationic mordants such as polymeric compounds composed of a polymer having quaternary nitrogen groups and at least two aromatic nuclei for each quaternary nitrogen in the polymer cation (i.e., having at least two aromatic nuclei for each positively charged nitrogen atom), such polymeric compounds being substantially free from carboxy groups. Useful mordants of this type are comprised of units of the following formula in copolymerized relationship with units of at least one other ethylenically unsaturated monomer:



wherein each of R^7 and R^8 represents a hydrogen atom or a lower alkyl radical (of 1 to about 6 carbon atoms), and R^8 can additionally be a group containing at least one aromatic nucleus (e.g., phenyl, naphthyl, tolyl; Q can be a divalent alkylene radical (of 1 to about 6 carbon atoms), a divalent arylene radical, a divalent aralkylene radical, a divalent alkarylene radical,



wherein R^{12} is an alkylene radical; or R^8 can be taken together with Q to form a



group; R^9, R^{10} and R^{11} can be lower alkyl or aryl, or R^9 and R^{10} and the nitrogen atom to which they are attached can together with Q represent the atoms and bonds necessary to form a quaternized nitrogen-containing heterocyclic ring; and $X^{\ominus}$ is a monovalent negative salt-forming radical or atom in ionic relationship with the positive salt-forming radical; wherein said polymer is substantially free from carboxy groups and wherein the positive salt-forming radical of said polymer comprises at least two aryl groups for each quaternary nitrogen atom in said polymer. These preferred polymeric cationic mordants are described further in the above-mentioned U.S. Pat. No. 3,709,690.

Other mordants useful in my invention include poly-4-vinylpyridine, the 2-vinylpyridine polymer metho-p-toluenesulfonate and similar compounds described in Sprague et al, U.S. Pat. No. 2,484,430 issued Oct. 11, 1949, and cetyl trimethylammonium bromide, etc. Effective mordanting compositions are also described in U.S. Pat. Nos. 3,271,148 by Whitmore and 3,271,147 by Bush, both issued Sept. 6, 1966.

The term "image dye-providing material" as used herein is understood to refer to those compounds which either (1) do not require a chemical reaction to form the image dye or (2) undergo reactions encountered in photographic imaging systems to produce an image dye, such as with color couplers, oxichromic compounds and the like. The first class of compounds is generally referred to as preformed image dyes and includes shifted dyes, etc., while the second class of compounds is generally referred to as dye precursors.

The terms "initially mobile" and "initially immobile" as used herein refer to compounds which are incorporated in the photographic element and, upon contact with an alkaline processing solution, are substantially mobile or substantially immobile, respectively.

The following examples are included for a further understanding of the present invention. In these examples, all temperatures indicated are centigrade. All oxidants referred to are found in Table 1 below. The structural formulas for other compounds used are found in the footnotes to the examples.

EXAMPLE 1

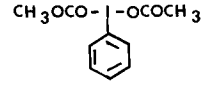
The oxidants listed in Table 1 below are tested as follows: A matrix element is prepared comprising a transparent film base support having a layer of 125 mg./ft.^{2} gelatin and 50 mg./ft.^{2} of oxichromic compound dissolved in 75 mg./ft.^{2} of diethyl lauramide. A receiver element is prepared comprising a transparent film base support having on it a first layer of 200 mg./ft.^{2} of the mordant copoly[styrene:N,N-dimethyl-N-benzyl-N-3-maleiimidopropyl)ammonium chloride] in 100 mg./ft.^{2} of gelatin and a second layer (over the first layer) comprising 2000 mg./ft.^{2} of titanium dioxide in 200 mg./ft.^{2} of gelatin. The two elements are then placed in face-to-face contact for 60 sec. with an alkaline processing composition, comprising 20 g. of oxidant/liter of an aqueous solution of 4% potassium hydroxide and 2.5% hydroxyethyl cellulose, spread between the elements. Upon contact of the two elements, the oxichromic compound migrates from the matrix through the processing composition and the titanium dioxide layer into the mordant layer of the receiver. The oxichromic compound is oxidized by the iodoso oxidant to the corresponding dye which is visible through the transparent support and against the white background of the titanium dioxide layer. The oxichromic compounds and the oxidants used, as well as the color and reflection density of the dye in the receiver are shown in Table 1 below.

Table 1

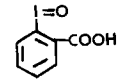
Oxidant*	Oxichromic Compound**	Color of Dye in Receiver	Dmax
1	A	yellow	1.75
1	B	magenta	1.00
1	C	cyan	1.45
2	A	yellow	1.30
2	B	magenta	2.35
2	C	cyan	1.34

*Oxidants:

Oxidant 1

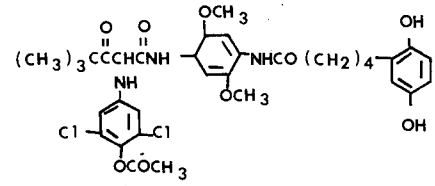


Oxidant 2



**Oxichromic Compound:

A



B

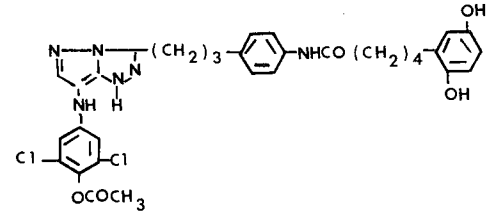
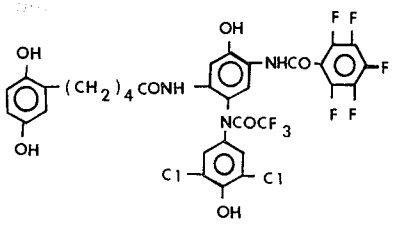


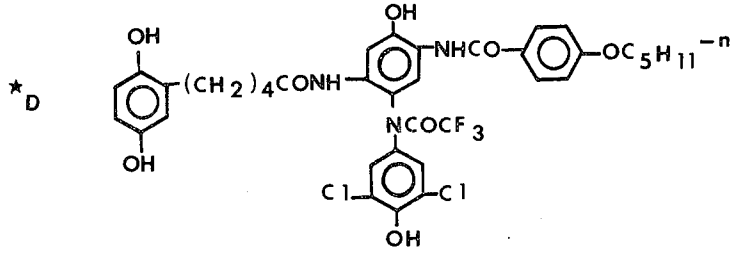
Table 1-continued

Oxidant*	Oxichromic Compound**	Color of Dye in Receiver	Dmax
C			

EXAMPLE 2

An integral color-transfer, photographic element is prepared having the following structure:

1. transparent polyethylene terephthalate support;
2. dye mordant layer containing gelatin at 100 mg./ft.^{2}, copoly[styrene:N-benzyl-N,N-dimethyl-N-(3-maleimidopropyl)-ammonium chloride] at 200 mg./ft.^{2} and iodoso Oxidant 1 at 200 mg./ft.^{2};
3. layer containing titanium dioxide at 2000 mg./ft.^{2} and gelatin at 200 mg./ft.^{2};
4. layer containing carbon opacifying agent at 200 mg./ft.^{2} and gelatin at 156 mg./ft.^{2};
5. layer containing gelatin at 75 mg./ft.^{2}, 2,5-di-sec-dodecylhydroquinone at 70 mg./ft.^{2} and tricresyl phosphate at 23 mg./ft.^{2};
6. layer containing a red-sensitive silver bromoiodide emulsion at 70 mg./ft.^{2} based on silver, gelatin at 230 mg./ft.^{2}, Compound D* at 42 mg./ft.^{2} dispersed in diethyl lauramide at 73 mg./ft.^{2}, 5-(2-cyanoethylthio)-1-phenyltetrazole at 5 mg./ft.^{2} dispersed in tricresyl phosphate at 15 mg./ft.^{2} and 5,6,7,8-tetrahydro-5,8-methano-1,4-naphthalenediol at 10 mg./ft.^{2};



7. layer containing gelatin at 300 mg./ft.^{2}, 2,5-di-sec-dodecylhydroquinone at 70 mg./ft.^{2} and a magenta filter dye at 30 mg./ft.^{2} dissolved in diethyl lauramide at 50 mg./ft.^{2};
8. layer containing green-sensitive silver bromoiodide emulsion at 70 mg./ft.^{2} based on silver, gelatin at 230 mg./ft.^{2}, Oxichromic Compound B at 54 mg./ft.^{2} dispersed in diethyl lauramide at 64 mg./ft.^{2}, 5-(2-cyanoethylthio)-1-phenyltetrazole at 5 mg./ft.^{2} dispersed in tricresyl phosphate and 5,6,7,8-tetrahydro-5,8-methano-1,4-naphthalenediol at 10 mg./ft.^{2};
9. layer containing gelatin at 300 mg./ft.^{2}, 2,5-di-sec-dodecylhydroquinone at 70 mg./ft.^{2} and a yellow filter dye at 100 mg./ft.^{2} dispersed in diethyl lauramide at 28 mg./ft.^{2};
10. layer containing a blue-sensitive silver bromoiodide emulsion at 70 mg./ft.^{2} based on silver, gelatin at 210 mg./ft.^{2}, Oxichromic Compound A at 64 mg./ft.^{2} dispersed in diethyl lauramide at 106 mg./ft.^{2}, 5-(2-cyanoethylthio)-1-phenyltetrazole at 5 mg./ft.^{2} dispersed in tricresyl phosphate at 15 mg./ft.^{2} and 5,6,7,8-tetrahydro-5,8-methano-1,4-naphthalenediol at 10 mg./ft.^{2};
11. layer containing gelatin at 50 mg./ft.^{2}.

A transparent cover sheet for the above element is prepared as follows:

1. transparent polyethylene terephthalate support;
2. layer containing gelatin at 900 mg./ft.^{2}, polyacrylic acid at 900 mg./ft.^{2} and imidazole at 760 mg./ft.^{2};
3. layer containing cellulose acetate at 1140 mg./ft.^{2} and copoly(styrene-maleic anhydride) at 60 mg./ft.^{2}.

The photographic element is exposed through a multicolor, graduated-density test object, the transparent cover sheet is superposed on the element, and a pod containing an opaque processing composition is ruptured to discharge between the cover sheet and the photosensitive element by passing the film unit through juxtaposed rollers having a gap of about 8 mils. The processing composition is as follows:

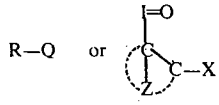
potassium hydroxide	51 g./l.
hydroxyethyl cellulose	30 g./l.
potassium bromide	40 g./l.
α-benzylpicolinium bromide	15 g./l.
5,6,7,8-tetrahydro-5,8-methano-1,4-naphthalenediol	15 g./l.
carbon	40 g./l.

After about 1 to 2 min., a well-defined color image with excellent color reproduction is viewed through the transparent support of the integral element.

Although the invention has been described in considerable detail with particular reference to certain preferred embodiments thereof, variations and modifications can be effected within the spirit and scope of the invention.

I claim:

1. A photographic element comprising a support having thereon at least one photographic image-receiving layer and at least one layer containing an oxidant of the formulae:



wherein Q is an iodoxy diacetate, R is a group containing a 5- to 7-membered carbocyclic or heterocyclic group covalently bonded to the iodine atom of Q through a carbon atom of said cyclic group, X is a carboxylic acid group or a sulfonic acid group, and Z represents a group containing the atoms necessary to form a 5- to 7-membered ring with the remainder of the atoms of said formula.

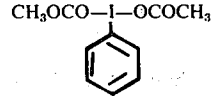
2. A photographic element according to claim 1 wherein said oxidant has the formula:

wherein Q is an iodoxy diacetate and R is a group containing a 5- to 7-membered carbocyclic or heterocyclic group covalently bonded to the iodine atom of Q through a carbon atom of said cyclic group.

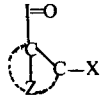
3. A photographic element according to claim 2 wherein said 5- to 7-membered group of R is an aromatic carbocyclic group or aromatic heterocyclic group.

4. A photographic element according to claim 2 wherein R is an aromatic carbocyclic group which contains a ballast moiety.

5. A photographic element according to claim 1 wherein said oxidant has the formula:



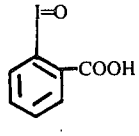
6. A photographic element according to claim 1 wherein said oxidant has the formula:



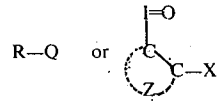
wherein X is a carboxylic acid group or a sulfonic acid group and Z represents a group containing the atoms necessary to form a 5- to 7-membered ring with the remainder of the atoms of said formula.

7. A photographic element according to claim 6 wherein X is a carboxy group.

8. A photographic element according to claim 1 wherein said oxidant has the formula:



9. A photographic element comprising a support having thereon at least one layer containing a silver halide emulsion, at least one layer containing an image dye-providing material and at least one layer containing an oxidant according to the formulae:



wherein Q is an iodoxy diacetate, R is a group containing a 5- to 7-membered carbocyclic or heterocyclic group covalently bonded to the iodine atom of Q through a carbon atom of said cyclic group, X is a carboxylic acid group or a sulfonic acid group, and Z represents a group containing the atoms necessary to form a 5- to 7-membered ring with the remainder of the atoms of said formula.

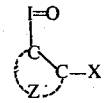
10. A photographic element according to claim 9 wherein said image dye-providing material is an image-dye.

11. A photographic element according to claim 9 wherein said image dye-providing material is associated with a silver halide emulsion.

12. A photographic element according to claim 9 wherein said oxidant has the formula:

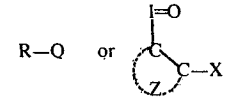
wherein Q is an iodoxy diacetate and R is a group containing a 5- to 7-membered carbocyclic or heterocyclic group covalently bonded to the iodine atom of Q through a carbon atom of said cyclic group.

13. A photographic element according to claim 9 wherein said oxidant has the formula:



wherein X is a carboxylic acid group or a sulfonic acid group and Z represents a group containing the atoms necessary to form a 5- to 7-membered ring with the remainder of the atoms of said formula.

14. A photographic film unit comprising a support having thereon at least one layer containing a silver halide emulsion having associated therewith an image dye-providing material, a layer containing an image-dye mordant, means for discharging an alkaline processing solution within said film unit, and at least one layer containing an oxidant of the formula:



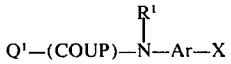
wherein Q is an iodoxy diacetate, R is a group containing a 5- to 7-membered carbocyclic or heterocyclic group covalently bonded to the iodine atom of Q through a carbon atom of said cyclic group, X is a carboxylic acid group or a sulfonic acid group, and Z represents a group containing the atoms necessary to form a 5- to 7-membered ring with the remainder of the atoms on said formula.

15. A photographic film unit according to claim 14 wherein said image-receiving layer is located on a support separate from said layer containing silver halide.

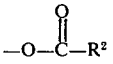
16. A photographic film unit according to claim 14 wherein said image-receiving layer is present on the same support adjacent said layer containing said silver halide emulsion.

17. A photographic film unit according to claim 14 wherein said image dye-providing material is an oxichromic compound.

18. A photographic film unit according to claim 14 wherein said image dye-providing material is an oxichromic developer having the formula:



wherein (COUP) is a photographic color coupler linked to the nitrogen atom through a carbon atom at the coupling position; Ar is an arylene group; X is selected from an amino group, an hydroxyl group or a group having the formula:



wherein R^2 is an alkyl or aryl group; R^1 is a hydrogen atom or a group having the formula:

wherein R^2 is as defined above; and Q^1 is a silver halide developing agent or an oxidizable releasing group.

19. A photographic film unit comprising:

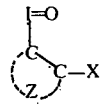
a. a photosensitive element comprising a support having thereon a layer containing a red-sensitive silver halide emulsion having associated therewith a cyan image dye-providing material, a layer containing a green-sensitive silver halide emulsion having associated therewith a magenta image dye-providing material, and a layer containing a blue-sensitive silver halide emulsion having associated therewith a yellow image dye-providing material;

b. an image dye-receiving layer; and

c. means for discharging an alkaline processing composition within said film unit;

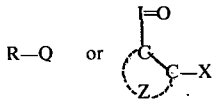
said film unit containing an iodoxyarylene diester.

20. In a photographic element comprising a support and at least one layer containing a silver halide emulsion having associated therewith an image-dye precursor, the improvement comprising at least one layer containing an iodoso compound having the formula:



wherein X is a carboxylic acid group or a sulfonic acid group, and Z represents a group containing the atoms necessary to form a 5- to 7-membered ring with the remainder of the atoms of said formula.

21. In a photographic element comprising a support and at least one layer containing a silver halide emulsion having associated therewith an image-dye precursor, the improvement comprising at least one layer containing an oxidant compound of the formulae:



wherein Q is an iodoxy diacetate, R is a group containing a 5- to 7-membered carbocyclic or heterocyclic group covalently bonded to the iodine atom of Q through a carbon atom of said cyclic group, X is a carboxylic acid group or a sulfonic acid group, and Z represents a group containing the atoms necessary to form a 5- to 7-membered ring with the remainder of the atoms on said formula.

22. A photographic element according to claim 21 wherein said oxidant has the formula:

and Q is an iodoxy diacetate and R is a group containing a 5- to-7-membered carbocyclic or heterocyclic group covalently bonded to the iodine atom of Q through a carbon atom of said cyclic group.

23. A photographic element according to claim 21 wherein said image-dye precursor is an oxichromic compound.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

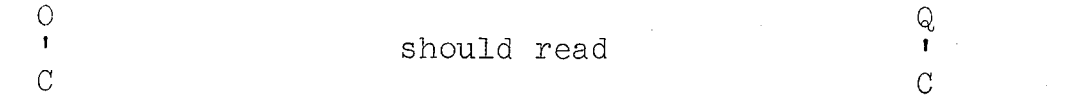
PATENT NO. : 3,928,043

DATED : December 23, 1975

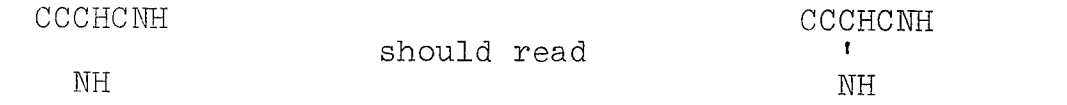
INVENTOR(S) : Samuel John Ciurca, Jr.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 47, before "now", --,-- should be inserted. Column 2, line 47, that part of formula reading:



Column 3, line 33, that part of formula reading "$OCOOH_3$ should read --$OCOCH_3$--. Column 7, line 15, "of" should read --or--. Column 10, under Table 1, that part of Oxichromic Compound A set forth as:



that part of Oxichromic Compound B set forth as:

Column 14, line 21, after "dye", --precursor-- should be inserted.

Signed and Sealed this

thirtieth Day of March 1976

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks