

[54] **SENSITIZING A GRANULAR DISPERSION OF A N-VINYL COMPOUND AND AN ORGANOHALOGENO COMPOUND BY HEAT**

[75] Inventors: **Hiroshi Yamashita; Nobuyoshi Sekikawa; Hisatake Ono**, all of Asaka, Japan

[73] Assignee: **Fuji Photo Film Co., Ltd.**, Minami Ashigara-shi, Kanagawa, Japan

[22] Filed: **June 23, 1972**

[21] Appl. No.: **265,887**

[30] **Foreign Application Priority Data**

June 23, 1971 Japan..... 46-45381

[52] U.S. Cl..... **96/48 R; 96/48 QP; 96/90 R; 250/323**

[51] Int. Cl. **G03c 5/24; G03c 1/52**

[58] Field of Search..... **96/48 R, 90 R, 48 QP; 250/323**

[56]

References Cited

UNITED STATES PATENTS

3,476,562	11/1969	Yamada et al.	96/88
3,510,304	5/1970	Fichter, Jr. et al.	96/90 R
3,607,266	9/1971	Yamada et al.	96/48
3,649,284	3/1972	Price	96/90 R
3,697,276	10/1972	Lewis et al.	96/90 R

Primary Examiner—Norman G. Torchin

Assistant Examiner—Won H. Louie, Jr.

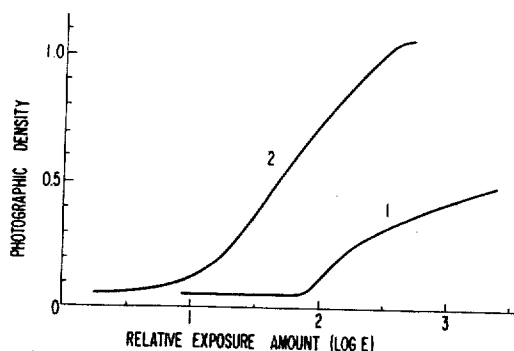
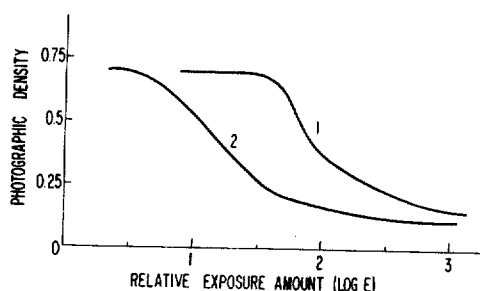
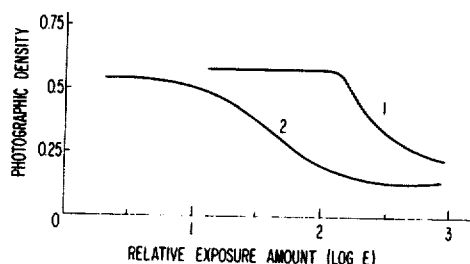
Attorney, Agent, or Firm—Sughrue, Rothwell, Mion, Zinn and Macpeak

[57]

ABSTRACT

The sensitivity of a recording material having dispersed in a hydrophilic binder the fine particles of an organohalogeno compound capable of forming free radicals containing halogen atoms and halogen ions on light exposure and an N-vinyl compound is improved remarkably by heating the recording material, prior to the image exposure, from 35° to 250°C.

26 Claims, 3 Drawing Figures



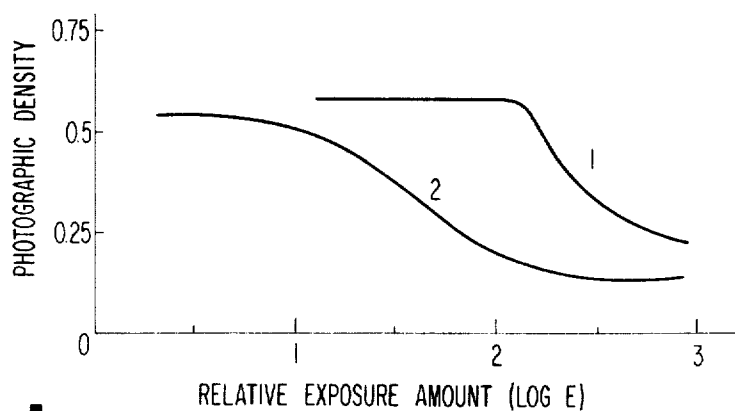


FIG. 1

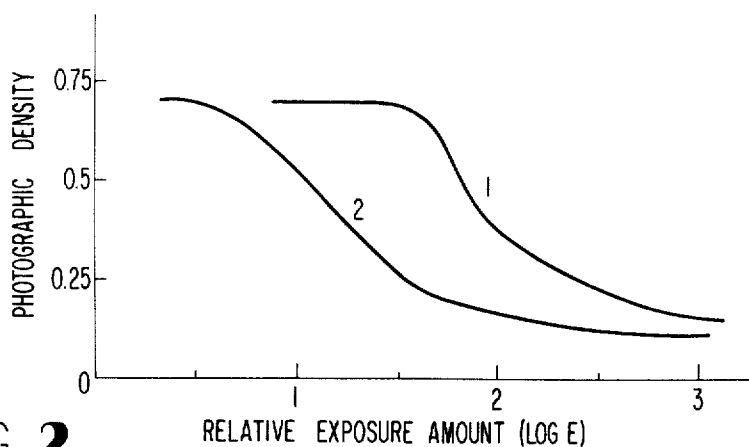


FIG. 2

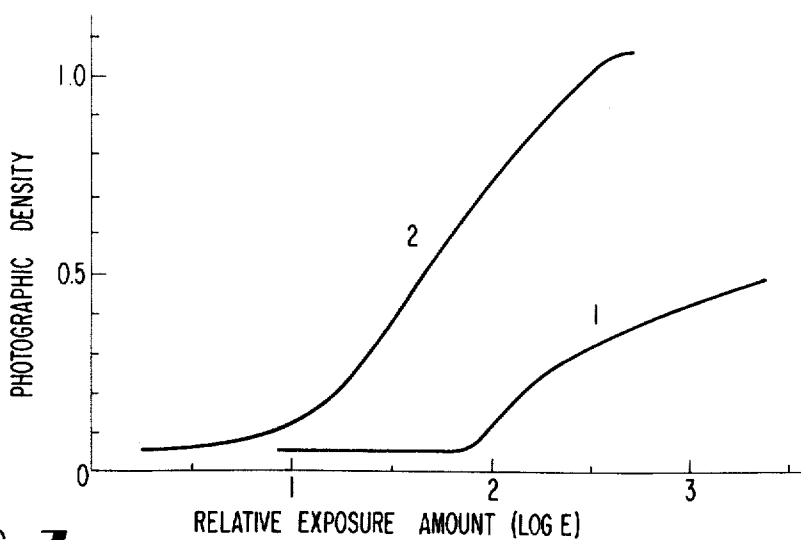


FIG. 3

SENSITIZING A GRANULAR DISPERSION OF A N-VINYL COMPOUND AND AN ORGANOHALOGENO COMPOUND BY HEAT

BACKGROUND OF THE INVENTION

1. Field Of The Invention

The instant invention relates generally to a novel process for sensitizing a recording material capable of recording images thereon due to the action of radiation. More particularly, the invention relates to a novel sensitizing process in forming images on a recording material mainly comprising finely dispersed particular of a N-vinyl compound and an organohalogeno compound in a water-soluble binder.

2. Description Of The Prior Art

Many patents have been issued hitherto in regard to light-sensitive materials containing organohalogeno compounds as the light-sensitive compounds, for instance, many such patents are reviewed in *Insha Kogaku II*, edited by Wada and published by Kyoritsu Shuppan K. K. in 1969 and in J. Kosar, *Light Sensitive Systems*, pages 361 - 380, published by John Wiley & Sons, Inc. in 1965. In many of these patents, the light-sensitive composition is dispersed in a hydrophilic binder in the molecular state.

The light-sensitive materials in which a light-sensitive composition is dispersed in a hydrophilic binder in the fine droplet form are disclosed in the specifications of U.S. Pat. Nos. 3,476,562 and 3,503,745. The latter patent relates to the sensitization of the light-sensitive material by incorporating therein a dye or a dye base. Thus, the sensitizations of such light-sensitive materials have hitherto been made by the use of a dye or a dye base or the incorporation of a polycyclic aromatic hydrocarbon, ferrocene, a hydrazone compound, an anthraquinone derivative, etc.

An object of this invention is to provide a novel sensitizing process using a physical method different from the conventional methods employing chemical sensitizations.

SUMMARY OF THE INVENTION

The process of this invention comprises sensitizing a recording material comprising an organohalogeno compound capable of forming free radical containing halogens and halogen ions due to the action of radiation, an N-vinyl compound dispersed discontinuously in a hydrophilic binder as fine particles for forming an image on exposure to radiation by heating the recording material overall prior to the exposure to radiation forming the image. If desired, a light activator, a sensitizer, a stabilizer and an enhancer can also be present.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

FIGS. 1, 2 and 3 of the accompanying drawings show the photographic characteristic curves obtained when the recording material used in this invention is subjected to the sensitizing process of this invention prior to the formation of an image in comparison with image formation in accordance with a conventional process.

DETAILED DESCRIPTION OF THE INVENTION

The recording material used in this invention is prepared by dispersing discontinuously as fine particles in a hydrophilic binder an organohalogeno compound and an N-vinyl compound, and if desired, together with

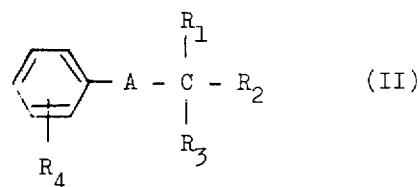
other components such as an activator, a sensitizer, a stabilizer, and an enhancer.

Suitable organohalogeno compounds to be employed in the invention are those compounds represented by the general formulas:

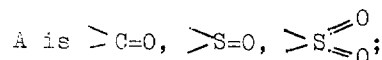


(I)

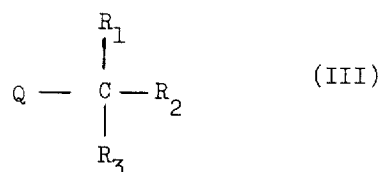
wherein R is a hydrogen atom, a halogen atom, an aryl group, an alkyl group, an aralkyl group or an aroyl group; X is a chlorine atom, a bromine atom or a iodine atom.



wherein R_4 is a hydrogen atom, a chlorine atom, a bromine atom, a iodine atom, a nitro group, an alkyl group, an alkoxyl group;



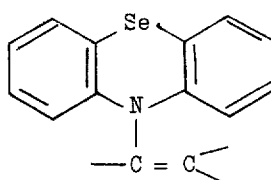
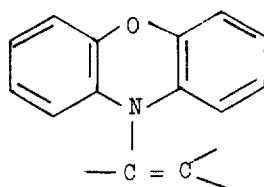
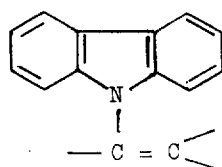
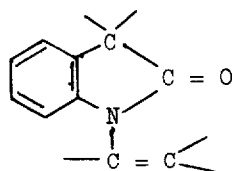
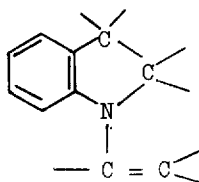
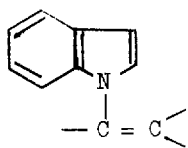
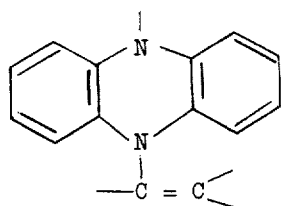
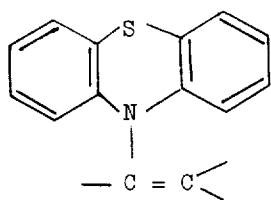
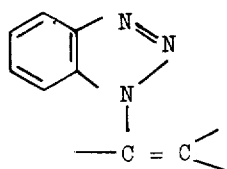
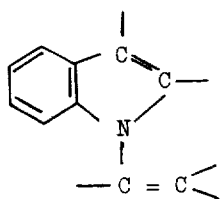
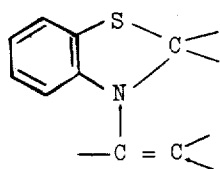
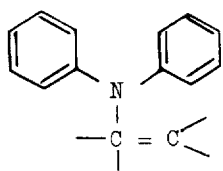
R_1 , R_2 and R_3 each are a hydrogen atom, a chlorine atom or a bromine atom, with at least one of R_1 , R_2 and R_3 being a halogen atom.

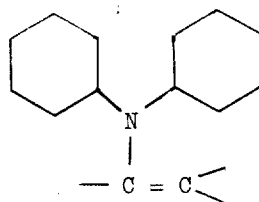
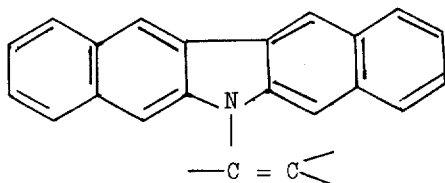
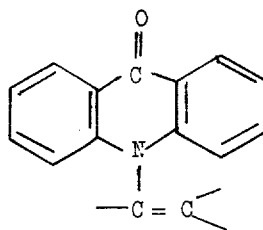
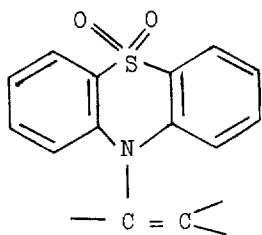


wherein Q is a substituted or unsubstituted heterocyclic compound, R_1 , R_2 and R_3 each are a hydrogen atom, a chlorine atom or a bromine atom, with at least one of R_1 , R_2 and R_3 being a halogen atom, can be suitably employed in the recording material of the present invention.

More specifically, organohalogeno containing compounds, within the above general formula as well as other suitable compounds which are suitable are materials such as carbon tetrachloride, hexabromoethane, pentabromoethane chloranil, bromanil, tetrachlorotetrahydronaphthalene, tetraiodomethane, iodoform, bromoform, trichlorobromomethane, tribromoethanol, tribromoacetic acid, hexachloroethane, p-phenylphenacyl bromide, tetrabromo-o-cresol, tetrabromophenolphthalein, hexabromobenzene, hexachlorobenzene, iodobenzene, carbon tetrabromide, tribromoacetophenone, p-nitrotribromacetophenone, p-bromotribromoacetophenone, tribromophenylsulfone, and hexachloroxylene.

Suitable N-vinyl compounds which can be used in this invention are the compounds having the following structural formulas;





That is to say, N-vinyl compounds having the above skeletal structures can be suitably used in this invention. Suitable specific examples of the N-vinyl compounds are N-vinylcarbazole and N-vinyl-carbazole which may contain substituents on the carbazole ring, e.g., alkyl groups having from 1 to 5 carbon atoms, halogen atoms, hydroxyl groups, alkoxy groups having from 1 to 5 carbon atoms and nitro groups.

The above two components are the fundamental components of the light-sensitive composition used in this invention but the light-sensitive composition may also contain such other components as an activator, a sensitizer, a stabilizer, an enhancer, etc.

The term activator is intended to cover a compound which forms a free radical or ions due to the action of light and there are, for example, the quinones, inorganic halogen compounds, bishexaaryl imidazoles, disulfides, etc., for example, lead bromide, lead iodide, hexa-aryl-bi-imidazoles which may be substituted with an alkyl group or a halogen atom.

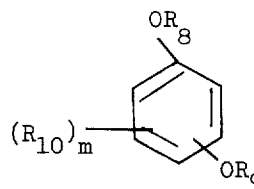
A sensitizer is a compound which sensitizes the coloring reaction and the polymerization reaction and specific examples of such compounds are the anthraquinones, the metallocenes, the hydrazones, the aromatic amine N-oxides, and further photographic spectral sensitizing dye materials being in a dye form or a dye base form such as the azo dyes, diphenylmethane dyes, triphenylmethane dyes, anthraquinone dyes, methine dyes, polymethine dyes, acridine dyes, azine dyes, thiazine dyes, oxazine dyes, styryl dyes, cyanine dyes, carbocyanine dyes, merocyanine dyes, xanthene dyes or their dye bases.

A stabilizer is a material having the action of improving the shelf life of the recording materials. Suitable stabilizers are, for example, hydroquinone, resorcin, catechol, and their derivatives, amides, thiourea and

their derivatives, for example, amides having the general formula



wherein R_5 , R_6 and R_7 are each a hydrogen atom, an alkyl group, an aryl group or an aralkyl group. Examples of suitable amides are formamide, N, N-dimethylformamide, N, N-dimethylacetoamide, and the like. Also, hydroquinone derivatives of the general formula

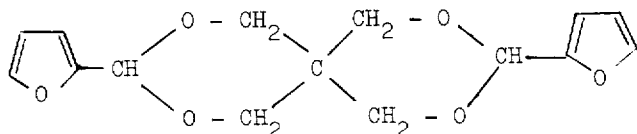
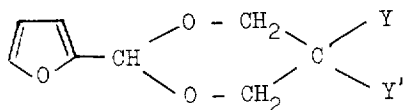
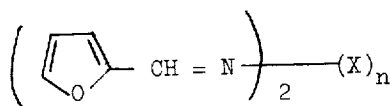


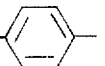
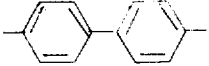
wherein R_8 and R_9 are each a hydrogen atom, an alkyl group, an aryl group, an acetyl group, a hydroxy-alkyl group, a benzoyl group or a



group; and R_{10} is an alkyl group, a hydroxyl group, a halogen atom or an alkoxy group; and m is an integer of 1 - 4. Suitable examples of hydroquinone derivatives are hydroquinone monomethyl ether, hydroquinone diethyl ether, and the like.

An enhancer is a material having the action of changing the color tone of the image, in particular, changing the color of the image to black to increase the density of image. For example, there are furfurylidene compounds represented by the following formulas;



wherein X represents a  group or a  group

and Y and Y' represent a hydrogen atom or an alkyl group having from about 1 to 5 carbon atoms, and n is 0 or 1.

As the binder for these components, hydrophilic high molecular weight compounds can be used. Typical examples of these hydrophilic high molecular weight compounds are gelatin, polyvinyl alcohol, polyvinyl pyrrolidone, casein, starch, carboxymethyl cellulose, gum arabic, hydroxymethyl cellulose, etc.

As the support, there are illustrated paper sheets, glass sheets, plastic films, and metallic sheets.

The components such as the N-vinyl compound and the organohalogeno compound are hydrophobic compounds and when they are dispersed in the hydrophilic high molecular weight compound, they are believed to be distributed discontinuously in the continuous phase of the hydrophilic high molecular weight compound in the form of fine particles of about 0.1 to 20 microns.

For recording images using such a recording material as described above, the following methods are known. That is to say, in the negative type, the recording material is exposed to ultraviolet rays or visible rays in compliance with an image and then, if necessary, heated to provide a colored image. In the positive type the recording material is image-wise exposed to ultraviolet rays or visible rays to cause the polymerization reaction and then the entire surface of the recording material is exposed to ultraviolet rays or visible rays followed, if necessary, by heating to color the unpolymerized portion, whereby a positive image is obtained.

Furthermore, as the results of investigations of various methods of forming images by using such a recording material, it has been found that images can be recorded using high energy radiations such as electron beams, X-rays, gamma rays, etc., in addition to ultraviolet rays and visible rays. Also, the recording material is suitable for recording images using the irradiation of a laser.

It is known that the sensitivity of such a kind of recording material can be increased by using a sensitizer but the inventors have discovered that the sensitivity of the recording material can also be increased physically in addition to chemically. That is to say, when the recording material is heated just before use, the subsequent photo-reaction is greatly accelerated.

As described above, the instant invention provides a novel sensitization process in conducting image formation using the above-described recording material. That is, according to the sensitization process of this invention the entire surface of the recording material is heated prior to the use of the recording material. By conducting such a pre-heating operation, the sensitivity of the recording material can be increased to 2 to 20 times that of the original one.

Also, using the pre-heating operation, the effects of the change in gamma, the increase of image density, etc., can be obtained in addition to the increase in sensitivity.

Although, the phenomenon obtained by pre-heating is not completely understood, it may be explained as follows. For the sake of simplicity it is assumed that only the two components (a) and (b) are dispersed as fine particles. In such a case, it is considered that one or both of the compositions (a) and (b) is activated by the pre-heating and then becomes more reactive when it is irradiated with radiation. Also, when there is a physiochemical co-action between the component (a) and the component (b) and the lowering of melting point occurs or when the melting point of either of the components (a) and (b) is comparatively low, it is believed that the fine particles of them are melted by the heating and the reaction readily proceeds when they are exposed to radiation. When the fine particles are easily melted, the pre-heating effect is particularly remarkable.

The recording material may be heated using a heating plate, heating rollers, an air heating bath, an infrared radiation source, a microwave heating using a commercially available microwave oven, or a hair dryer. However, the use of a heating plate or a heating roller is particularly preferred and the heating temperature can range from about 35° to 250°C, preferably from about 60° to 150°C.

Such a pre-heating effect is particularly remarkable in the system in which the fine particles are discontinuously dispersed although it is possible in principle in the system wherein the components are dispersed in molecular state.

In FIG. 1, FIG. 2, and FIG. 3 of the accompanying drawings the characteristic curve of the pre-heated re-

cording material (Curve 2) and the characteristic curve of a conventional recording material (Curve 1) are shown. It will be understood from these results that the recording materials were sensitized by the pre-heating to 7 - 8 times the original sensitivities. FIG. 1 is the characteristic curves showing the relationship between the logarithmic value (relative value) of the exposure amount E of the first exposure causing the polymerization reaction and the photographic reflection density. Curve 1 in FIG. 1 is the characteristic curve obtained when the recording material was subjected to a white light exposure (first exposure), a red exposure (second exposure), and mercury lamp exposure (third exposure) without employing the pre-heating operation. At the first exposure, the recording material was exposed through a photographic step wedge. Curve 2 is the characteristic curve obtained when the recording material was subjected to the first exposure, the second exposure, and the third exposure after it was pre-heated for 10 seconds at 150°C. As is clear from the curves, by heating the recording material prior to the first exposure, the sensitivity thereof to the first exposure could be increased to 7.4 times the original sensitivity.

FIG. 2 shows the pre-heating effect on the second exposure. That is to say, the graph of the figure shows the relationship between the logarithmic value of the exposure amount in the second exposure and the photographic reflection density. As is shown in the characteristic curves, it will be understood that the recording material was sensitized by the pre-heating (Curve 2) to about 7.1 times that of the non-pre-heated case (Curve 1).

FIG. 3 shows the pre-heating effect to the response of a negative type recording material which had been dye-sensitized. That is to say, the graph of FIG. 3 shows the relationship between the logarithmic value of the exposure amount in the first exposure and the photographic reflection density. Curve 1 is the characteristic curve obtained by subjecting the recording material to a white light exposure (first exposure), a red exposure (second exposure), and heating and Curve 2 is the characteristic curve obtained by subjecting the recording material, after the recording material was heated overall for 30 seconds to 100°C, to the first exposure, the second exposure, and heating. As is clear from the results, the sensitivity of the recording material was increased to 7.8 times by the pre-heating operation.

Now, the invention will be explained in greater detail by reference to the following examples. In these examples, the recording materials were prepared and processed under a red safety lamp for photography or a safety lamp for panchromatic film.

EXAMPLE 1

A mixture of 25 ml of a 16% aqueous gelatin solution and 2.5 g of N-vinylcarbazole was stirred vigorously for 2 minutes at 70°C in a homogenizer (made by Tokushu Kika Kogyo K. K.) to disperse the N-vinylcarbazole in the gelatin as fine particles. Then, 1.5 g of carbon tetrabromide and 0.5 of hexachloroethane were added to the dispersion followed by dispersion. The dispersion was applied to a baryta-coated paper and dried.

The recording material thus prepared was first heated for 15 seconds to 130°C, exposed, then, through a photographic positive image to a photographic lamp of 300 watts at a distance of 25 cm from the lamp for 1.5 seconds, exposed overall to a super high pressure

mercury lamp of 250 watts at a distance of 35 cm from the lamp for one second, and further heated overall for 3 seconds to 100°C, whereby a dark blue positive image was obtained. For the purposes of comparison, the same procedures were followed without employing the pre-heating operation. In the comparison case, the recording material was, first, exposed to a photographic lamp of 300 watts for 10 seconds through a photographic positive image at a distance of 25 cm from the lamp, exposed overall to a super high pressure mercury lamp for 1 second at a distance of 35 cm from the lamp, and then heated for 3 seconds to 100°C, whereby a dark green positive image was obtained. Thus, when the recording material was subjected to the pre-heating operation, the exposure time for the first exposure was about one-seventh of that in the comparison case and also a better image was obtained than the latter case.

EXAMPLE 2

Composition A:	
N-Vinylcarbazole	5 g
4-(p-Dimethylamino)styryl	1 mg
Quinoline (sensitizer)	
Carbon Tetrachloride	3 g
N,N-Dimethylacetamide (stabilizer)	0.2 g
Composition B:	
N-Vinylcarbazole	5 g
4-(p-Dimethylamino)styryl	1 mg
Quinoline (sensitizer)	
Carbon Tetrabromide	0.3 g
bis-Hexaphenyl Imidazole (light activator)	0.5 g
Composition C:	
N-Vinylcarbazole	5 g
Carbon Tetrabromide	3 g
Lead Bromide (light activator)	2 g
Crystal Violet (sensitizer)	2 mg
Composition D:	
N-Vinylcarbazole	5 g
Iodoform	2 g
Pentabromoethane	2 g
Thiourea	0.2 g
Composition E:	
N-vinylindole	5 g
Carbon Tetrabromide	5 g
Leucocrystal Violet	10 mg
Composition F:	
N-Vinyl-2-phenyl Imidazole	5 g
Carbon Tetrabromide	5 g
Furfurylidene Pentaerythritol (enhancer)	1 g
Dimethylformamide (stabilizer)	0.2 g

Six kinds of recording materials were prepared using the above compositions. In each case, a 1% aqueous solution of sodium n-dodecylsulfonate was added to improve the emulsification efficiency.

The results of testing the effects of the pre-heating on these recording materials showed that the sensitivity of the recording materials was increased to 2 to 10 times by the pre-heating.

EXAMPLE 3

N-Vinylcarbazole	4 g
Carbon Tetrabromide	2 g
Iodoform	1 g
Hexachloroethane	0.3 g
Triglycidyl Ether (stabilizer)	0.3 g
4-(p-Dimethylamino)styryl	4 mg
Quinoline (sensitizer)	

The mixture of the above composition was dispersed

by emulsification in 50 ml of a 15% aqueous gelatin solution and by using the dispersion thus prepared, a recording material was produced.

When the recording material produced above was exposed to a photographic lamp of 300 watts (first exposure), exposed to light through a red filter passing light having wave lengths longer than 580 nm (second exposure), and then a super high pressure mercury lamp of 250 watts (third exposure), an image could be formed by a positive system. In this case, by heating the entire surface of the recording material prior to the first exposure, the sensitivity of the recording material could be greatly increased.

FIG. 1 shows the pre-heating effect to the first exposure. Curve 1 in the figure is the characteristic curve of the recording material when it was subjected to the three-stage exposures without being subjected to the pre-heating operation and Curve 2 is the characteristic curve when the recording material was pre-heated for 10 seconds to 150°C prior to the exposure treatments. When the sensitivity was evaluated using the reciprocal of the exposure amount giving a density of (maximum density - 1), the sensitivity was increased to 7.4 times. Also, as is shown in FIG. 1 the minimum density was lowered and the formation of fog was reduced.

FIG. 2 shows the pre-heating effect to the second exposure. Curve 1 is the characteristic curve of the recording material when it was not pre-heated prior to the exposure treatments and Curve 2 is the characteristic curve when the recording material was preheated. The sensitivity was increased to 7.1 times by the pre-heating operation.

EXAMPLE 4

N-Vinylcarbazole	5 g
Carbon Tetrachloride	5 g
4-(p-Dimethylamino)styryl	5 mg
Quinoline	

By using a mixture of the above components, a recording material was prepared. The recording material was exposed to a photographic lamp of 300 watts (first exposure), exposed to red light (second exposure), and heated overall for 3 seconds to 100°C. By these procedures, a negative type response could be obtained. The recording material had been sensitized since it contained the sensitizer but the sensitivity could be increased further by applying the pre-heating operation. The pre-heating effect is shown in FIG. 3, which shows the relationship between the exposure amount in the first exposure and the photographic reflection density. Curve 1 is the characteristic curve when the recording material was not pre-heated and Curve 2 is the characteristic curve when the pre-heating operation was applied. When the sensitivity was evaluated using the reciprocal of the exposure amount giving a density of (fog density + 0.1), the sensitivity was increased to about 8 times by the pre-heating. Also, as is shown in FIG. 3, the D_{max} (maximum density) increased to more than twice with the pre-heating operation and the gamma increased. Moreover, by the pre-heating operation, the color tone of image was improved to provide a blue image having good light fastness.

While the invention has been described in detail and with reference to various embodiments thereof, it will be apparent to one skilled in the art that changes and

modifications can be made therein without departing from the spirit and scope thereof.

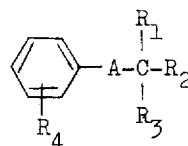
What is claimed is:

1. A method for forming an image on a dried recording material having on a support an N-vinyl compound and an organohalogeno compound forming free radical containing halogens and halogen ions on irradiation dispersed discontinuously as fine particles thereof in a hydrophilic binder which comprises sensitizing said material to irradiation prior to image-wise exposure by heating said dried material overall to a temperature ranging from about 60°C. to 250°C. for a period of time sufficient to increase the sensitivity thereof to image-irradiation from 2 to 20 times, and imagewise exposing said material to irradiation, wherein said N-vinyl compound and said organohalogeno compound are fine particles having a size of from about 0.1 to 20 microns.
2. The method according to claim 1, wherein said recording material additionally contains at least one of an activator, a sensitizer, a stabilizer and an enhancer.
3. The method according to claim 1, wherein said organohalogeno compound is a compound represented by the following general formulas:



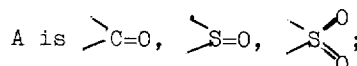
(I)

wherein R is a hydrogen atom, a halogen atom, an aryl group, an alkyl group, an aralkyl group or an aroyl group; X is a chlorine atom, a bromine atom or a iodine atom

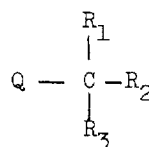


(II)

wherein R_4 is a hydrogen atom, a chlorine atom, a bromine atom, a iodine atom, a nitro group, an alkyl group, an alkoxyl group;



R_1 , R_2 and R_3 each are a hydrogen atom, a chlorine atom or a bromine atom, with at least one of R_1 , R_2 and R_3 being a halogen atom



(III)

wherein Q is a substituted or unsubstituted heterocyclic compound, R_1 , R_2 and R_3 each are a hydrogen atom, a chlorine atom or a bromine atom, with at least one of R_1 , R_2 and R_3 being a halogen atom.

4. The method according to claim 1, wherein said organohalogeno compound containing compound carbon tetrachloride, hexabromoethane, pentabromoethane, chloranil, bromanil, tetrachlorotetrahydronaphthalene, tetraiodomethane, iodoform, bromoform, trichlorobromomethane, tribromoethanol, tribromoacetic acid, hexachloroethane, p-phenylphenacyl bromide, tetra-

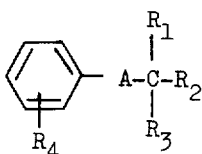
bromo-o-cresol, tetrabromophenolphthalein, hexabromobenzene, hexachlorobenzene, iodobenzene, carbon tetrabromide, tribromoacetophenone, p-nitrotribromoacetophenone, p-bromotribromoacetophenone, tribromophenylsulfone, or hexachloroxylene.

5. The method according to claim 2, wherein said organo halogeno compound is a compound represented by the following general formulas:



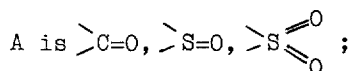
(I)

wherein R is a hydrogen atom, a halogen atom, an aryl group, an alkyl group, an aralkyl group or an aroyl group; X is a chlorine atom, a bromine atom or a iodine atom

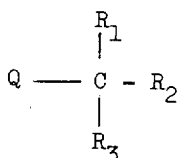


(II)

wherein R₁ is a hydrogen atom, chlorine atom, a bromine atom, a iodine atom, a nitro group, an alkyl group, an alkoxy group;



R₁, R₂ and R₃ each are a hydrogen atom, a chlorine atom or a bromine atom, with at least one of R₁, R₂ and R₃ being a halogen atom



(III)

wherein Q is a substituted or unsubstituted heterocyclic compound, R₁, R₂ and R₃ each are a hydrogen atom, a chlorine atom or a bromine atom, with at least one of R₁, R₂ and R₃ being a halogen atom.

6. The method according to claim 2, wherein said organo halogeno containing compound is carbon tetrachloride, hexabromoethane, pentabromoethane, chlor-

anil, bromanil, tetrachlorotetrahydronaphthalene, tetraiodomethane, iodoform, bromoform, trichlorobromomethane, tribromoethanol, tribromoacetic acid, hexachloroethane, p-phenylphenacyl bromide, tetrabromo-o-cresol, tetrabromophenolphthalein, hexabromobenzene, hexachlorobenzene, iodobenzene, carbon tetrabromide, tribromoacetophenone, p-nitrotribromoacetophenone, p-bromotribromoacetophenone, tribromophenylsulfone, or hexachloroxylene.

7. The method according to claim 1, wherein said N-vinyl compound is N-vinyl-carbazole or a derivative thereof.

8. The method according to claim 2, wherein said N-vinyl compound is N-vinyl-carbazole or a derivative thereof.

9. The method according to claim 1, wherein said organohalogeno compound is carbon tetrabromide, hexabromoethane, iodoform, tribromoacetophenone, or tribromophenylsulfone.

10. The method according to claim 2, wherein said organohalogeno compound is carbon tetrabromide, hexabromoethane, iodoform, tribromoacetophenone, or tribromophenylsulfone.

11. The method according to claim 2, wherein said light activator is a halide of a heavy metal.

12. The method according to claim 2, wherein said sensitizer is a member selected from the group consisting of the anthraquinones, the metallocenes, the hydrazones, the aromatic amine N-oxides, and the spectral sensitizing dye materials selected from the group consisting of the azo dyes, triphenylmethane dyes, anthraquinone dyes, methine dyes, polymethine dyes, acrydine dyes, azine dyes, thiazine dyes, oxazine dyes, styryl dyes, cyanine dyes, carbocyanine dyes, merocyanine dyes, xanthene dyes in their dye form and their dye base form.

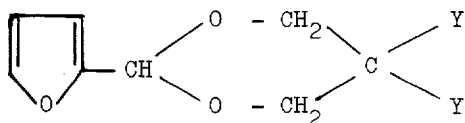
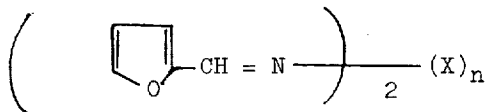
13. The method according to claim 12, wherein said sensitizer is a dye in its dye form or its dye base form.

14. The method according to claim 13, wherein said sensitizer is a styryl dye or a styryl dye base.

15. The method according to claim 14, wherein said sensitizer is 4-(p-dimethylamino)styrylquinoline.

16. The method according to claim 2, wherein said stabilizer is a compound selected from the group consisting of hydroquinone, resorcin, catechol, and their derivatives, amides, thiourea and their derivatives.

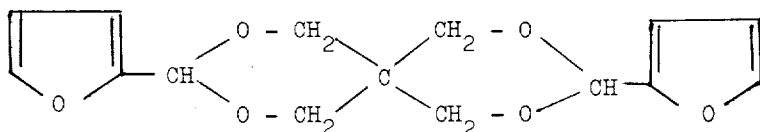
17. The method according to claim 2, wherein said enhancer is a member selected from the group of furfurylidene compounds represented by the following general formulas:

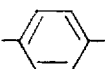
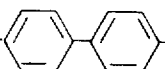


and

15

16



wherein X is , or ,

Y and Y' are hydrogen or alkyl groups each having from 1 to about 5 carbon atoms, and *n* is 0 or 1.

18. The method according to claim 17, wherein said enhancer is difurylidene pentaerythritol.

19. The method according to claim 1, wherein said hydrophilic binder is a water soluble high molecular weight compound selected from the group consisting of gelatin, polyvinyl alcohol, polyvinyl pyrrolidone, casein, starch, carboxymethyl cellulose, gum arabic, said

20. The method according to claim 2, wherein said hydrophilic binder is a water soluble high molecular weight compound selected from the group consisting of gelatin, polyvinyl alcohol, polyvinyl pyrrolidone, casein, starch, carboxymethyl cellulose, gum arabic, and hydroxymethyl cellulose.

21. A method according to claim 1, wherein said support member is a sheet material selected from the group consisting of papers, glasses, plastic films, and thin metal plates.

22. The method according to claim 2, wherein said support is a sheet material selected from the group consisting of papers, glasses, plastic films, and thin metal plates.

23. The method according to claim 1, wherein said irradiation is with ultraviolet rays, visible rays, infrared rays, electron beams, or irradiation from a laser.

24. The method according to claim 1, wherein said heating of said recording material is using a heating plate, a heating roller, or an infrared heater.

25. The method according to claim 1, wherein said N-vinyl compound, said organohalogeno compound and said hydrophilic binder are present in layer form on said support, which layer consists essentially of said N-vinyl compound, said organohalogeno compound and said hydrophilic binder.

26. The method according to claim 1, wherein said heating prior to image-wise exposure is to a temperature ranging from about 60° to 150°C.

* * * * *

35

40

45

50

55

60

65