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HEAT-SENSITIVE SHEET MATERIAL

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ABSTRACT OF THE DISCLOSURE

Colored sheet material, preferably in clear film form, contains an amine-reactive dye and a tetralkylammonium cyanoacetate salt dissolved in a binder. When subjected to a thermographically induced heat-pattern the color is permanently diminished or destroyed, producing a visible image and, when using the preferred film product, a negative projection transparency.

This invention relates to heat-sensitive copy-sheets useful in the thermographic copying of differentially radiation-absorptive graphic originals. While not restricted thereto, the invention in a preferred embodiment consists of a transparent colored film which is at least changed in color and preferably rendered colorless at heated image areas, whereby to provide a negative projection transparency.

The copy-sheet consists generally of a carrier or support having on one surface a coating of a colored amine-reactive dye and a tetraalkylammonium cyanoacetate salt dissolved in a film-forming non-reactive binder. Paper is useful as a carrier but transparent heat-resistant films, of which Mylar polyester film is an excellent example, are preferred; or the film-forming binder may itself serve as a carrier. Low concentrations of the dye are sufficient to provide good color contrast while still permitting color projection and facilitating color change or disappearance of color. Polyvinyl chloride-acetate is a preferred binder material, both the dye and the salt in the amounts used being fully soluble therein to provide a clear colored non-light-diffusing film. Polyvinyl acetate, ethyl cellulose and cellulose acetate are also useful.

In an example, a thin transparent Mylar polyester film is coated over one surface with a three mil layer of a composition containing 0.075 gm. of Genacryl Red 6B (Color Index 48020) and two drops of a solution, of one gram of tetraethylammonium cyanoacetate in two grams of 95% ethyl alcohol, in five grams of a solution of ten grams of VYHH polyvinyl chloride-acetate in 90 grams of methyl ethyl ketone. The dry coating is a clear intense magenta. The film is placed against a printed original which is then briefly exposed to intense infra-red radiation in a thermographic copying machine. The areas of the film corresponding to the printed areas are bleached and rendered clear and transparent. Projection from an overhead projector produces a clear white image against a magenta background on the projection screen. No apparent change is noted after several hours of image projection.

In another example the magenta dye is replaced with a mixture of 0.025 gm. of Color Precursor No. 1 and 0.100 gm. of dichloromaleic acid to produce a cyan colored film which yields a clear colorless image. As the acid component may be used a chemically equivalent

amount of any organic acid having a pKa value less than 4.0. Another color precursor which may be similarly acidified to provide a useful color body is bis-(4-dimethylaminophenyl)-carbinol. Similarly, substitution of Genacryl Yellow 5GF (CI 48065) for the magenta dye produces an intense yellow film and a clear colorless image. These several films may therefore be combined to provide any desired image or background color or combination of colors.

Other color bodies which have been found useful in the practice of the invention include Genacryl Pink 6G (CI 48015), and acidified Color Precursors X–4405 and X–4406. These and other effective color bodies are identified, for the purposes of this invention, as decolorizable by brief heating in dilute solution in an inert solvent in the presence of a small amount of a mixture of one mole of tetrabutylammonium cyanoacetate and four moles of cyanoacetic acid.

The characterizing test is run as follows. A least amount of the color body sufficient to give a distinctive color to the solution is dissolved in 2½ ml. of 3-methylsulfolane. To the solution is added one drop of one molal solution of cyanoacetic acid and two drops of one-tenth molal solution of tetrabutyl ammonium hydroxide (2.5 gm. of the reagent in 90 gm. of dioxane and 7.5 gms. of methanol). The solution is heated at 150° C. in a closed vial. A gross change in color, or disappearance of color, within not more than four minutes shows the color body to be effective for the purposes of this invention.

Tetramethyl ammonium cyanoacetate and tetraethyl ammonium cyanoacetate are preferred salts for use in the sheet materials of the invention. Other useful but somewhat less effective salts include tetramethyl guanidinium cyanoacetate, tetramethylammonium sec-butyl cyanoacetate, diphenylguanidinium cyanoacetate, methylenediamine cyanoacetate, octadecyl dimethyl ammonium cyanoacetate. More generally, there is used a salt of a moderately strong organic nitrogenous base, having a pKb value no greater than about 4.0 and a boiling point of at least about 100° C. or preferably 150° C., and cyanoacetic acid or an alpha-alkyl-substituted cyanoacetic acid. However the tetraalkylammonium cyanoacetates are readily available, produce rapid and complete decolorization of the most useful color bodies, and are greatly preferred.

What is claimed is as follows:

1. A heat-sensitive copy-sheet including a heat-decolorizable color layer containing, in solution in a non-reactive film-forming binder, (a) a salt of an organic nitrogenous base, having a pKb value no greater than about 4.0 and a boiling point of at least about 100° C., and cyanoacetic acid or alpha-alkyl-substituted cyanoacetic acid, and (b) an amine-reactive color body characterized by its ability to undergo rapid reduction in color in solution in an inert solvent on heating in presence of a reactant solution containing a 1:4 molal ratio of tetrabutylammonium cyanoacetate and cyanoacetic acid.

2. Copy-sheet of claim 1 wherein said salt is a tetraalkylammonium cyanoacetate.

3. Copy-sheet of claim 1 wherein said color layer is transparent and non-light-diffusing.

4. Copy-sheet of claim 3 wherein said layer is supported on a transparent heat-resistant carrier film.

5. Copy-sheet of claim 4 wherein said color body is Genacryl Red 6B, Color Precursor No. 1 acidified with

an organic acid having a pKa value less than about 4.0, or Genacryl Yellow 5GF.

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