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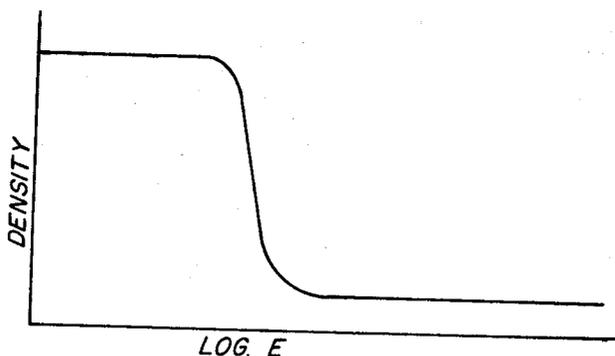
[54] **DIRECT-POSITIVE COMPOSITION CONTAINING INDIVIDUALLY AND DIFFERENTLY FOGGED SILVER HALIDE EMULSIONS**
 16 Claims, 9 Drawing Figs.

[52] U.S. Cl. 96/94,
 96/64

[51] Int. Cl. G03c 1/02

[50] Field of Search..... 96/94, 64,
 101, 103, 107

ABSTRACT: This invention relates to direct-positive, photographic compositions. In one aspect, this invention relates to direct-positive, chemically fogged silver halide compositions having extended exposure latitude. In another aspect, this invention relates to direct-positive, silver halide compositions having the ability to produce discrete, high-contrast steps over the exposure range of the photographic composition.



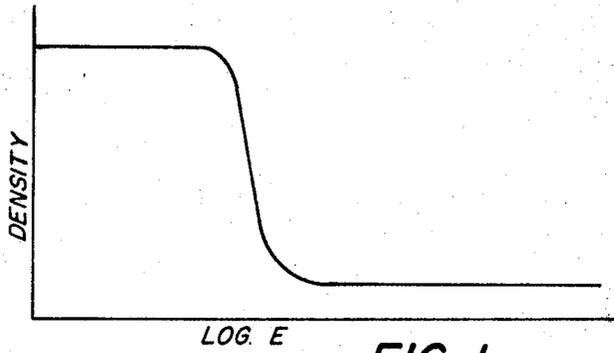


FIG. 1

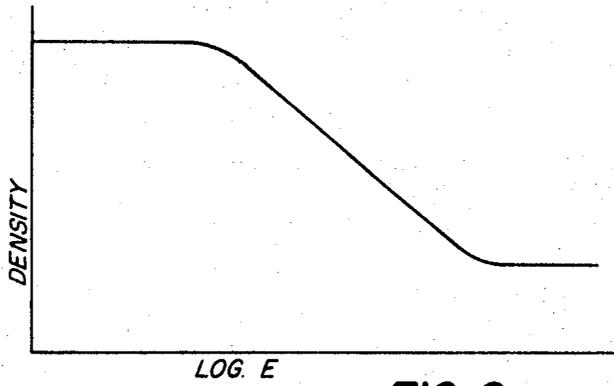


FIG. 2

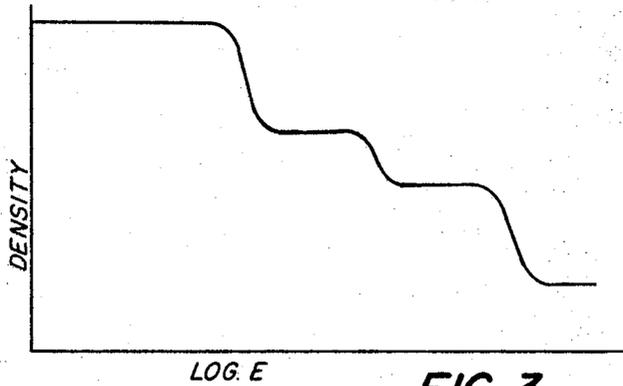


FIG. 3

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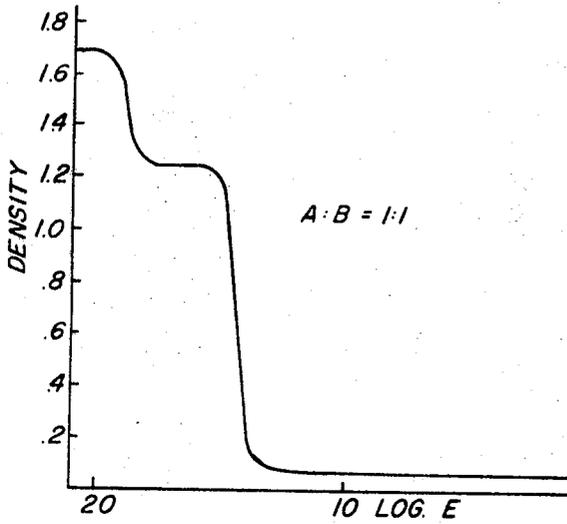


FIG. 4

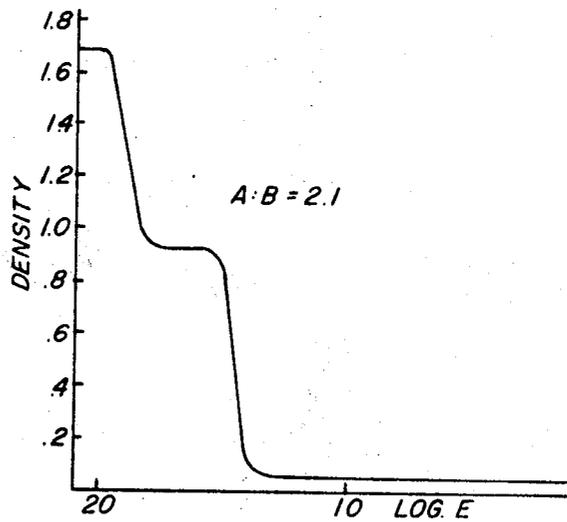


FIG. 5

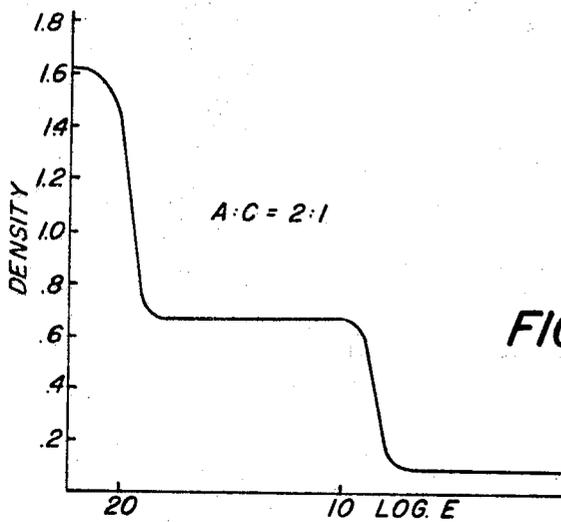


FIG. 6

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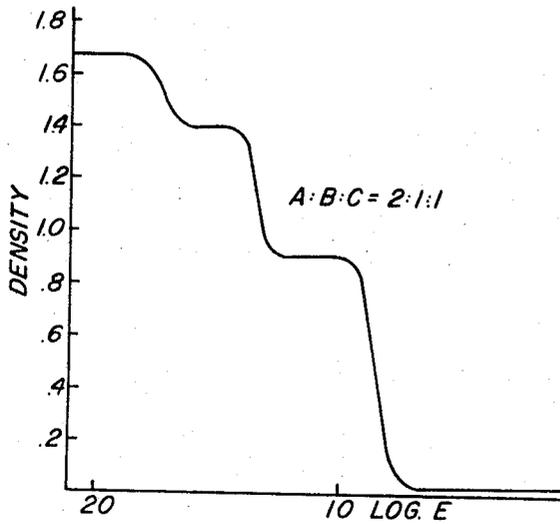


FIG. 7

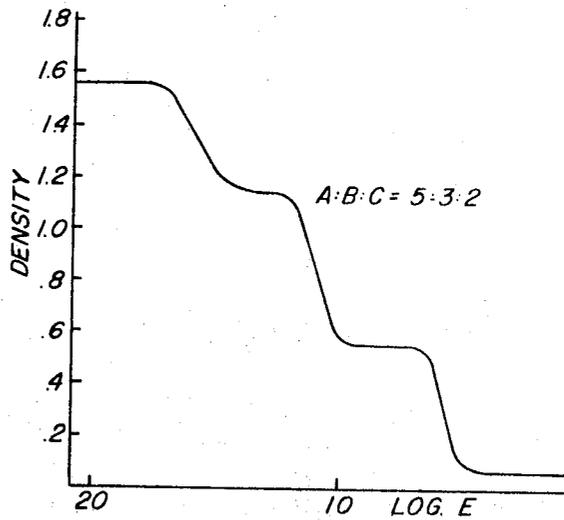


FIG. 8

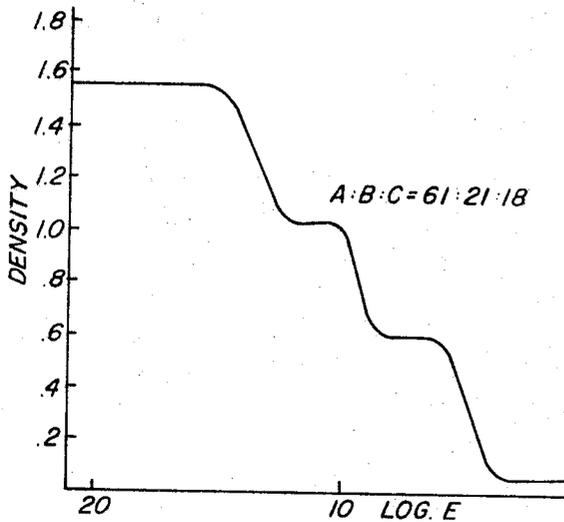


FIG. 9

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DIRECT-POSITIVE COMPOSITION CONTAINING INDIVIDUALLY AND DIFFERENTLY FOGGED SILVER HALIDE EMULSIONS

In the prior art it is generally known that negative-working silver halide compositions can be extended in exposure latitude by incorporating emulsions of various grain size in a photographic element, either in admixture or in separate layers. Moreover, another approach to achieve extended latitude has been to use sensitizing dyes in a portion of the sensitive emulsion, such as in one of the layers of a multilayer element.

With high-speed, direct-positive silver halide emulsions it is more difficult to achieve extended latitude of the exposure curve. Generally the grain size of high-speed, direct-positive emulsions is very small and the admixture of silver halide grains of different sizes would result in Ostwald ripening during the coating operation, resulting in unpredictability and nonuniformity from batch to batch or from the exposure characteristics of the first-coated emulsion to the last of said sample. Moreover, it would be desirable, in some instances, to provide means for tailoring an exposure curve to provide discrete step increments over certain selective exposure ranges. Therefore, improved means for obtaining direct-positive compositions with extended exposure latitude would be desirable.

In accordance with this invention we have now discovered improved means for obtaining "extended exposure latitude" in direct-positive compositions. This objective is accomplished with silver halide compositions comprising mixtures of silver halide grains which have been selectively fogged to various fog levels.

In one preferred embodiment, the silver halide grains are selectively fogged with chemical compounds. More preferably, they are reduction and gold fogged.

In another embodiment, the direct-positive compositions are blue-sensitive, chemically fogged, silver halide emulsions. In one aspect of this embodiment, the silver halide compositions comprise grains having internal centers which promote the deposition of photolytic silver with a fogged silver halide cover or outer region thereon and preferably a halogen-conducting compound contiguous therewith. In another aspect of this invention, the direct-positive compositions comprise fogged silver halide grains and an organic compound which accepts electrons.

In another preferred embodiment of this invention, the direct-positive compositions comprise silver halide grains selectively fogged to provide from two to four distinct, high-contrast steps on a Density vs. Log. Exposure curve.

The direct-positive compositions utilized according to this invention are preferably fogged with chemical fogging agents. In preferred embodiments of this invention, the silver halide composition is chemically fogged by the addition thereto of a reducing agent, such as thiourea dioxide and a compound of a metal more electropositive than silver, such as a gold salt e.g., potassium chloroaurate as described in British Pat. No. 723,019/1955/).

Typical reducing agents that are useful in providing such emulsions include stannous salts, e.g., stannous chloride, hydrazine, sulfur compounds such as thiourea dioxide, certain phosphonium salts such as tetra(hydroxymethyl) phosphonium chloride, amine boranes such as disclosed in U.S. Pat. No. 3,361,564, and the like. Typical useful metal compounds that are more electropositive than silver include gold, rhodium, platinum, palladium, iridium, etc., preferably in the form of soluble salts thereof, e.g., potassium chloroaurate, auric chloride, $(\text{NH}_4)_2\text{PdCl}_4$, and the like.

Useful concentrations of reducing agent and metal compound (e.g., metal salt) can be varied over a considerable range. As a general guideline, good results are obtained using about 0.05 to 40 mg. reducing agent per mole of silver halide, and 0.05 to 15.0 mg. metal compound per mole of silver halide. Best results are obtained at lower concentration levels of both reducing agent and metal compound.

As used herein, and in the appended claims, "fogged" refers to emulsions containing silver halide grains which produce a

density of at least 0.5 when developed, without exposure, for 5 minutes at 68° F. in developer A having the composition set forth below, when the emulsion is coated at a silver coverage of 50 mg. to 500 mg. per square foot.

Developer A

N-Methyl-p-aminophenol sulfate	2.5 g.
Sodium sulfite (anhydrous)	30.0 g.
Hydroquinone	2.5 g.
Sodium metaborate	10.0 g.
Potassium bromide	0.5 g.
Water to make	1.0 l.

According to this invention, extended exposure latitude in direct-positive emulsions is achieved by utilizing in a single photographic element a plurality of said fogged silver halide, direct-print compositions which have been fogged to different fog levels. Generally, the respective silver halide grains which have been fogged to different levels are incorporated in admixture in a single layer; however, they can also be in superposed layers.

If all of the silver halide grains are fogged to a precise level in an aliquot portion of the emulsion, a high-contrast curve such as represented by FIG. 1 can be obtained upon development. If a large number of aliquot portions of the emulsion are fogged to incrementally higher levels and then utilized in a single photographic element, a substantially smooth extended latitude curve such as shown in FIG. 2 can be obtained. In a highly preferred embodiment of this invention, the silver halide grains are selectively fogged to provide an admixture which will provide discrete, high-contrast steps in the exposure curve as represented by FIG. 3.

A photographic element according to this invention comprising an emulsion having silver halide grains fogged selectively to several levels can be utilized to produce a very desirable "continuous tone" image. Photographic elements of this type are preferred for obtaining optimum reproduction of every tone level of the scene being reproduced.

In a specific, highly preferred embodiment according to this invention, the silver halide emulsion comprises silver halide grains fogged to from two to four discrete step levels similar to the three step curve indicated in FIG. 3. Photographic elements comprising compositions of this type are very useful in systems involving the transmission of graphic information from one point to another by transducing the optical information into some form of time-varying signals and, ultimately, reconstituting a spatial optical display. Systems of this type are described in "Source Coding of Image Information" by Bartleson and Witzel, *Photographic Science and Engineering*, vol. 11, No. 4, 1967. It has been found that approximately 80 percent of the intelligence provided by a continuous tone image can be transmitted and reproduced if the continuous tone curve is separated into three discrete, high-contrast steps. This would, in essence, provide a binary system for each of three tone levels. Likewise, after transmission of said data a good reproduction can be obtained using the source data.

In another aspect, direct-positive compositions having stepped curves can be advantageously used in the reproduction of posters. Good detail can be achieved in the highlight areas as well as obtaining good detail and reproduction of weak background areas. Compositions of this type are useful in processes such as the "Leica Person Process" described in *Photo. Dealers Assoc. J.* 1936, 31-35.

In a preferred embodiment, the direct-positive compositions of this invention are blue-sensitive compositions. It is understood that blue-sensitive means that the direct-positive compositions will provide a reversal image when exposed with light in the 350 to 500 millimicron range of the electromagnetic spectrum. The silver halide compositions can also be spectrally sensitized to form reversal images when exposed in other regions of the spectrum such as in the green and red re-

gions. However, they all have the property of being capable of forming a reversal image when exposed with light in the blue region of the visible spectrum. Generally, these emulsions have high photographic speed compared to compositions such as conventional Herschel reversal emulsions.

Typical direct-positive silver halide compositions which can be characterized by the above tests and which are useful in this invention are: (1) emulsions comprising silver halide grains having internal centers which promote the deposition of photolytic silver and an outer region or shell of a fogged insoluble silver salt and preferably a halogen-conducting compound in said emulsion or (2) an emulsion which comprises fogged silver halide grains and an organic compound which accepts electrons, said grains being such that a test portion thereof, when coated as a photographic silver halide emulsion on a support to give a maximum density of at least about 0.5 upon processing for 5 minutes at about 68° F in developer A, has a maximum density which is at least about 30 percent greater than the maximum density of an identical coated test portion which is processed for 6 minutes at about 68° F. in developer A after being bleached for about 10 minutes at about 68° F. in a bleach composition of:

potassium cyanide	50.00 mg.
acetic acid (glacial)	3.47 cc.
sodium acetate	11.49 g.
potassium bromide	119.00 mg.
water to	1.00 liter.

This invention can be practiced with direct-positive emulsions of the type in which a silver halide grain has a water-insoluble silver salt center and an outer shell composed of a fogged water-insoluble silver salt that develops to silver without exposure. These emulsions can be prepared in various ways, such as those described in Berriman U.S. Pat. No. 3,367,778 issued Feb. 6, 1968. For example, the shell of the grains in such emulsions may be prepared by precipitating over the core grains a light-sensitive, water-insoluble silver salt that can be fogged and which fog is removable by bleaching. The shell is of sufficient thickness to prevent access of the developer used in processing the emulsions of the invention to the core. The silver salt shell is surface fogged to make it developable to metallic silver with conventional surface image-developing compositions. The silver salt of the shell is sufficiently fogged to produce a density of at least about 0.5 when developed for 6 minutes at 68° F in developer B below when the emulsion is coated at a silver coverage of 100 mg. per square foot. Such fogging can be effected by chemically sensitizing to fog with the sensitizing agents described for chemically sensitizing the core emulsion, high-intensity light and the like fogging means well-known to those skilled in the art. While the core need not be sensitized to fog, the shell is fogged. Fogging by means of a reduction sensitizer, a noble metal salt such as gold salt plus a reduction sensitizer, a sulfur sensitizer, high pH and low pAg silver halide precipitating conditions, and the like can be suitably utilized. The shell portion of the subject grains can also be coated prior to fogging.

Developer B

N-Methyl-p-aminophenol sulfate	2.5 g.
Ascorbic acid	10.0 g.
Potassium metaborate	35.0 g.
Potassium bromide	1.0 g.
Water to	1.0 l.
pH of	9.6

Before the shell of water-insoluble silver salt is added to the silver salt core, the core emulsion is first chemically or physically treated by methods previously described in the prior art to produce centers which promote the deposition of photolytic silver, i.e., latent image nucleating centers. Such centers can be obtained by various techniques as described in

the Berriman patent referred to above. Silver salt cores containing centers attributable to a metal of group VIII of the periodic table, e.g., palladium, iridium or platinum and the like, are especially useful since these centers also appear to function as electron acceptors. Chemical sensitization techniques of the type described by Antoine Hautot and Henri Sauvenier in *Science et Industries Photographiques*, vol. XX-VIII, Jan., 1957, pages 1 to 23, and Jan. 1957, pages 57 to 65, are particularly useful. Such chemical sensitization includes three major classes, namely, gold or noble metal sensitization, sulfur sensitization, such as by a labile sulfur compound, and reduction sensitization, e.g., treatment of the silver halide with a strong reducing agent which introduces small specks of metallic silver into the silver salt crystal or grain.

In another embodiment, the silver halide emulsions can comprise silver halide grains having centers which promote the deposition of photolytic silver which are either sufficiently small or sufficiently buried within the crystal as to be not accessible to initiate development to a visible image. Silver halide grains of this type can be provided by either using very low concentrations of the sensitizing agent throughout the precipitation or adding the sensitizing agent to the precipitation medium during the initial part of the precipitation whereby the concentration of the sensitizing agent will be lowered significantly by occlusion of the agent in the grains so that continued precipitation would result in lowered concentration of centers for promoting deposition of photolytic silver in the outer regions of each grain.

The practice of this invention is particularly suitable for high-speed direct-positive emulsions comprising fogged silver halide grains and a compound which accepts electrons, as described and claimed in Illingsworth Pat. application, Ser. No. 619,909 and titled "Photographic Reversal Materials III." The fogged silver halide grains of such emulsions are such that a test portion thereof, when coated as a photographic silver halide emulsion on a support to give a maximum density of at least about 1 upon processing for 6 minutes at about 68° F in developer A, has a maximum density which is at least about 30 percent greater than the maximum density of an identical coated test portion which is processed for 6 minutes at about 68° F in developer A after being bleached for about 10 minutes at about 68° F in a bleach composition of:

potassium cyanide	50.00 mg.
acetic acid (glacial)	3.47 cc.
sodium acetate	11.49 g.
potassium bromide	119.00 mg.
water to	1.00 l.

The grains of such emulsions will lose at least about 25 percent and generally at least about 40 percent of their fog when bleached for 10 minutes at 68° F in a potassium cyanide bleach composition as described herein. This fog loss can be illustrated by coating the silver halide grains as a photographic silver halide emulsion on a support to give a maximum density of at least 1.0 upon processing for 6 minutes at about 68° F in developer A and comparing the density of such a coating with an identical coating which is processed for 6 minutes at 68° F in developer A after being bleached for about 10 minutes at 68° F in the potassium cyanide bleach composition. As already indicated, the maximum density of the unbleached coating will be at least 30 percent greater, generally at least 60 percent greater, than the maximum density of the bleached coating.

The silver halides employed in the preparation of the photographic emulsions useful in this invention include any of the photographic silver halides as exemplified by silver chloride, silver bromide, silver bromiodide, silver chlorobromide, silver chlorobromiodide, and the like. Emulsion blends, e.g., blends of silver chloride and silver chlorobromide, can be used. Also, the core of the silver halide grain can be composed of silver halide of different composition than that in the outer shell of the grain.

Silver halide grains having an average grain size less than about 2 microns, preferably less than about 0.5 micron, give particularly good results. The silver halide grains can be regular and can be any suitable shape such as cubic or octahedral, as described and claimed in Illingsworth Pat. application Ser. No. 619,948 and titled "Direct Positive Photographic Emulsions I." Such grains advantageously have a rather uniform diameter frequency distribution, as described and claimed in Illingsworth Pat. application Ser. No. 619,936 titled "Photographic Reversal Emulsions II." For example, at least 95 percent by weight, of the photographic silver halide grains can have a diameter which is within about 40 percent, preferably within about 30 percent of the mean grain diameter. Mean grain diameter, i.e., average grain size, can be determined using conventional methods, e.g., as shown in an article by Trivelli and Smith entitled "Empirical Relations Between Sensitometric and Size-Frequency Characteristics in Photographic Emulsion Series" in *The Photographic Journal*, vol. LXXIX, 1949, pages 330-338. The fogged silver halide grains in these direct-positive photographic emulsions of this invention produce a density of at least 0.5 when developed without exposure for 5 minutes at 68° F in developer A when such an emulsion is coated at a coverage of 50 to about 500 mg. of silver per square foot of support. The photographic silver halides can be coated at silver coverages in the range of about 50 to 500 milligrams of silver per square foot.

In preferred embodiments of this invention, electron acceptors and halogen conductors (sometimes referred to as halogen acceptors) are present in the direct-positive emulsions. When the grains of the silver halide emulsion are substantially free of internal sites for the deposition of photolytic silver, it is essential that an electron acceptor be present in the emulsion if it is to be reversed by blue light.

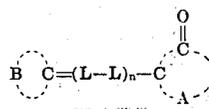
The electron acceptors or halogen conductors which give particularly good results in the practice of this invention can be characterized in terms of their polarographic half-wave potentials, i.e., their oxidation reduction potentials determined by polarography. The electron acceptors useful herein have an anodic polarographic potential and a cathodic polarographic potential which, when added together, give a positive sum. The halogen conductors useful herein have an anodic polarographic potential less than 0.85 and a cathodic polarographic potential which is more negative than -1.0. Preferred halogen conductors have an anodic polarographic potential less than 0.62 and a cathodic polarographic potential which is more negative than -1.3. Cathodic measurements can be made with a 1×10^{-4} molar solution of the electron acceptor in a solvent, for example, methanol which is 0.05 molar in lithium chloride using a dropping mercury electrode with the polarographic half-wave potential for the most positive cathodic wave being designated E_c . Anodic measurements can be made with 1×10^{-4} molar aqueous solvent solution, for example, methanolic solutions of the electron acceptor which are 0.05 molar in sodium acetate and 0.005 molar in acetic acid using a carbon paste of pyrolytic graphite electrode, with the voltammetric half-peak potential for the most negative anodic response being designated E_a . In each measurement, the reference electrode can be an aqueous silver-silver chloride (saturated potassium chloride) electrode at 20° C. 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, 1954; *Polarography*, by Kolthoff and Lingane, 2nd Edition, Interscience Publishers, New York, N.Y. 1952; *Analytical Chemistry*, 36, 2426 (1964) by Elving; and *Analytical Chemistry*, 30, 1576 (1958) by Adams. Signs are given according to IUPAC, Stockholm Convention 1953.

Advantageously, these electron acceptors used herein also provide spectral sensitization such that the ratio of minus blue relative speed to blue relative speed of the emulsion is greater than 7, and preferably greater than 10, when exposed to a tungsten light source through Wratten No. 16 and No. 35 plus 38A filters respectively. Such electron acceptors can be

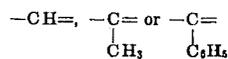
termed "spectrally sensitizing electron acceptors." However, electron acceptors can be used which do not spectrally sensitize the emulsion.

An especially useful class of electron acceptors which can be used in the direct-positive photographic silver halide emulsions and processes of this invention are cyanine dyes, such as the imidazo[4,5-*b*]quinoxaline dyes. Dyes of this class are described in Brooker and Van Lare Belgian Pat. No. 660,253 issued Mar. 15, 1965. In these dyes, the imidazo[4,5-*b*]quinoxaline nucleus is attached, through the two-carbon atom thereof, to the methine chain. Typical good electron-acceptor dyes used in direct-positive emulsions are disclosed in Illingsworth and Spencer Belgian Pat. No. 695,364 granted Sept. 11, 1967.

A preferred class of halogen-conducting compounds useful in this invention is characterized by an anodic half-wave potential which is less than 0.62 and a cathodic half-wave potential which is more negative than -1.3. A preferred class of halogen conductors that can be used in the practice of this invention comprises the spectral sensitizing merocyanine dyes having the formula:



where A represents the atoms necessary to complete an acid heterocyclic nucleus, e.g., rhodanine, 2-thiohydantoin and the like, B represents the atoms necessary to complete a basic nitrogen-containing heterocyclic nucleus, e.g., benzothiazole, naphthothiazole, benzoxazole and the like, each L represents a methine linkage, e.g.,



and n is an integer from 0 to 2, i.e., 0, 1 or 2. Typical halogen-conducting compounds are disclosed in Wise, Belgian Pat. No. 695,361 granted Sept. 11, 1967.

In the preparation of the above photographic emulsions, the electron acceptors, halogen conductors, bromide and iodide salts are advantageously incorporated in the washed, finished silver halide emulsion and should, of course, be uniformly distributed throughout the emulsion. The methods of incorporating such addenda in emulsions are relatively simple and well known to those skilled in the art of emulsion making. For example, it is convenient to add them from solutions in appropriate solvents, in which case the solvent selected should be completely free from any deleterious effect on the ultimate light-sensitive materials. Methanol, isopropanol, pyridine, water, etc., alone or in admixtures, have proven satisfactory as solvents for the electron acceptors and halogen conductors. The type of silver halide emulsions that can be sensitized with these dyes include any of those prepared with hydrophilic colloids that are known to be satisfactory for dispersing silver halides, for example, emulsions comprising natural materials such as gelatin, albumin, agar-agar, gum arabic, alginic acid, etc., and hydrophilic synthetic resins such as polyvinyl alcohol, polyvinyl pyrrolidone, cellulose ethers, partially hydrolyzed cellulose acetate, and the like. The binding agents for the emulsion layer can also contain dispersed polymerized vinyl compounds, such as disclosed, for example, in U.S. Pat. Nos. 3,142,568, 3,193,386, 3,062,674 and 3,220,844, and include the water-insoluble polymers of alkyl acrylates and methacrylates, acrylic acid, sulfoalkyl acrylates or methacrylates and the like.

The invention can be further illustrated by the following examples:

EXAMPLE 1

Three separate regular grain monodispersed silver bromoiodide emulsions having the same average grain size are prepared as described in Illingsworth U.S. Application Ser. No. 619,948, emulsion C of example 1. The three emulsion samples are then separately fogged as follows: sample A is fogged by heating with 0.375 mg./mole of silver of thiourea dioxide for 60 minutes at 65° C, adding 2.0 mg./mole of silver of potassium chloroaurate and continued heating for 40 minutes at 65° C. sample B is fogged by heating with 2.0 mg./mole of silver of thiourea dioxide at 65° C. for 60 minutes, adding 4.0 mg./mole of silver of potassium chloroaurate and continued heating for 52 minutes at 65° C. sample C is fogged by heating with 1.0 mg./mole of silver of thiourea dioxide for 60 minutes at 65° C. and continued heating with 2.0 mg./mole of silver of potassium chloroaurate for 20 minutes at 65° C. 100 mg. of 5-m-nitrobenzylidenerhodanine/mole of silver halide is added to each emulsion as an electron acceptor. A sample of each emulsion is coated on a film support at a coverage of 100 mg. of silver and 250 mg. of gelatin/ft². A sample of each coating is exposed on and intensity scale sensitometer and processed for 6 minutes in an Elon-hydroquinone developer with the following results:

Emulsion	Relative Speed	Contrast	Exposure Latitude in Log E Units
A	1,100	2.04	0.5
B	100	5.00	0.3
C	325	4.00	0.4

0.16 mole of emulsion A, 0.067 mole of emulsion B and 0.092 mole of emulsion C, based on silver content, are blended together. 190 mg. of 5-m-nitrobenzylidenerhodanine/mole of silver halide is added to the emulsion blend as an electron acceptor. The emulsion blend is coated on a film support at a coverage of 100 mg. of silver and 145 mg. of gelatin/ft². A sample of each coating is exposed on an intensity scale sensitometer and processed for 6 minutes in an Elon-hydroquinone photographic developer with the following results:

Relative Speed	Contrast	Exposure Latitude in Log E Units
398	1.18	1.2

It can be seen from the above results that by blending three emulsions having the same grain size which are fogged to different levels, blended together and coated, a direct-positive film is obtained having lower contrast and wider exposure latitude than any of the individual emulsions.

EXAMPLE 2

A pure silver chloride emulsion is prepared using the general method described in example 1 of Berriman U.S. Pat. No. 3,367,778. The pH of the emulsion is adjusted to 6.5 and the pAg to 7.35. To separate aliquots of the emulsion is added thiourea dioxide at 0.4 mg./mole (part A), 1.0 mg./mole (part B) and 3.0 mg./mole (part C). The emulsions, are heated to 65° C. and held for 1 hour prior to cooling to 40° C. This produces emulsions with very high-contrast reversal images with about 0.4 log E speed difference between A and B and between B and C. The speed relationship is A B C. The heat-treated emulsion fractions are mixed in various portions, spectrally sensitized with 200 mg. of 3-carboxymethyl-5 [(3-methyl-2-(3-thiazolylidene) isopropylidene) rhodanine per silver mole and coated on a paper support.

Pt. A	Pt. B	Pt. C	Mole Fraction	
			Ag/ft. ²	Gel/ft. ²
1. 0.5	0.5		180	270
2. 0.67	0.33		180	270
3. 0.67		0.33	180	270
4. 0.50	0.25	0.25	180	270
5. 0.50	0.30	0.20	140	210
6. 0.61	0.21	0.18	140	210

When these coatings are exposed on an Eastman Ib Sensitometer for 1 second to a 500 w. lamp through a continuous wedge and processed for 15 seconds in Kodak Dektol Developer 1:1, excellent stepped reversal curves with flat steps and sharp inflections are obtained.

The sensitometric curves for samples 1-6 are reproduced in FIGS. 4-9 respectively.

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 as described hereinbefore and in the appended claims.

We claim:

1. A direct-positive photographic element comprising a support and coated thereon at least two chemically fogged, direct-positive, silver halide emulsions of substantially the same average wherein one of said chemically fogged, silver halide emulsions is fogged to provide a photographic speed of at least about 0.4 log E greater than another of said chemically fogged, silver halide emulsions.

2. A direct-positive, photographic element according to claim 1 comprising three individual silver halide emulsions which have been individually fogged to substantially different fog levels whereby a Density vs. Log of Exposure curve will exhibit three discrete steps in said curve.

3. A direct-positive, photographic element according to claim 1 wherein said emulsions have been reduction- and gold-fogged.

4. A direct-positive, photographic element according to claim 1 wherein said emulsions fogged to substantially different fog levels are present in admixture in a single layer in said photographic element.

5. A direct-positive, photographic element according to claim 1 wherein each of said fogged emulsions individually has a grain size distribution wherein at least 95 percent, by weight, of the silver halide grains of said emulsions have a size which is within 40 percent of the mean grain size.

6. A direct-positive, photographic element according to claim 1 wherein said fogged, silver halide emulsions comprise an organic electron acceptor which has an anodic polarographic potential and a cathodic polarographic potential which, when added together, give a positive sum.

7. A direct-positive, photographic element according to claim 1 wherein said chemically fogged, silver halide emulsions are blue-sensitive whereby it will provide a reversal image when exposed to blue light, developed, fixed and washed.

8. A direct-positive element according to claim 1 wherein a sufficient number of individually fogged, silver halide emulsions are present in said element to provide extended exposure latitude in said photographic element.

9. A direct-positive element according to claim 1 whereby a Density vs. Log of Exposure curve of said element will exhibit at least two discrete steps in said curve.

10. A direct-positive element according to claim 7 wherein said silver halide emulsions have been reduction- and gold-fogged.

11. In a method of making a chemically fogged, direct-positive silver halide emulsion, the improvement comprising (1) individually chemically fogging at least two separate silver ha-

lide emulsions to form direct-positive silver halide emulsions of substantially different light-exposure sensitivity and (2) forming a composite emulsion from said individually fogged silver halide emulsions.

12. A method according to claim 11 wherein one of said silver halide emulsions is chemically fogged to provide a light-exposure speed at least about 0.4 log E greater than another of said chemically fogged, direct-positive silver halide emulsions.

13. A process according to claim 11 wherein said silver halide emulsions each have 95 percent, by weight, of their constituent silver halide grains within about 40 percent of the

means grain size.

14. A process according to claim 11 wherein said composite emulsion is formed by blending said fogged, silver halide emulsions.

15. A process according to claim 11 wherein each of said separate silver halide emulsions has an average constituent grain of substantially the same size and which is less than 2 microns.

16. A process according to claim 11 wherein said silver halide emulsions are reduction- and gold-fogged.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,615,573 Dated October 26, 1971

Inventor(s) Albert C. Smith, et al.

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

Column 5, line 48, "1 X 10¹⁴" should read --- 1 X 10⁻⁴ ---.

Column 5, line 53, "1 X 10¹⁴" should read --- 1 X 10⁻⁴ ---.

Column 7, line 9, "6500" should read ---65⁰---

Column 7, line 11, "sample" should read ---Sample---

Column 7, line 14, "sample" should read ---Sample---

Column 7, line 67, "emulsions" should read ---emulsions---

In the Claims

Column 8, line 31, after "average" insert ---silver halide grain size---

Column 10, line 1, "means" should read ---mean---

Signed and sealed this 6th day of March 1973.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents