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3,627,525

BIS(DIALKYLAMINOARYL) ALKANOL ORGANIC PHOTOCONDUCTORSJerome J. Looker and Charles J. Fox, Rochester, N.Y.,
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9 Claims

ABSTRACT OF THE DISCLOSURE

Bis(dialkylaminoaryl) alkanol compounds are useful as organic photoconductors in electrophotographic systems.

This invention relates to electrophotography, and in particular to photoconductive compositions and elements.

The process of xerography, as disclosed by Carlson in U.S. 2,297,691, employs an electrophotographic element comprising a support material bearing a coating of a normally insulating material whose electrical resistance varies with the amount of incident electromagnetic radiation it receives during an imagewise exposure. The element, commonly termed a photoconductive element, is first given a uniform surface charge, generally in the dark after a suitable period of dark adaptation. It is then exposed to a pattern of actinic radiation which has the effect of differentially reducing the potential of this surface charge in accordance with the relative energy contained in various parts of the radiation pattern. The differential surface charge or electrostatic latent image remaining on the electrophotographic element is then made visible by contacting the surface with a suitable electroscopic marking material. Such marking material or toner, whether contained in an insulating liquid or on a dry carrier, can be deposited on the exposed surface in accordance with either the charge pattern or discharge pattern as desired. Deposited marking material can then be either permanently fixed to the surface of the sensitive element by known means such as heat, pressure, solvent vapor, or the like, or transferred to a second element to which it can similarly be fixed. Likewise, the electrostatic latent image can be transferred to a second element and developed there.

Various photoconductive insulating materials have been employed in the manufacture of electrophotographic elements. For example, vapors of selenium and vapors of selenium alloys deposited on a suitable support and particles of photoconductive zinc oxide held in a resinous, film-forming binder have found wide application in the present-day document copying applications.

Since the introduction of electrophotography, a great many organic compounds have also been screened for their photoconductive properties. As a result, a very large number of organic compounds have been known to possess some degree of photoconductivity. Many organic compounds have revealed a useful level of photoconduction and have been incorporated into photoconductive compositions.

Typical of these organic photoconductors are the triphenylamines and the triarylmethane leuco bases. Optically clear photoconductor-containing elements having desirable electrophotographic properties can be especially useful in electrophotography. Such electrophotographic elements can be exposed through a transparent base if desired, thereby providing unusual flexibility in equipment design. Such compositions, when coated as a film or layer on a suitable support, also yield an element which is reusable; that is, it can be used to form subsequent images after residual toner from prior images has been removed by transfer and/or cleaning. Thus far, the se-

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lection of various compounds for incorporation into photoconductive compositions to form electrophotographic layers has proceeded on a compound-by-compound basis. Nothing as yet has been discovered from the large number of different photoconductive substances tested which permits effective prediction, and therefore selection of the particular compounds exhibiting the desired electrophotographic properties.

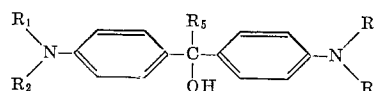
It is, therefore, an object of this invention to provide a novel class of photoconductors having high photosensitivity when electrically charged.

It is another object to provide novel photoconductor-containing compositions which exhibit high electrical speeds.

It is a further object of the invention to provide an improved process utilizing the novel photoconductors described herein.

These and other objects of the invention are accomplished by employing a tetra-substituted methane as a photoconductor. Two of the substituents of the tetra-substituted methane are dialkylaminoaryl groups, the third substituent is a hydroxy group and the fourth substituent is either an alkyl group, a cycloalkyl group, a diphenylenemethano group or a heterocyclic group. It has been found that, by using such compounds as photoconductors in electrophotographic elements, high quality images are reproduced from image-bearing originals. The photoconductors of the invention have significantly higher speeds and improved stability with respect to conversion to the corresponding ketone compared to those related compounds having one or no dialkylaminoaryl substituent or no hydroxyl group substituted on a central carbon such as those described in U.S. Pat. 3,274,000.

The preferred bis(dialkylaminoaryl) alkanol compounds useful as photoconductors in this invention are characterized by the following formula:



wherein R₁, R₂, R₃ and R₄ each represent a lower aliphatic alkyl group having 1 to 8 carbon atoms such as a methyl group, a propyl group, an ethyl group, a pentyl group, a hexyl group, an isobutyl group, a 3-methylpentyl group, an octyl group, etc.; R₅ represents any of the following substituents:

(1) An aliphatic alkyl group having 1 to 18 carbon atoms, e.g., methyl, ethyl, propyl, butyl, isobutyl, octyl, dodecyl, etc. including a substituted alkyl group having 1 to 18 carbon atoms such as

(a) alkoxyalkyl e.g., ethoxypropyl, methoxybutyl, propoxymethyl, etc.,

(b) aryloxyalkyl e.g., phenoxyethyl, naphthoxymethyl, phenoxypropyl, etc.,

(c) aminoalkyl e.g., aminobutyl, aminoethyl, aminoethyl, aminopropyl, etc.,

(d) hydroxyalkyl e.g., hydroxypropyl, hydroxyoctyl, hydroxymethyl, etc.,

(e) aralkyl e.g., benzyl, phenethyl, etc.,

(f) alkylaminoalkyl e.g., methylaminopropyl, methylaminoethyl, etc., and also including dialkylaminoalkyl e.g., diethylaminoethyl, dimethylaminopropyl, dipropylaminoethyl, etc.,

(g) arylaminoalkyl, e.g., phenylaminoalkyl, diphenylaminoalkyl, N-phenyl-N-ethylaminopentyl, N-phenyl-N-ethylaminohexyl, naphthylaminomethyl, etc.,

(h) nitroalkyl, e.g., nitrobutyl, nitroethyl, nitrophenyl, etc.,

(i) cyanoalkyl, e.g., cyanopropyl, cyanobutyl, cyanoethyl, etc.,

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- (j) haloalkyl, e.g., chloromethyl, bromopentyl, chlorooctyl, trifluoromethyl, etc.,
 (k) alkyl substituted with an acyl group having the formula



wherein R is hydroxy, etc., hydrogen, aryl, e.g., phenyl, naphthyl, etc., lower alkyl having 1 to 8 carbon atoms e.g., methyl, ethyl, propyl, etc., amino including substituted amino e.g., diloweralkylamino, lower alkoxy having 1 to 8 carbon atoms e.g., butoxy, methoxy, etc., aryloxy e.g., phenoxy, naphthoxy, etc.,

(2) A cycloalkyl group having 4 to 8 carbon atoms in the cyclic nucleus e.g., cyclobutyl, cyclohexyl, cyclopentyl, etc. including a substituted cycloalkyl group such as

- (a) alkoxy cycloalkyl e.g., ethoxy cyclohexyl, methoxy cyclobutyl, propoxy cyclohexyl, etc.,
 (b) aryloxy cycloalkyl, e.g., phenoxy cyclohexyl naphthoxy cyclohexyl, phenoxy cyclopentyl, etc.,
 (c) aminocycloalkyl, e.g., aminocyclobutyl, aminocyclohexyl, aminocyclopentyl, etc.,
 (d) hydroxycycloalkyl e.g., aminocyclohexyl, hydroxycyclopentyl, hydroxycyclobutyl, etc.,
 (e) arylcycloalkyl e.g., phenylcyclohexyl, phenylcyclobutyl, etc.,
 (f) alkylaminocycloalkyl e.g., methylaminocyclohexyl, methylaminocyclopentyl, etc. and also including dialkylaminocycloalkyl e.g., diethylaminocyclohexyl, dimethylaminocyclobutyl, dipropylaminocyclooctyl, etc.,
 (g) arylaminocycloalkyl, e.g., phenylaminocyclohexyl, diphenylaminocyclohexyl, N-phenyl-N-ethylaminocyclopentyl, N-phenyl-N-methylaminocyclohexyl, naphthylaminocyclopentyl, etc.,
 (h) nitrocycloalkyl, e.g., nitrocyclobutyl, nitrocyclohexyl, nitrocyclopentyl, etc.,
 (i) cyanocycloalkyl, e.g., cyanocyclohexyl, cyanocyclobutyl, cyanocyclopentyl, etc.
 (j) halocycloalkyl e.g., chlorocyclohexyl, bromocyclopentyl, chlorocyclooctyl, etc.,
 (k) cycloalkyl substituted with an acyl group having the formula



wherein R is hydroxy, hydrogen, aryl e.g., phenyl, naphthyl, etc., amino including substituted amino e.g., diloweralkylamino, loweralkoxy having 1 to 8 carbon atoms e.g., butoxy, methoxy, etc., aryloxy, e.g., phenoxy, naphthoxy, etc., lower alkyl having 1 to 8 carbon atoms e.g., methyl, ethyl, propyl, butyl, etc.; or

(3) A heterocyclic group including a substituted heterocyclic group containing 5 to 6 members in the hetero nucleus and including at least one sulfur, selenium, oxygen or nitrogen atom such as a thienyl group e.g., a benzothienyl group, a pyrrolyl group, e.g., a nitropyrrolyl group, a pyrrolidinyl group e.g., a prolyl group, a pyrrolinyl group, a benzopyrrolyl group e.g., an indolyl group, a carbazoyl group, a furyl group e.g., a furfuryl group, a benzofuryl group etc., a pyridyl group, e.g., a halopyridyl group, an aminopyridyl group, a hydroxypyridyl group, an alkylpyridyl group, a nitropyridyl group etc., a piperidyl group, a quinolyl group, an acridinyl group, a pyranol group, a benzopyranyl group, a pyrazolyl group, an oxazolyl group, a thiazolyl group, etc.; or

(4) A diphenylenemethano group e.g. fluorenyl including a substituted diphenylenemethano group e.g. an alkylfluorenyl such as 2-methylfluorenyl, 2-ethyl-7-methylfluorenyl, 2,7-dimethylfluorenyl, 2,7-diethylfluorenyl, 2-propylfluorenyl, 2-butylfluorenyl, 2,7-dipropylfluorenyl, 2,7-dibutylfluorenyl, 2-propyl-7-butylfluorenyl, 2-methyl-7-propylfluorenyl, 2-methyl-7-butylfluorenyl, 2-ethyl-7-propylfluorenyl, 2-ethyl-7-butylfluorenyl, 2-pentylfluorenyl, 2,7-dipentylfluorenyl, 2-pentyl-7-methylfluorenyl, 2-pentyl-

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7-ethylfluorenyl, 2-pentyl-7-propylfluorenyl, 2-pentyl-7-butylfluorenyl, etc.; a halo fluorenyl such as 2,7-dibromo fluorenyl, 2,7-dichlorofluorenyl, 2-chloro-7-methylfluorenyl, etc. The preferred substituent for R is a lower alkyl group having 1 to 8 carbon atoms.

Typical compounds which belong to the herein described general class of photoconductive materials include the following compounds listed in Table I below.

TABLE I

- (I) Bis(4-dimethylaminophenyl)benzylmethanol
 (II) Bis(4-diethylaminophenyl)benzylmethanol
 (III) Bis(4-dipropylaminophenyl)benzylmethanol
 (IV) Bis(4-dimethylaminophenyl)fluorenylmethanol
 (V) Bis(4 - dimethylaminophenyl)trifluoromethylmethanol
 (VI) 1,1 - bis(4 - dimethylaminophenyl)-1-hydroxyethane
 (VII) 1,1 - bis(4 - dimethylaminophenyl)-1-hydroxypropane
 (VIII) 1,1 - bis(4 - dimethylaminophenyl)-1-hydroxybutane
 (IX) Bis(4-dimethylaminophenyl)cyclohexylmethanol
 (X) Bis(4-dimethylaminophenyl)cyclopentylmethanol
 (XI) Bis(4 - dimethylaminophenyl)trichloromethylmethanol
 (XII) Bis(4 - dimethylaminophenyl)difluoromethylmethanol
 (XIII) Bis(4-diethylaminophenyl)cyclohexylmethanol
 (XIV) Bis(4 - diethylaminophenyl)chloromethylmethanol
 (XV) Bis(4-diethylaminophenyl)fluorenylmethanol
 (XVI) Bis(4-diethylaminophenyl)pyrrolylmethanol
 (XVIII) Bis(4 - dimethylaminophenyl)pyridinylmethanol
 (XVIII) Bis(4 - diethylaminophenyl)pyrrolidinylmethanol
 (XIX) Bis(4-dimethylaminophenyl)pyranilmethanol

Electrophotographic elements of the invention can be prepared with the photoconducting compounds of the invention in the usual manner, i.e., by blending a dispersion or solution of a photoconductive compound together with a binder, when necessary or desirable, and coating or forming a self-supporting layer with the photoconductor-containing material. Mixtures of the photoconductors described herein can be employed. Likewise, other photoconductors known in the art such as those described in Light Belgian Pat. 705,117 dated Apr. 16, 1968 can be combined with the present photoconductors. In addition, supplemental materials useful for changing the spectral sensitivity or electrophotosensitivity of the element can be added to the composition of the element when it is desirable to produce the characteristic effect of such materials.

The photoconductive layers of the invention can also be sensitized by the addition of effective amounts of sensitizing compounds to exhibit improved electrophotosensitivity. Sensitizing compounds useful with the photoconductive compounds of the present invention can be selected from a wide variety of materials, including such materials as pyrylium dye salts including thiapyrylium dye salts and selenapyrylium dye salts disclosed in Van Allen et al. U.S. Pat. 3,250,615; fluorenes, such as 7,12-dioxo-13-dibenzo(a,h)fluorene, 5,10-dioxo-4a,11-diazabenzob(b)fluorene, 3,13-dioxo-7-oxadibenzo(b,g)fluorene, and the like; aggregate-type sensitizers of the type described in Light Belgian Pat. 705,117 dated Apr. 16, 1968; aromatic nitro compounds of the kinds described in U.S. Pat. 2,610,120; anthrones like those disclosed in U.S. Pat. 2,670,284; quinones, U.S. Pat. 2,670,286; benzophenones U.S. Pat. 2,670,287; thiazoles U.S. Pat. 2,732,301; mineral acids; carboxylic acids, such as maleic acid, dichloroacetic acid, and salicylic acid; sulfonic and phosphoric acids; and various dyes, such as cyanine (including carbocyanine), merocyanine, diarylmethane, thiazine, azine, oxa-

zine, xanthene, phthalein, acridine, azo, anthraquinone dyes and the like and mixtures thereof. The sensitizers preferred for use with the compounds of this invention are selected from pyrylium salts including selenapyrylium salts and thiapyrylium salts, and cyanine dyes including carbocyanine dyes.

Where a sensitizing compound is employed with the binder and organic photoconductor to form a sensitized electrophotographic element, it is the normal practice to mix a suitable amount of the sensitizing compound with the coating composition so that, after thorough mixing, the sensitizing compound is uniformly distributed in the coated layer.

Other methods of incorporating the sensitizer or the effect of the sensitizer may, however, be employed consistent with the practice of this invention. In preparing the photoconductive layers, no sensitizing compound is required to give photoconductivity in the layers which contain the photoconducting substances, therefore, no sensitizer is required in a particular photoconductive layer. However, since relatively minor amounts of sensitizing compound give substantial improvement in speed in such layers, the sensitizer is preferred. The amount of sensitizer that can be added to a photoconductor-incorporating layer to give effective increases in speed can vary widely. The optimum concentration in any given case will vary with the specific photoconductor and sensitizing compound used. In general, substantial speed gains can be obtained where an appropriate sensitizer is added in a concentration range from about 0.0001 to about 30 percent by weight based on the weight of the film-forming coating composition. Normally, a sensitizer is added to the coating composition in an amount by weight from about 0.005 to about 5.0 percent by weight of the total coating composition.

Preferred binders for use in preparing the present photoconductive layers are film-forming, hydrophobic polymeric binders having fairly high dielectric strength which are good electrically insulating film-forming vehicles. Materials of this type comprise styrene-butadiene copolymers; silicone resins; styrene-alkyd resins; silicone-alkyd resins; soya-alkyd resins; poly(vinyl chloride); poly(vinylidene chloride); vinylidene chloride-acrylonitrile copolymers; poly(vinyl acetate); vinyl acetate-vinyl chloride copolymers; poly(vinyl acetals), such as poly(vinyl butyral); polyacrylic and methacrylic esters, such as poly(methyl methacrylate), poly(n-butyl methacrylate), poly(isobutyl methacrylate), etc.; polystyrene; nitrated polystyrene; polymethylstyrene; isobutylene polymers; polyesters, such as copoly[ethylene-co-alkylenebis(alkyleneoxyaryl)phenylenedicarboxylate]; phenolformaldehyde resins; ketone resins; polyamides; polycarbonates; polythiocarbonates; poly[ethylene-co-isopropylidene - 2,2 - bis(ethyleneoxyphenyl)terephthalate]; copolymers of vinyl haloarylates and vinyl acetate such as poly(vinyl m-bromo-benzoate-co vinyl acetate); etc. Methods of making resins of this type have been described in the prior art, for example, styrene-alkyd resins can be prepared according to the method described in U.S. Pats. 2,361,019 and 2,258,423. Suitable resins of the type contemplated for use in the photoconductive layers of the invention are sold under such tradenames as Vitel PE-101, Cymac, Piccopale 100, Saran F-220, Lexan 105 and Lexan 145. Other types of binders which can be used in the photoconductive layers of the invention include such materials as paraffin, mineral waxes, etc.

Solvents useful for preparing coating compositions with the photoconductors of the present invention can include a wide variety of organic solvents for the components of the coating composition. For example, benzene; toluene; acetone; 2-butanone; chlorinated hydrocarbons such as methylene chloride; ethylene chloride; and the like; others, such as tetrahydrofuran and the like, or mixtures of such solvents can advantageously be employed in the practice of this invention.

In preparing the coating compositions utilizing the photoconducting compounds disclosed herein useful results are obtained where the photoconductive substance is present in an amount equal to at least about 1 weight percent of the coating composition. The upper limit in the amount of photoconductive material present can be widely varied in accordance with usual practice. It is normally required that the photoconductive material be present in an amount ranging from about 1 weight percent of the coating composition to about 99 weight percent of the coating composition. A preferred weight range for the photoconductive material in the coating composition is from about 10 weight percent to about 60 weight percent.

Coating thicknesses of the photoconductive composition on a support can vary widely. Normally, a wet coating thickness in the range of about 0.001 inch to about 0.01 inch is useful in the practice of the invention. A preferred range of coating thickness is from about 0.002 inch to about 0.006 inch before drying although such thicknesses can vary widely depending on the particular application desired for the electrophotographic element.

Suitable supporting materials for the photoconductive layers of the present invention can include any of the electrically conducting supports, for example, various conducting papers; aluminum-paper laminates; metal foils, such as aluminum foil, zinc foil, etc.; metal plates such as aluminum, copper, zinc, brass, and galvanized plates; vapor deposited metal layers such as silver, nickel or aluminum on conventional film supports such as cellulose acetate, poly(ethylene terephthalate), polystyrene and the like conducting supports.

An especially useful conducting support can be prepared by coating a transparent film support material such as poly(ethylene terephthalate) with a layer containing a semiconductor dispersed in a resin. A suitable conducting coating can be prepared from the sodium salt of a carboxyester lactone of a maleic anhydride-vinyl acetate copolymer, cuprous iodide and the like. Such conducting layers and methods for their optimum preparation and use are disclosed in U.S. Pats. 3,007,901, 3,245,833 and 3,267,807.

The compositions of the present invention can be employed in photoconductive elements useful in any of the well known electrophotographic processes which require photoconductive layers. One such process is the xerographic process. In a process of this type, an electrophotographic element held in the dark, is given a blanket electrostatic charge by placing it under a corona discharge to give a uniform charge to the surface of the photoconductive layer. This charge is retained by the layer owing to the substantial dark insulating property of the layer, i.e., the low conductivity of the layer in the dark. The electrostatic charge formed on the surface of the photoconductive layer is then selectively dissipated from the surface of the layer by imagewise exposure to light by means of a conventional exposure operation such as for example, by a contact-printing technique, or by lens projection of an image, or reflex or bireflex techniques and the like, to thereby form a latent electrostatic image in the photoconductive layer. Exposing the surface in this manner forms a pattern of electrostatic charge by virtue of the fact that light energy striking the photoconductor causes the electrostatic charge in the light struck areas to be conducted away from the surface in proportion to the intensity of the illumination in a particular area.

The charge pattern produced by exposure is then developed or transferred to another surface and developed there, i.e., either the charge or uncharged areas rendered visible, by treatment with a medium comprising electrostatically responsive particles having optical density. The developing electrostatically responsive particles can be in the form of a dust, or powder and generally comprise a pigment in a resinous carrier called a toner. A preferred method of applying such a toner to a latent electrostatic image for solid area development is by the

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use of a magnetic brush. Methods of forming and using a magnetic brush toner applicator are described in the following U.S. Pats. 2,786,439; 2,786,440; 2,786,441; 2,811,465; 2,874,063; 2,984,163; 3,040,704; 3,117,884 and reissue Re. 25,779. Liquid development of the latent electrostatic image may also be used. In liquid development the developing particles are carried to the image-bearing surface in an electrically insulating liquid carrier. Methods of development of this type are widely known and have been described in the patent literature, for example, U.S. Pat. 2,297,691 and in Australian Pat. 212,315. In dry developing processes the most widely used method of obtaining a permanent record is achieved by selecting a developing particle which has as one of its components a low-melting resin. Heating the powder image then causes the resin to melt or fuse into or on the element. The powder is, therefore, caused to adhere permanently to the surface of the photoconductive layer. In other cases, a transfer of the charge image or powder image formed on the photoconductive layer can be made to a second support such as paper which would then become the final print after developing and fusing or fusing respectively. Techniques of the type indicated are well known in the art and have been described in a number of U.S. and foreign patents, such as U.S. Pats. 2,297,691 and 2,551,582, and in "RCA Review," vol. 15 (1954) pages 469-484.

The compositions of the present invention can be used in electrophotographic elements having many structural variations. For example, the photoconductive composition can be coated in the form of single layers or multiple layers on a suitable opaque or transparent conducting support. Likewise, the layers can be contiguous or spaced having layers of insulating material or other photoconductive material between layers or overcoated or interposed between the photoconductive layer or sensitizing layer and the conducting layer. It is also possible to adjust the position of the support and the conducting layer by placing a photoconductor layer over a support and coating the exposed face of the support or the exposed or overcoated face of the photoconductor with a conducting layer. Configurations differing from those contained in the examples can be useful or even preferred for the same or different application for the electrophotographic element.

The following examples are included for a further understanding of this invention.

EXAMPLE 1

A composition in the form of a dope consisting of the following materials is coated at a wet thickness of 0.004 inch on a poly(ethylene terephthalate) film support having a conducting layer of the sodium salt of a carboxy-ester resin lactone:

Photoconductor	0.25
Polymeric binder [Vitel 101, a polyester resin sold by Goodyear Tire and Rubber Co. comprising poly(4,4' - isopropylidenebisphenoxyethyl - co ethylene terephthalate)]	1.00
Sensitizer-Rhodamine B	0.01
Dichloromethane	9.60

In a darkened room, the surface of the photoconductive layer so prepared is charged to a potential of about +600 volts under a corona charger. The layer is then covered with a transparent sheet bearing a pattern of opaque and light-transmitting areas and exposed to the radiation from an incandescent lamp with an illumination intensity of about 75 meter-candles for 12 seconds. The resulting electrostatic latent image is developed by cascading over the surface of the layer negatively charged black thermoplastic toner particles on glass bead carriers. The quality of the image reproduced using the various photoconductors described herein are set forth in the following table.

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TABLE II

Photoconductor:	Image quality
None	None reproduced.
I	Good.
II	Do.
III	Do.
IV	Do.
V	Do.
VI	Do.
VII	Do.
VIII	Do.
IX	Do.
X	Do.
XI	Do.
XII	Do.
XIII	Do.
XIV	Do.
XV	Do.

EXAMPLE 2

Example 1 is repeated except that the sensitizer used is 4-(p-dimethylaminophenyl) - 2,6 - diphenylthiapyrylium perchlorate and the binder is Lexan 145 (a polycarbonate resin sold by General Electric Co.). A good reproduction is obtained in each instance. When the photoconductor is omitted, an inferior quality image is obtained.

EXAMPLE 3

Example 1 is repeated using various sensitizers with photoconductor I. The sensitizers employed are listed in the following table.

TABLE III

Sensitizer	Images obtained
6-chloro-1'-methyl-1,2',3'-triphenylimidazo[4,5-b]quinoxalino-3'-indolocarbocyanine p-toluenesulfonate.	Yes.
6,6'-dichloro-1,1',3,3'-tetraphenylimidazo[4,5-b]quinoxalino-carbocyanine p-toluenesulfonate.	Yes.
2-(4-methoxyphenyl)-4-(N-butylamino)benzo-[b]pyrylium perchlorate.	Yes.
6-(p-n-amyloxystryryl)-2,4-bis(p-ethoxyphenyl)pyrylium tetrafluoroborate.	Yes.
2,4-bis(4-ethylphenyl)-6-(4-stryrylstyryl)pyrylium perchlorate.	Yes.
2,4,6-triphenylpyrylium tetrafluoroborate.	Yes.
3-(p-diphenylaminophenyl)-5-phenylthioliium perchlorate.	Yes.

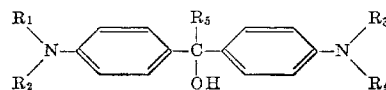
EXAMPLE 4

Example 3 is repeated except compounds II-XV are used. In each instance a good quality image is produced.

The invention has been described in detail with particular reference to preferred embodiments thereof, but, it will be understood that variations and modifications can be effected within the spirit and scope of the invention.

We claim:

1. An electrophotographic element comprising a support having coated thereon a photoconductive composition comprising a polymeric film-forming binder and an organic photoconductor having the formula



wherein:

R₁, R₂, R₃ and R₄ are each lower aliphatic alkyl groups having 1 to 8 carbon atoms; and

R₅ is selected from the group consisting of a lower aliphatic alkyl group having 1 to 8 carbon atoms, a cycloalkyl group, a diphenylenemethano group and a heterocyclic group having 5 to 6 atoms in the hetero nucleus.

2. The electrophotographic element as defined in claim 1 wherein said photoconductive composition contains a sensitizer for said photoconductor.

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3. An electrophotographic element comprising a support having coated thereon a photoconductive composition comprising

(a) from about 10 to about 60 percent by weight based on said photoconductive composition of bis (4-dimethylaminophenyl)-benzylmethanol as the organic photoconductor, 5

(b) a film-forming polymeric binder for said photoconductor and

(c) 0.005% to about 5% by weight based on said photoconductive composition of a sensitizer for said photoconductive composition. 10

4. An electrophotographic element comprising a support having coated thereon a photoconductive composition comprising 15

(a) from about 10 to about 60 percent by weight based on said photoconductive composition of bis(4-dimethylaminophenyl)fluorenylmethanol,

(b) a film-forming polymeric binder for said photoconductor and 20

(c) 0.005% to about 5% by weight based on said photoconductive composition of a sensitizer for said photoconductive composition.

5. An electrophotographic element comprising a support having coated thereon a photoconductive composition comprising 25

(a) from about 10 to about 60 percent by weight based on said photoconductive composition of bis (4-dimethylaminophenyl)trifluoromethylmethanol,

(b) a film-forming polymeric binder for said photoconductor and 30

(c) 0.005% to about 5% by weight based on said photoconductive composition of a sensitizer for said photoconductive composition.

6. An electrophotographic element comprising a support having coated thereon a photoconductive composition comprising 35

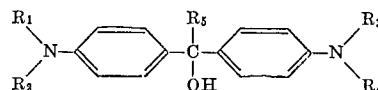
(a) from about 10 to about 60 percent by weight based on said photoconductive composition of 1,1 bis(4-dimethylaminophenyl)-1-hydroxyethane, 40

(b) a film-forming polymeric binder for said photoconductor and

(c) 0.005% to about 5% by weight based on said photoconductive composition of a sensitizer for said photoconductive composition. 45

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7. A photoconductive composition comprising a polymeric film-forming binder and an organic photoconductor having the formula



wherein:

R₁, R₂, R₃ and R₄ are each lower aliphatic alkyl groups having 1 to 8 carbon atoms; and

R₅ is selected from the group consisting of a lower aliphatic alkyl group having 1 to 8 carbon atoms, a cycloalkyl group, a diphenylenemethano group and a heterocyclic group having 5 to 6 atoms in the hetero nucleus.

8. The composition of claim 7 wherein said photoconductive composition contains a sensitizer for said photoconductor.

9. In an electrophotographic process wherein an electrostatic charge pattern is formed on an electrophotographic element, the improvement characterized in that said electrophotographic element has a sensitive layer comprising a photoconductive composition as described in claim 7.

References Cited

UNITED STATES PATENTS

3,140,948	7/1964	Stewart	96—48
3,232,755	2/1966	Hoegl et al.	96—1
3,310,401	3/1967	Greig	96—1.5
3,317,315	5/1967	Nicoll et al.	96—1.1

FOREIGN PATENTS

980,879	1/1965	Great Britain	96—1.5
1,078,520	8/1967	Great Britain	96—1.5

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252—501; 260—576