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METHOD OF PREPARING TRANSFER COPIES AND COMPOSITIONS FOR USE THEREIN

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This invention relates to an improved photographic diffusion-transfer process, a receiving sheet and to compositions for use in the process, and more particularly, to a receiving sheet which ensures formation of dense black images.

The diffusion-transfer process is now a well known photographic process. It is described, for example, in U.S. Patent 2,352,014. In the prior art processes, difficulty has been experienced in obtaining a black image of high density and often in effecting the transfer of the image from the exposed sensitized sheet to the receiving sheet.

It is an object of this invention to provide a diffusion-transfer process whereby a black image of high density is obtained.

It is a further object of this invention to provide a diffusion-transfer process whereby the transfer of the image is facilitated.

It is a still further object of this invention to provide a coating composition for use in forming a receiving layer on the receiving sheet in a diffusion-transfer process which composition contains bismuth nitrate.

Another object of this invention is to provide a novel receiving sheet for use in the diffusion-transfer process.

Other objects and advantages of this invention will appear to persons skilled in the art from the detailed description thereof given below.

We have discovered that by incorporating bismuth nitrate into the layer which constitutes the surface of the receiving sheet, a black image of improved density is produced by the diffusion-transfer process. Also, if a developing agent such as, for example, hydroxylamine hydrochloride, catechol, 1-phenyl-2-methyl - 3 - pyrazolidone or mixtures thereof, is incorporated in either the light-sensitive emulsion, the receiving sheet or the developing composition, or in all three, the transfer process is facilitated.

The light-sensitive element used in our process is of the type employed commercially. Such element comprises a base coated with a silver halide emulsion such as a silver chloride, silver bromide or the like. The emulsion may have small amounts of hydroxylamine hydrochloride added thereto. The amount of hydroxylamine hydrochloride may vary from about .2 to .8 liter of a 5% solution, preferably .5 liter per 10 kilos of emulsion.

The solution used to coat the receiving sheet may be of the usual type to which bismuth nitrate is added as the nucleating agent. Generally, the bismuth nitrate will be employed in an amount of from .5 to 5 grams per liter of solution. Sufficient nitric acid is also added to the solution to ensure that the bismuth nitrate will remain dissolved.

The transferred silver complex image is more readily formed by including in the solution hydroxylamine hydrochloride in an amount of from 10 to 30 grams per liter. The hydroxylamine hydrochloride may be supplanted, if desired, by an equivalent amount of another reducing agent such as catechol, hydroquinone or 1-phenyl-2-methyl-3-pyrazolidone. For the rest, the solution contains the usual adjuncts such as a water soluble colloid, i.e., gelatin, PVA, methyl cellulose or the like, an alkali metal thiocyanate, i.e., potassium thiocyanate, an alkali metal sulfite, i.e., sodium sulfite, an alkali metal thiosulfate, i.e., hypo, and preferably a wetting agent such as dodecyl toluene sulfonate, lauryl sulfate or the like.

The developer used for developing the exposed light-sensitive emulsion and effecting the transfer of the silver complex contains an alkali metal sulfite, i.e., sodium sulfite, an alkali metal hydroxide, i.e., sodium hydroxide, and a photographic black and white reducing agent such as hydroxylamine hydrochloride, catechol, hydroquinone, 1-phenyl-2-methyl-3-pyrazolidone or the like.

The desired density in the receiving sheet can be obtained when using bismuth nitrate as the sole nucleating agent. Bismuth nitrate alone forms a black image. We prefer, however, to use with the bismuth nitrate an amount of stannous chloride since optimum results are thus achieved. If stannous chloride is used alone, it gives a brown image. When used with bismuth nitrate, an image is obtained which has optimum density. This is the reason for our preference for the combination of bismuth nitrate and stannous chloride. The stannous chloride when used will be employed in an amount of 3 to 10 grams per liter of solution.

The carrier used for both the light-sensitive layer and for the receiving layer may be either photographic paper base or clear film such as cellulose acetate or the like.

The following example illustrates our novel method. It is to be understood, however, that this example is given by way of illustration and not by way of limitation.

Example

A. *Negative Material.*—To a silver chloride emulsion containing approximately 13 moles of silver halide per 100 kilos was added 0.50 liter of hydroxylamine hydrochloride (5% aqueous) per 10 kilos of emulsion. This was coated on a suitable carrier such as a photographic paper base so as to deposit 1.0–1.5 grams of Ag per square meter.

B. *Receiving sheet.*—To a 5% polyvinyl alcohol solution held in a liquid state were added per 10 liters the following materials:

Hydroxylamine hydrochloride	grams	200
Potassium thiocyanate	do	200
Sodium sulfite	do	100
Sodium thiosulfate	do	1.5
Bismuth nitrate (2% aqueous with sufficient nitric acid to hold in solution)	cc	500
Stannous chloride (5% in methanol)	do	1000
Dodecyl toluene sulfonate (10%)	do	400

This was coated on a suitable carrier such as a document type photographic base or a clear film base prepared to receive this coating.

The Negative Material A was exposed reflexwise to the material to be copied and then brought into intimate contact with the Receiving Sheet B in the presence of a thin layer of developer of the following formulation:

Sodium sulfite	grams	66.0
Sodium hydroxide	do	39.0
Hydroxylamine hydrochloride	do	5.0
Water	cc	1000.0

After a period of 2 to 8 seconds, the two sheets were stripped apart to yield a dense image on the receiving sheet of the subject matter copied by the negative material.

Modifications of this invention will occur to persons skilled in the art. We, therefore, do not intend to be limited in the patent granted except as necessitated by the appended claims.

We claim:

1. A photographic diffusion-transfer reversal process which comprises exposing to light a photographic element having a light-sensitive emulsion layer thereon comprising silver halide and a colloid to form an image thereon and contacting said image with a receiving layer compris-

ing a colloid, a silver halide developing agent and bismuth nitrate in the presence of a silver halide developing solution and a silver halide solvent.

2. A photographic diffusion-transfer reversal process as recited in claim 1 wherein said receiving layer also contains stannous chloride.

3. A photographic diffusion-transfer reversal process as recited in claim 1 wherein said developing solution contains an agent selected from the group consisting of hydroxylamine hydrochloride, catechol and 1-phenyl-2-methyl-3-pyrazolidone.

4. A photographic diffusion-transfer reversal process as recited in claim 3 wherein the developing solution contains hydroxylamine hydrochloride.

5. A photographic light-insensitive receiving element having an area suitable for receiving an image in a diffusion-transfer reversal process comprising a base and a coating on said base containing, in said image receiving area, bismuth nitrate as obtained from an aqueous solution acidified with sufficient nitric acid to maintain said bismuth nitrate in solution.

6. A photographic receiving element as recited in claim 5 wherein said coating comprises stannous chloride.

7. A photographic light-insensitive receiving element suitable for receiving an image in a diffusion-transfer reversal process comprising a base having a coating thereon comprising a water soluble colloid, hydroxylamine hydrochloride, an alkali metal thiocyanate, an alkali metal sulfite, an alkali metal thiosulfate, bismuth nitrate and stannous chloride.

8. A photographic light-insensitive receiving element suitable for receiving an image in a diffusion-transfer reversal process comprising a base having a coating thereon comprising polyvinyl alcohol, hydroxylamine hydrochloride, potassium thiocyanate, sodium sulfite, sodium thiosulfate, bismuth nitrate, stannous chloride and the sodium salt of dodecyl toluene sulfonate.

9. A photographic receiving element as recited in claim 8 wherein the base is photographic paper.

10. A photographic light insensitive receiving element for an area suitable for receiving an image in a diffusion-transfer reversal process comprising a base and a coating on said base containing bismuth nitrate, stannous chloride and a silver halide developing agent as obtained from an aqueous solution acidified with sufficient nitric acid to maintain said bismuth nitrate in solution.

11. A photographic diffusion-transfer reversal process which comprises exposing to light underneath a pattern a light-sensitive photographic silver halide emulsion to form an image therein and contacting in the presence of a silver halide developing agent and a silver halide solvent a receiving layer comprising a colloid containing bismuth nitrate, transferring a silver salt complex to the receiving layer and nucleating said complex in said layer with said bismuth nitrate.

12. The process as defined in claim 11 wherein the bismuth nitrate is acidified with nitric acid.

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