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LIGHT ADAPTED PHOTOCONDUCTIVE ELEMENTS

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U.S. Cl. 96—1 **10 Claims**

ABSTRACT OF THE DISCLOSURE

Photoconductive elements which have been exposed to light prior to charging produce images which have increased resolutions.

This invention relates to electrophotography, and in particular to photoconductive elements and the process for making and using them.

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 actinic 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 the 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 the discharge pattern as desired. The 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 applications in 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 are known to possess some degree of photoconductivity. Many organic compounds have revealed a useful level of photoconduction and have been incorporated into photoconductive compositions. Optically clear organic 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.

Particularly useful are photoconductors which display little or no persistence of photoconductivity. This class of photoconductors includes those which are rechargeable and do not retain any traces of the original image after having been exposed to a pattern of actinic radiation and recharged. Therefore, photoconductors which have this property are reusable. Included in the class are organic including organo-metallic, as well as some inorganic, photoconducting compounds.

In many xerographic applications it is desirable for the reproduction to have a relatively high resolution as measured in terms of lines per millimeter. A typical application where high resolution images are necessary is in microfilm reproductions. Ideally, a microfilm duplicating system should provide exact duplicates of existing microfilm frames with no loss in resolution from the original.

It is therefore, an object of this invention to provide a new process for preparing photoconductive elements which upon exposure produce images having high resolution.

It is another object of this invention to provide a new process for using the photoconductive elements to produce images having high resolution.

It is a further object of this invention to provide novel photoconductive elements which exhibit high resolving power.

It is also an object of this invention to provide novel photoconductive elements which after exposure to an image retain their resolving power for substantially long periods of time prior to development.

Yet another object of this invention is to provide a new process for preparing photoconductive elements which upon exposure to an image can be stored in the dark for substantially long periods of time prior to development without a significant loss of resolution in the final developed image.

These and other objects of this inventon are accomplished by subjecting a photoconductive element containing a photoconductor which displays substantially no persistence of photoconductivity to an amount of light for a period of time sufficient to increase the resolution of the final image prior to charging and its use in recording images. By adapting the element to light prior to charging and imagewise exposing, the resultant recorded image has a higher resolution than that obtainable in the absence of a light adaptation step. Also, after the element is exposed in an imagewise manner, the light adapted layer retains its increase resolving power for a substantial period of time prior to developing as opposed to a loss in the resolving power in an element which has not been light adapted. Therefore, before developing, the element can remain in the dark for at least about one hour or more without significantly affecting the resolution of the image.

The process of this invention includes the following steps:

(1) Preparing the element including coating at least one photoconductive layer on a conducting support and drying,

(2) Light adapting the element by subjecting the element to an overall light exposure for a period of time,

(3) Charging the element,

(4) Exposing the element in an imagewise manner and

(5) Developing the resultant latent image.

The light adaptation step (Step 2 above) takes place after the element is prepared. The element can be light adapted merely by subjecting it to a source of light such as ordinary room light or sunlight for a period of time sufficient to increase the resolution of the final image. Higher light intensities require shorter exposure times than lower intensities. Generally, the minimum amount of light necessary to obtain the increase resolutions of this invention is about 10^4 foot-candle-seconds while the maximum amount of light is dependent upon the stability of the particular photoconductive composition employed. However, it is not generally practical to employ more than about 10^9 foot-candle-seconds since the increase in resolution thus obtained is slight compared to the increase in the amount of light. Also, the stabilities of the various photoconductors are not significantly effected by this amount of light. The preferred exposure to which the photoconductive elements are subjected is from about 6.1×10^4 foot-candle-seconds to about 6.1×10^6 foot-candle-seconds.

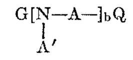
After the element has been light adapted, it is preferable to charge and expose it as soon as possible. If the element remains in the dark for a long period of time after the light adaptation step, its resolving power is somewhat diminished. For example, an element which has been light adapted at an exposure of 6.1×10^5 foot-candle-seconds begins to lose its resolving power if placed in the dark for more than 24 hours.

The electrophotographic elements to be used in this invention can be prepared 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 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 increased image resolutions of this invention can be obtained by using an organic including organo-metallic, or inorganic, photoconducting material which has little or substantially no persistence of photoconductivity. A typical inorganic photoconductor which has the required lack of persistence is selenium while representative organo-metallic compounds are the organic derivatives of Group IV*a* and V*a* metals such as those having at least one amino-aryl group attached to the metal atom. Exemplary organo-metallic compounds are the triphenyl-p-dialkylaminophenyl derivatives of silicon, germanium, tin and lead and the tri-p-dialkylaminophenyl derivatives of arsenic, antimony, phosphorus and bismuth.

An especially useful class of organic photoconductors is referred to herein as "organic amine" photoconductors. Such organic photoconductors have as a common structural feature at least one amino group. Useful organic photoconductors which can be spectrally sensitized in accordance with this invention include, therefore, arylamine compounds comprising (1) diarylamines such as diphenylamine, dinaphthylamine, N,N'-diphenylbenzidine, N - phenyl-1-naphthylamine; N-phenyl-2-naphthylamine; N,N' - diphenyl-p-phenylenediamine; 2-carboxy-5-chloro-4' - methoxydiphenylamine; p-anilinophenol; N,N'-di-2-naphthyl-p-phenylenediamine; 4,4'-benzylidene-bis-(N,N-diethyl-m-toluidine), those described in Fox U.S. Pat. 3,240,597 issued Mar. 15, 1966, and the like, and (2) triarylamines including (a) nonpolymeric triarylamines, such as triphenylamine, N,N,N',N'-tetraphenyl-m-phenylenediamine; 4-acetyltriphenylamine, 4-hexanoyltriphenylamine; 4-lauroyltriphenylamine; 4-hexyltriphenylamine, 4-dodecyltriphenylamine, 4,4'-bis(diphenylamino)benzil, 4,4'-bis(diphenylamino)benzophenone, and the like, and (b) polymeric triarylamines such as poly[N,4''-(N,N',N'-triphenylbenzidine)]; polyadiplytriphenylamine, polysebacyltriphenylamine; polydecamethylenetriphenylamine; poly - N - (4-vinylphenyl)diphenylamine, poly-N-(vinylphenyl)-α,α'-dinaphthylamine and the like. Other useful amine-type photoconductors are disclosed in U.S. Pat. 3,180,730 issued Apr. 27, 1965.

Useful photoconductive substances capable of being spectrally sensitized in accordance with this invention are disclosed in Fox U.S. Pat. 3,265,496 issued Aug. 9, 1966, and include those represented by the following general formula:

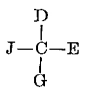


$$G[\underset{\underset{A'}{|}}{N}-A-]_b Q$$

wherein A represents a mononuclear or polynuclear divalent aromatic radical, either fused or linear, (e.g., phenyl, naphthyl, biphenyl, binaphthyl, etc.), or a substituted divalent aromatic radical of these types wherein said substituent can comprise a member such as an acyl group having from 1 to about 6 carbon atoms (e.g., acetyl, propionyl, butyryl, etc.), an alkyl group having from 1 to about 6 carbon atoms (e.g., methyl, ethyl, propyl, butyl, etc.), an alkoxy group having from 1 to about 6 carbon atoms (e.g., methoxy, ethoxy, propoxy, pentoxy, etc.), or a nitro group; A' represents a mononuclear or polynuclear monovalent aromatic radical, either fused or linear (e.g., phenyl, naphthyl, biphenyl, etc.); or a substituted monovalent aromatic radical wherein said substituent can comprise a member, such as an acyl group having from 1 to about 6 carbon atoms (e.g., acetyl, propionyl, butyryl, etc.), an alkyl group having from 1 to about 6 carbon atoms (e.g., methyl, ethyl, propyl, butyl, etc.), an alkoxy group having from 1 to about 6 carbon atoms (e.g., methoxy, propoxy, pentoxy, etc.), or a nitro group; Q can represent a hydrogen atom, a halogen atom or an aromatic amino group, such as A'NH—; *b* represents an integer from 1 to about 12, and G represents a hydrogen atom, a mononuclear or polynuclear aromatic radical, either fused or linear (e.g., phenyl, naphthyl, biphenyl, etc.), a substituted aromatic radical wherein said substituent comprises an alkyl group, an alkoxy group, an acyl group, or a nitro group, or a poly(4'-vinylphenyl) group which is bonded to the nitrogen atom by a carbon atom of the phenyl group.

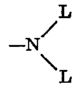
Polyarylalkane photoconductors are particularly useful in producing the present invention. Such photoconductors are described in U.S. Pat. 3,274,000; French Pat. 1,383,461 and in copending application of Seus and Goldman titled "Photoconductive Elements Containing Organic Photoconductors" filed Apr. 3, 1967 or Ser. No. 627,857. These photoconductors include leuco bases of diaryl or triaryl methane dye salts, 1,1,1-triarylalkanes wherein the alkane moiety has at least two carbon atoms and tetraarylmethanes, there being substituted an amine group on at least one of the aryl groups attached to the alkane and methane moieties of the latter two classes of photoconductors which are non-leuco base materials.

Preferred polyarylalkane photoconductors can be represented by the formula:



$$J-\overset{\overset{D}{|}}{\underset{\underset{G}{|}}{C}}-E$$

wherein each of D, E and G is an aryl group and J is a hydrogen atom, an alkyl group, or an aryl group, at least one of D, E and G containing an amino substituent. The aryl groups attached to the central carbon atom are preferably phenyl groups, although naphthyl groups can also be used. Such aryl groups can contain such substituents as alkyl and alkoxy typically having 1 to 8 carbon atoms, hydroxy, halogen, etc. in the ortho, meta or para positions, ortho-substituted phenyl being preferred. The aryl groups can also be joined together or cyclized to form a fluorene moiety, for example. The amino substituent can be represented by the formula



$$-N\left\langle\begin{matrix}L\\L\end{matrix}\right.$$

wherein each L can be an alkyl group typically having 1 to 8 carbon atoms, a hydrogen atom, an aryl group, or together the necessary atoms to form a heterocyclic amino group typically having 5 to 6 atoms in the ring such as morpholino, pyridyl, pyrryl, etc. At least one of D, E, and G is preferably p-dialkylaminophenyl group. When J is an alkyl group, such an alkyl group more generally has 1 to 7 carbon atoms.

Representative useful polyarylalkane photoconductors include the compounds listed below:

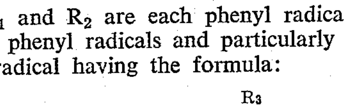
Table A

Compound No.:

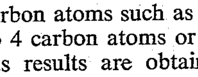
Compound Name

(1)__4,4′-benzylidine-bis(N,N-diethyl-m-toluidine).
(2)__4′,4″ - diamino-4-dimethylamino - 2′,2″ - dimethyl-triphenylmethane.
(3)__4′,4″ - bis(diethylamino) - 2,6-dichloro-2′,2″-dimethyltriphenylmethane.
(4)__4′,4″ - bis(diethylamino) - 2′,2″ - dimethyldiphenyl-naphthylmethane.
(5)__2′,2″ - dimethyl - 4,4′,4″-tris(dimethylamino) triphenylmethane.
(6)__4′,4″- bis(diethylamino)-4-dimethylamino-2′, 2″-dimethyltriphenylmethane.
(7)__4′,4″ - bis(diethylamino) - 2 - chloro-2′,2″-dimethyl-4-dimethylaminotriphenylmethane.
(8)__4′,4″-bis(diethylamino)-4-dimethylamino-2,2′, 2″-trimethyltriphenylmethane.
(9)__4′,4″ - bis(dimethylamino)-2-chloro-2′,2″-dimethyltriphenylmethane.
(10)__4′,4″ - bis(dimethylamino) - 2′,2″-dimethyl-4-methoxy-triphenylmethane.
(11)__Bis(4-diethylamino)-1,1,1-triphenylethane.
(12)__Bis(4-diethylamino)tetraphenylmethane.
(13)__4′,4″-bis(benzylethylamino) - 2′,2″-dimethyltriphenylmethane.
(14)__4′,4″ - bis(diethylamino) - 2′,2″ - diethoxytriphenylmethane.
(15)__4,4′-bis(dimethylamino)-1,1,1-triphenylethane.
(16)__1-(4 - N,N-dimethylaminophenyl)-1,1-diphenylethane.
(17)__4-dimethylaminotetraphenylmethane.
(18)__4-diethylaminotetraphenyl methane.

Another class of photoconductors useful in this invention are the 4-diarylamino-substituted chalcones. Typical compounds of this type are low molecular weight nonpolymeric ketones having the general formula:



wherein R_1 and R_2 are each phenyl radicals including substituted phenyl radicals and particularly when R_2 is a phenyl radical having the formula:



where R_3 and R_4 are each aryl radicals, aliphatic residues of 1 to 12 carbon atoms such as alkyl radicals preferably having 1 to 4 carbon atoms or hydrogen. Particularly advantageous results are obtained when R_1 is a phenyl radical including substituted phenyl radicals and where R_2 is diphenylamino, dimethylamino or hydrogen.

Sensitizing compounds useful with the photoconductive elements of the present invention can include a wide variety of substances such as pyrylium, thiapyrylium, and selenapyrylium salts of U.S. Pat. 3,250,615, issued May 10, 1966; fluorenes, such as 7,12-dioxo - 13 - dibenzo(a,h)fluorene, 5,10 - dioxo - 4 - a,11 - diazabenzo(b)fluorene, 3,13 - dioxo - 7 - oxadibenzo(b,g)fluorene, trinitrofluorenone, tetranitrofluorenone and the like; aromatic nitro compounds of U.S. Pat. 2,610,120; anthrones of U.S. Pat. 2,670,285; quinones of U.S. Pat. 2,670,286; benzophenones of U.S. Pat. 2,670,287; thiazoles of 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 triphenylmethane, diarylmethane, thiazine, azine, oxazine, xanthene, phthalein, acridine, azo, anthraquinone dyes and many other suitable sensitizing dyes. The preferredsensitizers for use with the compounds of this invention are pyrylium and thiapyrylium salts, fluorenes, carboxylic acids, and triphenylmethane dyes.

Where a sensitizing compound is to be used within a photoconductive layer as disclosed herein it is conventional practice to mix a suitable amount of the sensitizing compounds with the coating composition so that, after thorough mixing, the sensitizing compound is uniformly distributed throughout the desired layer of the coated element. In preparing the photoconducting layers, no sensitizing compound is needed for the layer to exhibit photoconductivity. The lower limit of sensitizer required in a particular photoconductive layer is, therefore, zero. However, since relatively minor amounts of sensitizing compound give substantial improvement in the electrophotographic speed of such layers, the use of some 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 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-alkyl resins; soya-alkyl 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 ester, such as poly(methylmethacrylate), poly(n-butylmethacrylate), poly(isobutyl methacrylate), etc.; polystyrene; nitrated polystyrene; polymethylstyrene; isobutylene polymers; polyesters, such as poly(ethylenealkaryloxyalkylene terephthalate); phenolformaldehyde resins; ketone resins; polyamide; polycarbonates; polythiocarbonates; poly(ethyleneglycolcobishydroxyethoxyphenyl propane terephthalate); 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. Pat. 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 Vietel PE-101, Cymac, Piccopale 100, Saran F-220 and Lexan 105. Other types of binders which can be used in the photoconductive layers of the invention include such materials as paraffin, mineral waxes, etc.

Solvents of choice for preparing coating compositions of the present invention can include a number of solvents such as benzene, toluene, acetone, 2-butanone, chlorinated hydrocarbons, e.g., methylene chloride, ethylene chloride, etc., ethers, e.g., tetrahydrofuran, or mixtures of these solvents, etc.

In preparing the coating composition useful results are obtained where the photoconductor 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 photoconductor substance present can be widely varied in accordance with usual practice. In those cases where a binder is employed, it is normally required that the photoconductor substance be present in an amount from about 1 weight percent of the coating composition to about 99 weight percent of the coating composition. A preferred weight range for the photoconductor substance 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 coating in the range of about 0.001 inch to about 0.01 inch before drying is useful for the practice of this invention. The preferred range of coating thickness was found to be in the range from about 0.002 inch to about 0.006 inch before drying although useful results can be obtained outside of this range. As previously mentioned, more than one layer may be coated on the support. Good results are obtainable when a first layer containing a photoconductor, a binder and a sensitizer is overcoated with a second layer of a composition containing a photoconductor and a binder. The photoconductor and binder employed in the overcoat can be different than those employed in the first layer.

Suitable supporting materials for coating the photoconductive layers of the present invention can include any of a wide variety of electrically conducting supports, for example, paper (at a relative humidity above 20 percent); 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 or aluminum and the like. An especially useful conducting support can be prepared by coating a support material such as polyethylene terephthalate with a layer containing a semiconductor dispersed in a resin. Such conducting layers both with and without insulating barrier layers are described in U.S. Pat. 3,245,833. Likewise, a suitable conducting coating can be prepared from the sodium salt of a carboxyester lactone of maleic anhydride and a vinyl acetate polymer. Such kinds of conducting layers and methods for their optimum preparation and use are disclosed in U.S. 3,007,901 and 3,267,807.

The elements of the present invention can be employed in any of the well-known electrophotographic processes which require photoconductive layers. One such process is the aforementioned xerographic process. As previously explained, in a process of this type the electrophotographic element is given a blanket electrostatic charge by placing the same under a corona discharge which serves to give a uniform charge to the surface of the photoconductive layer of at least 400 volts and preferably at least 500 volts. This charge is retained by the layer owing to the substantial 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 photoconducting layer is then selectively dissipated from the surface of the layer by exposure to light through an image-bearing transparency by a conventional exposure operation such as, for example, by contact-printing technique, or by lens projection of an image, etc., to form a latent image in the photoconducting layer. By exposure of the surface in this manner, a charged pattern is created by virtue of the fact that light causes the charge to be conducted away in proportion to the intensity of the illumination in a particular area. The charge pattern remaining after exposure is then developed, i.e., rendered visible, by treatment with a medium comprising electrostatically attractable particles having optical density. The developing electrostatically attractable particles can be in the form of a dust, e.g., powder, pigment in a resinous carrier, i.e., toner, or a liquid developer may be used in which the developing particles are carried in an electrically insulating liquid carrier. Methods of development of this type are widely known and have been described in the patent literature in such patents, for example, as U.S. Pat. 2,297,691 and in Australian Pat. 212,315. In processes of electrophotographic reproduction such as in xerography, by selecting a developing particle which has as one of its components, a low-melting resin, it is possible to treat the developed photoconductive material with heat and cause the powder to adhere permanently to the surface of the photoconductive layer. In other cases, a transfer of the image formed on the photoconductive layer can be made to a second support, which would then become the final print. 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 present invention is not limited to any particular mode of use of the new electrophotographic materials, and the exposure technique, the charging method, the transfer (if any), the developing method, and the fixing method as well as the materials used in these methods can be selected and adapted to the requirements of any particular technique.

Electrophotographic materials according to the present invention can be applied to reproduction techniques wherein different kinds of radiations, i.e., electromagnetic radiations as well as nuclear radiations, can be used. For this reason, it is pointed out herein that although materials according to the invention are mainly intended for use in connection with methods comprising an exposure, the term "electrophotography" wherever appearing in the description and the claims, is to be interpreted broadly and understood to comprise both xerographiy and xeroradiography.

The invention is further illustrated by the following examples which include preferred embodiments thereof.

EXAMPLE 1

A pyrylium sensitized triphenylamine organic photoconductor in a polyester resin binder, a copolymer made from iso- and terephthalic acids, ethylene glycol and 2,2-bis(4-β-hydroxy-ethoxyphenyl)propane, (overcoated with unsensitized triphenylamine in a polystyrene binder, coated on a Rem-jet backed cellulose triacetate support subbed with a sodium CERL (carboxy ester resin lactone) coating, (see Minsk U.S. Pats. 2,861,056 and 3,007,901) is used as the recording film for xerographic microfilming in a camera operation. The photoconductor is stored in room light for 10 hours. This corresponds to an equivalent exposure of 6.1×10^5 foot-candle-seconds since room light is equal to about 17 foot-candles. The recording film is placed in the dark immediately prior to use and is charged to a uniform negative surface potential of at least about 500 volts. The charged layer is placed in a microfilming camera and exposed to an original for 15 seconds. The exposed photoconductor, representing a 12X reduction of the original, is developed by cascading a combination of 120-mesh iron filings and a toner powder with a maximum diameter size of 5 microns, over its surface. The dry toner is prepared by mixing carbon pigment and piccolastic Record resin (homologs of polystyrene), heat fusing the mixture, and after ball milling for about 48 hours, sieving through a 200-mesh screen, and air elutriating the powder to produce a dry toner having the maximum particle size of 5 microns. The resultant image after development is a positive-appearing micro image of a positive-appearing original and has a resolving power of 100 lines per mm. The image is fixed to the photoconductor by heat.

EXAMPLE 2

A second xerographic image made by the above method is transferred to a moistened, partially hardened gelatin layer on a transparent film base instead of being fixed by heat. This image also has a resolving power of 100 lines per mm.

EXAMPLE 3

A photoconductive element is prepared in the same manner as that in Example 1 except that the element is stored for 24 hours in the dark instead of being exposed to light prior to charging. The element is then charged, exposed and developed in the same manner as set forth in Example 1. The resolution of the resultant image is 30 lines per mm.

EXAMPLE 4

The procedure of Example 1 is followed except that after the image exposure step the element is allowed to remain in the dark for one hour prior to development. The resolving power of the resultant image is 100 lines per mm. Thus, when this result is compared with the result of Example 1, it can be seen that the light adapted layer not only produces a higher initial resolving power but is also capable of retaining said resolving power for at least one hour.

EXAMPLE 5

The procedure of Example 3 is followed except that after the image exposure step the element is allowed to remain in the dark for one hour before development. The resolving power of the resultant image is 15 lines per mm. When this result is compared with the result of Example 3, it is seen that the dark adapted sample not only shows poor initial resolving power, but also allows the latent image to degenerate during the one hour dark decay period.

EXAMPLE 6

This example is carried out in a manner similar to that set forth in Example 1 except that the photoconductor, 4,4′-diethylamino-2,2′-dimethyltriphenylmethane, is exposed to room light for 24 hours prior to charging. After the element is exposed in an imagewise manner, it is placed in the dark for one hour prior to developing. The latent image is then developed with a liquid developer according to conventional techniques. The final image has a resolving power of 251 lines per millimeter. Without the light adaptation step, the image has a resolving power of 158 lines per millimeter.

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 as described hereinbefore and as defined in the appended claims.

I claim:

1. A process for increasing the resolution of a recorded xerographic image comprising:

(a) subjecting a photoconductive element to a light exposure of at least about 6.1×10^4 foot-candle-seconds, said element comprising a photoconductive composition containing an organic photoconductor which has substantially no persistence of photoconductivity coated on a conducting support,

(b) charging the light adapted element to at least 400 volts,

(c) exposing the charged, light adapted element to actinic radiation in an imagewise manner and

(d) developing the resultant latent electrostatic image with a liquid developer.

2. The process of claim **1** including the step of allowing the element to remain in the dark for at least about one hour after exposing it to actinic radiation and before developing.

3. The process of claim **1** wherein the photoconductive element comprises a conducting support having coated

thereon a layer of a composition comprising a binder, a sensitizer and an organic photoconductor which is overcoated by a layer of a composition comprising a binder and an organic photoconductor.

4. The process of claim **1** wherein the photoconductive element is subjected to a light exposure of about 6.1×10^5 foot-candle-seconds.

5. A process for increasing the resolution of a recorded xerographic image comprising:

(a) a light adapting a photoconductive element containing triphenylamine and a binder by subjecting it to a light exposure of about 6.1×10^5 foot-candle-seconds,

(b) charging the light adapted element to at least 500 volts,

(c) exposing the charged element to actinic radiation in an imagewise manner and

(d) developing the resultant recorded xerographic image with a liquid developer.

6. A process for increasing the resolution of a recorded xerographic image comprising:

(a) subjecting a photoconductive element to a light exposure of at least about 6.1×10^4 foot-candle-seconds, said element comprising a photoconductive composition containing an organic photoconductor which has substantially no persistence of photoconductivity coated on a conducting support,

(b) charging the light adapted element to at least 400 volts,

(c) exposing the charged, light adapted element to actinic radiation in an imagewise manner and

(d) developing the resultant latent electrostatic image with a dry developer.

7. The process of claim **6** including the step of allowing the element to remain in the dark for at least about one hour after exposing it to actinic radiation and before developing.

8. The process of claim **6** wherein the photoconductive element comprises a conducting support having coated thereon a layer of a composition comprising a binder, a sensitizer and an organic photoconductor which is overcoated by a layer of a composition comprising a binder and an organic photoconductor.

9. The process of claim **6** wherein the photoconductive element is subjected to a light exposure of about 6.1×10^5 foot-candle-seconds.

10. A process for increasing the resolution of a recorded xerographic image comprising:

(a) light adapting a photoconductive element containing triphenylamine and a binder by subjecting it to a light exposure of about 6.1×10^5 foot-candle-seconds,

(b) charging the light adapted element to at least 500 volts,

(c) exposing the charged element to actinic radiation in an imagewise manner and

(d) developing the resultant recorded xerographic image with a dry developer.

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