United States Patent [19]

Bergfjord et al.

[11] **3,922,169**

[45] **Nov. 25, 1975**

[54] **PHOTOELECTRIC AND ELECTROPHOTOGRAPHIC PIGMENTS COMPRISING DERIVATIVES OF CONDENSED POLYCYCLIC AROMATIC HYDROCARBON ALDEHYDES**

[75] Inventors: **John Alf Bergfjord,** Macedon; **Steven James Grammatica,** Webster; **Richard William Radler,** Marion, all of N.Y.

[73] Assignee: **Xerox Corporation,** Stamford, Conn.

[22] Filed: **Sept. 25, 1974**

[21] Appl. No.: **508,966**

Related U.S. Application Data

[62] Division of Ser. No. 337,787, March 5, 1973.

[52] **U.S. Cl.** ..... **96/1 PE;** 96/1.3; 96/1.5; 260/566 B; 252/62.1; 204/181

[51] **Int. Cl.²** **G03G 13/24;** G03G 5/04; B44C 1/04

[58] **Field of Search** ..... 96/1 PE, 1.2, 1.3, 1.5; 204/181; 252/62.1; 260/566 B

[56] **References Cited**

UNITED STATES PATENTS

2,851,495	9/1958	Jensch et al.	260/566 B
3,246,983	4/1966	Sus et al.	96/1.5
3,414,650	12/1968	Catino et al.	260/566 B
3,510,419	5/1970	Carreira et al.	96/1 PE
3,546,085	12/1970	Weinbeger et al.	96/1.3
3,867,141	2/1975	Bergfjord et al.	96/1 PE

FOREIGN PATENTS OR APPLICATIONS

930,988	7/1963	United Kingdom	96/1.5
980,511	1/1965	United Kingdom	96/1.5

OTHER PUBLICATIONS

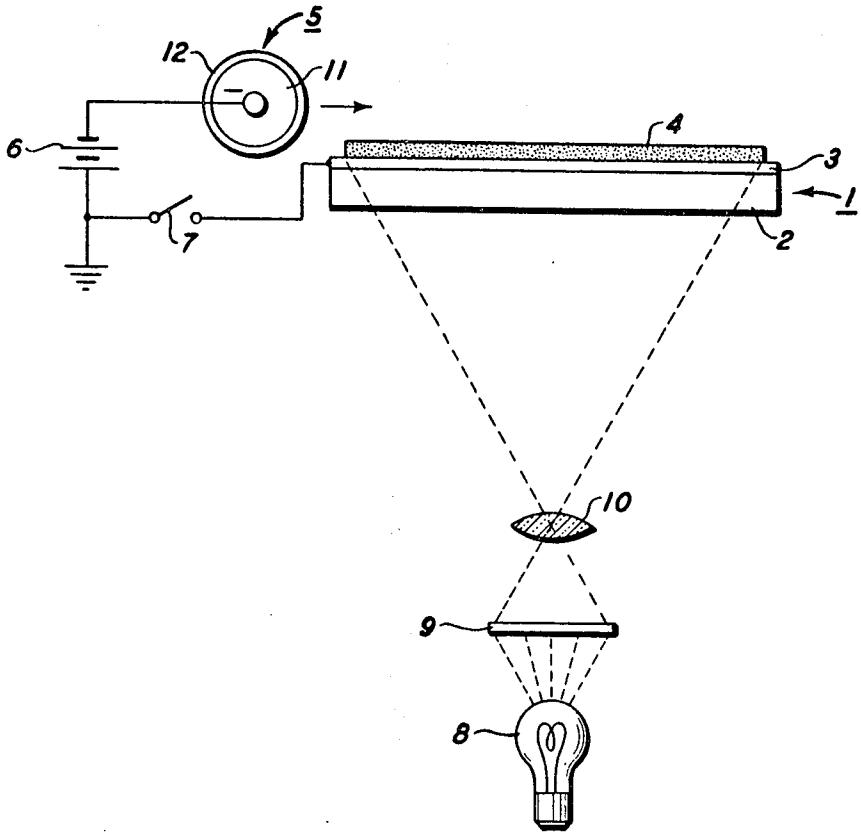
Weizmann et al., Jour. of Am. Chem., SPC, Vol. 70 (1948), pp. 2829–2830.

Primary Examiner—Roland E. Martin, Jr.
Assistant Examiner—J. P. Brammer

[57] **ABSTRACT**

An electrophoretic imaging system which is capable of polychromatic or monochromatic imaging is disclosed, using as at least a portion of the imaging material compounds which are the reaction product of a condensed polycyclic aromatic hydrocarbon aldehyde and certain ketones or amines containing active hydrogen. These compounds may also be used in the preparation of electrophotographic plates for xerography.

2 Claims, 1 Drawing Figure


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PHOTOELECTRIC AND ELECTROPHOTOGRAPHIC PIGMENTS COMPRISING DERIVATIVES OF CONDENSED POLYCYCLIC AROMATIC HYDROCARBON ALDEHYDES

This is a division, of application Ser. No. 337,787, filed Mar. 5, 1973.

BACKGROUND OF THE INVENTION

There has been recently developed an electrophoretic imaging system capable of producing color images which utilizes single-component photoconductive particles. This process is described in detail and claimed in U.S. Pat. Nos. 3,384,565, 3,384,566 and 3,384,488. In such an imaging system, variously colored light absorbing particles are suspended in a non-conductive liquid carrier. The suspension is placed between electrodes, subjected to a potential difference and exposed to an image. As these steps are completed, selective particle migration takes place in image configuration, providing a visible image at one or both of the electrodes. An essential component of the system is the suspended particles which must be electrically photosensitive and which apparently undergo a net change in charge polarity upon exposure to activating electromagnetic radiation through interaction with one of the electrodes. In a monochromatic system, particles of a single color are used, producing a single colored image equivalent to conventional black-and-white photography. In a polychromatic system, the images are produced in natural color because mixtures of particles of two or more different colors which are each sensitive to light of a specific wavelength or narrow range of wavelengths are used. Particles used in this system must have both intense pure colors and be highly photosensitive. The pigments of the prior art often lack the purity and brilliance of color, the high degree of photosensitivity, and the preferred correlation between the peak spectral response and peak photosensitivity necessary for use in such a system.

Several recent patents have issued dealing with the preparation and use of certain yellow pigments having desirable photoelectrophoretic properties. For example, U.S. Pat. No. 3,447,922 discloses pigments comprising N-substituted-8,13-dioxodinaptho-(2,1-b; $2^1,3^1$-d)-furan-6-carboxamides. Another class of suitable pigments are 1,3,6,8-substituted pyrenes as disclosed in U.S. Pat. No. 3,546,085. While these pigments are suitable for use in photoelectrophoretic imaging processes, the varieties of shades or tones of color produced are limited due to chemical structure of the various compounds. It is always desirable to have available pigments which offer a broader selection of yellow or orange-yellow shades and tones.

The reaction product of pyrene-3-aldehyde and methyl ketones has been reported in the prior art as disclosed by M. Weizmann and E. Bograchov, *Journal of the American Chemical Society*, Vol. 70, 2829 (1948). However, the fact that these and related compounds are extremely useful in photoelectrophoretic or xerographic imaging processes in the form of finely divided pigments has been unrecognized until the present invention.

It is accordingly an object of this invention to provide novel electrophoretic imaging systems.

It is an additional object of this invention to provide a novel imaging suspension comprising an insulating carrier liquid having dispersed therein a finely divided pigment having peak photosensitive and spectral response characteristics.

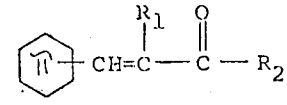
It is a further object of this invention to provide a photoconductive insulating material suitable for use in electrophotographic plates.

More particularly, it is an object of this invention to provide novel electrophoretic imaging suspensions comprising a compound which is the reaction product of a condensed polycyclic aromatic hydrocarbon aldehyde and certain ketones or amines containing active hydrogen.

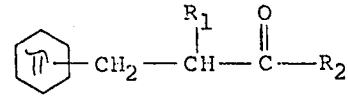
SUMMARY OF THE INVENTION

The foregoing objects and others are accomplished by utilizing as a photosensitive component in electrophoretic imaging processes and xerographic processes one or more compounds having the general formulae:

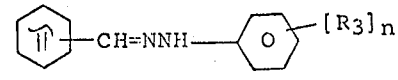
A.



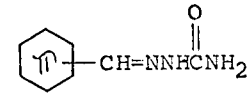
B.



C.



D.



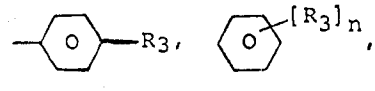
wherein:

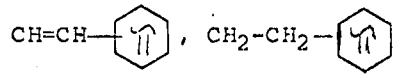


represents a condensed polycyclic aromatic group having from about 14 to about 20 carbon atoms,

R_1 is selected from the group consisting of: H and C_6H_5;

R_2 is selected from the group consisting of: CH_3, C_2H_5, lower alkyl containing 3-8 carbon atoms,





R_3 is selected from the group consisting of: H, OH, CH_3, OCH_3, C_2H_5, OC_2H_5, $COCH_3$, CO_2CH_3, COC_2H_5, $CO_2C_2H_5$, NO_2, CN, SO_2NH_2, $SO_2NHC_6H_5$, Cl, F. Br, I; and

n is a positive integer from 1–3.

These compounds may be prepared by reacting a monosubstituted condensed polycyclic aromatic alde-

hyde with an amine or ketone containing active hydrogen, as will be hereinafter disclosed. The preferred aldehydes are the monosubstituted carboxaldehydes of pyrene, anthracene, phenanthrene, chrysene, tetracene and tetraphene. The reaction products are formed as the result of an aldol type condensation involving the aromatic aldehyde and a suitable ketone, or a condensation reaction involving the aromatic aldehyde and a primary aliphatic or aromatic amine.

The compounds produced by the above reactions have the common characteristic of a brilliant, intense yellow or orange color and are readily dispersible in common solvents. They are surprisingly effective when used in monochromatic or polychromatic electrophoretic imaging systems, as well as in preparing electrophotographic plates as will be hereinafter defined. Their good spectral response and high photosensitivity result in dense, brilliant photoelectrophoretic images.

DETAILED DESCRIPTION OF THE INVENTION

The use of the above compounds in electrophoretic imaging will be better understood upon reference to the drawing which shows schematically an exemplary electrophoretic imaging system.

Referring now to the FIG., there is seen a transparent electrode generally designated **1** which, in this exemplary instance, is made up of a layer of optically transparent glass **2** overcoated with a thin optically transparent layer **3** of tin oxide, commercially available under the name NESA glass. This electrode will hereafter be referred to as the "injecting" electrode. Coated on the surface of injecting electrode **1** is a thin layer **4** of finely divided photosensitive particles dispersed in an insulating liquid carrier. The term "photosensitive" for the purposes of this application, refers to the properties of a particle which, once attracted to the injecting electrode, will migrate away from it under the influence of an applied electric field when it is exposed to actinic electromagnetic radiation. For a detailed theoretical explanation of the apparent mechanism of operation of the invention, see the above-mentioned U.S. Pat. Nos. 3,384, 565, 3,384,566 and 3,384,488, the disclosures of which are incorporated herein by reference. Liquid suspension **4** may also contain a sensitizer and/or a binder for the pigment particles which is at least partially soluble in the suspending or carrier liquid as will be explained in greater detail below. Adjacent to the liquid suspension **4** is a second electrode **5**, hereinafter called the "blocking electrode" which is connected to one side of the potential source **6** through a switch **7**. The opposite side of potential source **6** is connected to the injecting electrode **1** so that when switch **7** is closed, an electric field is applied across the liquid suspension **4** between electrodes **1** and **5**. An image projector made up of a light source **8**, a transparency **9**, and a lens **10** is provided to expose the dispersion **4** to a light image of the original transparency **9** to be reproduced. Electrode **5** is made in the form of a roller having a conductive central core **11** connected to the potential source **6**. The core is covered with a layer of a blocking electrode material **12**, which may be Baryta paper. The pigment suspension is exposed to the image to be reproduced while a potential is applied across the blocking and injecting electrodes by closing switch **7**. Roller **5** is caused to roll across the top surface of injecting electrode **1** with switch **7** closed during the period of image exposure. This light exposure causes exposed pigment particles originally attracted to electrode **1** to migrate through the liquid and adhere to the surface of the blocking electrode, leaving behind a pigment image on the injecting electrode surface which is a duplicate of the original transparency **9**. After exposure, the relatively volatile carrier liquid evaporates off, leaving behind the pigment image. This pigment image may then be fixed in place as, for example, by placing a lamination over its top surface or by virture of a dissolved binder material in the carrier liquid such as paraffin wax or other suitable binder that comes out of solution as the carrier liquid evaporates. About 3 to 6 percent by weight of paraffin binder in the carrier has been found to produce good results. The carrier liquid itself may be liquefied paraffin wax or other suitable binder. In the alternative, the pigment image remaining on the injecting electrode may be transferred to another surface and fixed thereon. As explained in greater detail below, this system can produce either monochromatic or polychromatic images depending upon the type and number of pigments suspended in the carrier liquid and the color of light to which this suspension is exposed in the process.

Any suitable insulating liquid may be used as the carrier for the pigment particles in the system. Typical carrier liquids are decane, dodecane, N-tetradecane, paraffin, beeswax or other thermosplastic materials, Sohio Odorless Solvent **3440** or **3454** (kerosene factions available from Standard Oil Company of Ohio) and Isopar G (a long chain saturated aliphatic hydrocarbon available from Humble Oil Company of New Jersey). Good quality images have been produced with voltages ranging from 300 to 5,000 volts in the apparatus of the figure.

In a monochromatic system, particles of a single composition are dispersed in the carrier liquid and exposed to a black-and-white image. A single color results, corresponding to conventional black-and-white photography. In a polychromatic system, the particles are selected so that those of different colors respond to different wavelengths in the visible spectrum corresponding to their principal absorption bands. Also, the pigments should be selected so that their spectral response curves do not have substantial overlap, thus allowing for color separation and subtractive multicolor image formation. In a typical multicolor system the particle dispersion should include cyan colored particles sensitive mainly to red light, magenta particles sensitive mainly to green light, and yellow colored particles sensitive mainly to blue light. When mixed together in a carrier liquid, these particles produce a black appearing liquid. When one or more of the particles are caused to migrate from base electrode **1** toward an upper electrode, they leave behind particles which produce a color equivalent to the color of the impinging light. Thus, for example, red light exposure causes the cyan-colored pigment to migrate, leaving behind the magenta and yellow pigments which combine to produce red in the final image. In the same manner, blue and green colors are reproduced by removal of yellow and magenta, respectively. When white light impinges upon the mix, all pigments migrate, leaving behind the color of the white or transparent substrate. No exposure leaves behind all pigments which combine to produce a black image. This is an ideal technique of subtractive color imaging in that the particles are not only each composed of a single component, but in addition, they perform the dual functions of final image colorant and photosensitive medium. For best results, the parti-

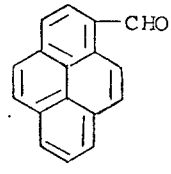
cle size of the pigments should be less than about 10 microns, preferably within the range of about 0.01 to 5 microns.

Any suitable different-colored photosensitive pigment particles having the desired spectral responses may be used with the pigments of this invention to form a partial suspension in a carrier liquid for color imaging. Typical cyan and magenta pigments include those described, for example, in U.S. Pat. Nos. 3,383,993 and 3,384,566. The magenta particles may comprise watching Red B, the barium salt of 1-(methyl-5'-chloro-azobenzene-2'-sulfonic acid)-2-hydroxy-3-napthoic acid, C.I. No. 15865 available from E. I. duPont de Nemours and Company; the cyan particles may comprise a metal-free about 20 percent pigment by weight has been found to produce good results. The addition of small amounts (generally ranging from 0.5 to 5 mol percent) of electron donors or acceptors to the suspensions may impart significant increases in system photosensitivity.

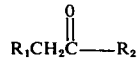
As previously indicated, compounds of the above general formulae may be prepared by conventional condensation reactions involving the condensed polycyclic aromatic hydrocarbon aldehyde and an amine or ketone containing active hydrogen. The preferred aldehydes are the monosubstituted carboxaldehydes of condensed polycyclic aromatic hydrocarbons containing from about 14 to about 20 carbon atoms such as pyrene, anthracene, phenanthrene, chrysene, tetracene and tetraphene. These hydrocarbons may also contain organic or inorganic substituent groups which do not interfere with the progress of the reaction. For example, derivatives of pyrene may be prepared by reacting pyrene carboxaldehyde in Aldol type condensation with the appropriate ketone having active hydrogen at the α carbon. The pyrene carboxaldehyde employed is preferably 1, 3, 6 or 8 monosubstituted pyrene carboxaldehyde, although pyrene-3-carboxaldehyde is preferred.

The following reactions serve only to illustrate some of the methods which may be used to prepare various derivative of pyrene-3-carboxaldehyde. The symbol

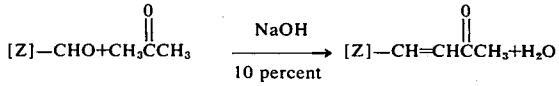
[Z]- CHO represents:



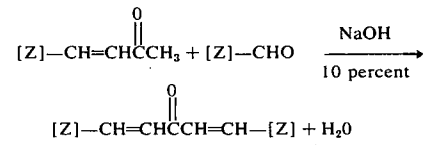
Compounds in accordance with Formula I may be prepared by condensing 3-pyrene carboxaldehyde with ketones of the formula



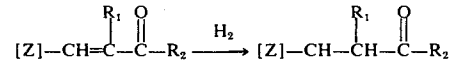
where R_1 and R_2 are as previously designated. Examples of suitable ketones within the same of the above formula are acetophenone, dimethyl ketone, methyl ethyl ketone, methyl isobutyl ketone and the like. For example, 3-pyrylideneacetone corresponding to Formula I may be prepared by a Claisen reaction as follows:



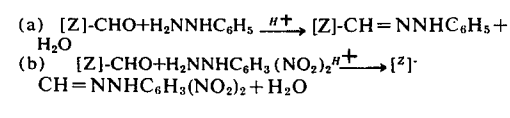
By carrying the above reaction further using a molar excess of pyrene-3-carboxaldehyde, bis pyrenyl substituted ketones also corresponding to Formula I may be obtained:



Compounds corresponding to Formula II may be prepared by catalytic reduction or hydrogenation of the alpha, beta, unsaturated ketones corresponding to Formula I by techniques well known in the art:

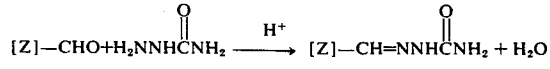


Hydrazones corresponding to Formula III may be prepared by an amine condensation reaction of pyrene-3-carboxaldehyde with phenylhydrazine:



In the case of (b), 2,4-dinitrophenyl hydrazine is used as a reactant.

Semicarbazones corresponding to Formula IV may be prepared by the amine condensation of pyrene-3-carboxaldehyde and semicarbazide:



Similarly, derivatives of other aromatic hydrocarbons such as anthracene, phenanthrene, chrysene; tetracene and tetraphene can be prepared in like manner using the appropriate aromatic hydrocarbon carboxaldehyde as a starting material. From the above, their structure and method of preparation are apparent to those skilled in the art.

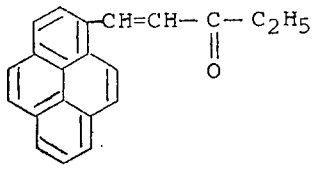
DESCRIPTION OF PREFERRED EMBODIMENTS

The following examples are carried out in an apparatus of the general type illustrated in the figure with the imaging mix 4 coated on a NESA glass substrate through which exposure is made. The NESA glass surface is connected in series with a switch, a potential source, and the conductive center of a roller having a coating of Baryta paper on its surface. The roller is approximately 2 ½ inches in diameter and is moved across the plate surface at about 1.45 centimeters per second. The plate employed is roughly 3 inches square and is exposed with a light intensity of 8,000 foot candles as measured on the uncoated NESA glass surface. Unless otherwise indicated, about 13.5 percent by weight of the indicated pigments in each example are suspended in Sohio Odorless Solvent 3454 and the magnitude of the applied potential is 2,500 volts. All pigments which have a relatively large particle size as made are ground in a ball mill for 48 hours to reduce their size to provide a more stable dispersion which im-

proves the resolution of the final images. The exposure is made with a 3,200°K lamp through a positive transparency.

EXAMPLE I

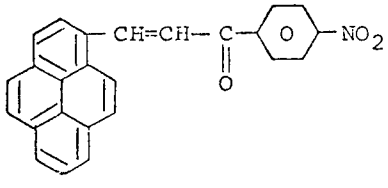
About 13.5 parts of a pigment having the formula:



prepared by reacting pyrene-3-carboxaldehyde with methyl ethyl ketone is suspended in about 100 parts Sohio Odorless Solvent 3454, a kerosene fraction available from Standard Oil Company of Ohio. The suspension is coated onto the NESA glass and a positive potential is imposed on the roller electrode. The plate is exposed to an image through a positive black-and-white transparency. A good image in yellow on the white or transparent background, conforming to the original, was produced on the negative NESA. The procedure was repeated with a negative potential imposed on the roller electrode. An image in yellow was produced on the positive NESA.

EXAMPLE II

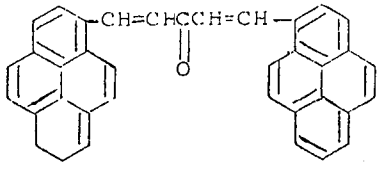
About 13.5 parts of a pigment having the formula:



is suspended in about 100 parts of solvent and the images developed as in Example I. A good orange image was produced on the negative NESA with a slight image on the positive NESA.

EXAMPLE III

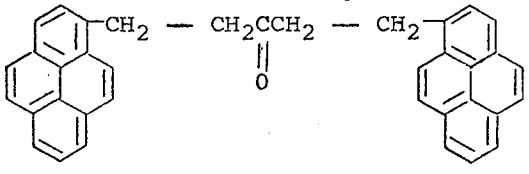
About 13.5 parts of a pigment having the formula:



is suspended in 100 parts of solvent and the images developed as in Example I. A good orange image was produced on both the negative and the positive NESA.

EXAMPLE IV

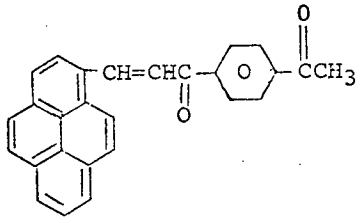
About 13.5 parts of a pigment having the formula:



is suspended in 100 parts of solvent and the images developed as in Example I. A good yellow image was produced on the negative NESA, with a slight image on the positive NESA.

EXAMPLE V

About 13.5 parts of a pigment having the formula:

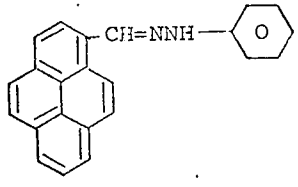


is suspended in 100 parts of solvent and the images developed as in Example I. A good yellow-orange image was produced on both the negative and positive NESA.

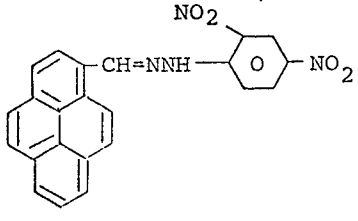
EXAMPLES VI – VIII

In the same manner as detailed in Example I, pigments having the following formulae are suspended in solvent and imaged. All produce a good yellow or yellow-orange image on the negative and positive NESA.

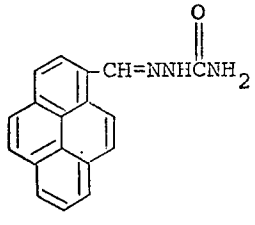
Example VI



Example VII



Example VIII



In the following example, a suspension comprising three colored pigments is made by dispersing the pigments in finely divided form in Sohio Odorless Solvent 3440 so that the pigments constitute 8 percent by weight of the mixture. The mixture may be referred to as a "trimix." The trimixes are individually tested by coating them on the NESA glass plate and exposing them as in Example I above, except that a multicolor transparency is used in place of the black-and-white transparency. Thus, a multicolored image is projected on the plate as the roller electrode moves across the surface thereof. A Baryta paper blocking electrode is employed and the roller is held at a positive potential of

about 2,500 volts. The roller is passed over the plate, after which the quality of the image upon the plate is evaluated as to the image density and color purity.

EXAMPLE IX

A trimix ink was prepared using 1 part yellow compound of Example VI, 1 part Monolite Fast Blue GS, and 2 parts watching Red B, CI No. 15865. When exposed, as discussed above, the trimix produced a full color image on the negative NESA corresponding to the original with good color separation and excellent density characteristics.

As shown by the above examples, the class of pigments of the present invention having the above general formula are suitable for use in electrophoretic imaging processes. Since their photographic speed, density characteristics and color characteristics vary, a mixture of the particular pigments may be preferred for specific uses. Some characteristics of the pigments may be improved by particular purification processes, recrystallization processes and dye sensitization.

The compositions of the general formula given above are also useful in xerographic imaging systems. For use in such processes, xerographic plates may be produced by coating a relatively conductive substrate, e.g., aluminum or paper, with a dispersion of particles of the photosensitive pigment of the above general formula in a resin binder. The pigment-resin layer may also be cast as a self-supporting film. The plate formed may be both with or without an overcoating on the photoconductive layer. As a third alternative to the above noted self-supporting layer and substrate supported layer, the photosensitive pigment-resin photoconductive layer may be used in the formation of multilayer sandwich configurations adjacent a dielectric layer, similar to that shown by Golovin, et al., in the publication entitled "A New Electrophotographic Process, Effected by Means at Combined Electret Layers," Doklady Akad. Nauk SSR vol. 129, No. 5, pp. 1008–1011, November-December 1959.

When it is desired to coat the pigmented resin film on a substrate, various supporting materials may be used. Suitable materials for this purpose include aluminum, steel, brass, metalized or tin oxide coated glass, semiconductive plastics and resins, paper and other convenient materials. Any suitable dielectric material may be used to overcoat the photoconductive layer. A typical overcoating is bichromated shellac.

Any suitable organic binder or resin may be used in combination with the pigment to prepare the photoconductive layer of this invention. In order to be useful the resin used in the present invention should be more resistive than about 10^{10} and preferably more than 10^{12} ohms per centimeter under the conditions of xerographic use. Typical resins include thermoplastics such as polyvinyl chloride, polyvinylacetates, polyvinylidene chloride, polystyrene, polybutadiene, polymethacrylates, polyacrylics, polyacrilonitrile, silicone resins, chlorinated rubber, and mixtures and copolymers thereof where applicable; and thermosetting resins such as epoxy resins including halogenated epoxy and phenoxy resins, phenolics, epoxyphenolic copolymers, epoxy ureaformaldehyde copolymers, epoxy melamine formaldehyde copolymers and mixtures thereof where applicable. Other typical resins are epoxy esters, vinyl epoxy resins, tall-oil modified epoxies, and mixtures thereof where applicable. In addition to the above noted binder materials, any other suitable resin may be used if desired. Also, other binders such as paraffin and mineral waxes may be used if desired.

The pigments may be incorporated in the dissolved or melted binder resin by any suitable means such as strong shear agitation, preferably with simultaneous grinding. These include ball milling, roller milling, sand milling, ultrasonic agitation, high-speed blending and any desirable combination of these methods. Any suitable range of pigment-resin ratios may be used.

The pigment-resin-solvent slurry (or the pigment-resin melt) may be applied to the conductive substrate by any of the well known painting or coating methods, including spraying, flow coating, knife coating, electrocoating, Mayer bar drawdown, dip coating, reverse foil coating, etc. Spraying in an electric field may be preferred for the smoothest finish and dip coating for convenience in the laboratory. The setting, drying and/or curing steps for these plates are generally similar to those recommended for films of the particular binder used for other painting applications. For example, pigment-epoxy plates may be cured by adding a crosslinking agent and stoving according to approximately the same schedule as other baking enamels made with the same resins and similar pigments for painting applications. A very desirable aspect of these pigments is that they are stable against chemical decomposition at the temperatures normally used for a wide variety of bake-on enamels, and therefore, may be incorporated in very hard glossy photoconductive coatings, similar to automotive or kitchen appliance resin finishes.

The thickness of the photoconductive films may be varied from about 1 to about 100 microns, depending on their required individual purpose. Self-supporting films, for example, can not usually be manufactured in thicknesses thinner than about 10 microns, and they are easiest to handle and use in the 15 to 75 micron range. Coatings, on the other hand, are preferably formed in the 5 to 30 micron range. For certain compositions and purposes, it is desirable to provide an overcoating; this should usually not exceed the thickness of the photoconductive coating, and preferably no above one-quarter of the latter. Any suitable overcoating material may be used, such as bichromated shellac.

The invention as it pertains to xerographic imaging processes will be further described with reference to the following example, which describes in detail a preferred embodiment of the present invention. Parts, ratios and percentages are by weight unless otherwise stated.

A xerographic plate for use as in the following example is prepared as follows: mixtures using specific pigments and resin binders are prepared by ball milling the pigment and a solution of a resinous binder and one or more solvents until the pigment is well dispersed. This is done by adding the desired parts of the pigment to the desired parts of resin solution in a suitable mixing vessel. A quantity of ⅛ inch steel balls are added and the vessel is rotated for approximately one half hour in order to obtain a homogeneous dispersion. The cooled slurry is applied onto an aluminum substrate with a wire drawdown rod and force dried in an oven for about 3 minutes at about 100°C. The coated sheets are dark rested for about one hour and then tested.

In the following example the plate is tested as follows. The plate is charged negative by corona discharge to about 400 volts and exposed to a light and shadow image. The plate is cascade developed using Xerox 1824 developer. The powder image produced on the plate

corresponds to the projected image. The developed image may be then either fused to the plate or may be electrostatically transferred to a receiving sheet and there fused. Where the image is transferred, the plate may be then cleaned of residual toner and may be reused as by the above described process.

EXAMPLE X

The xerographic plate is prepared by initially mixing about 2 parts of Lucite 2042, an ethylmethacrylate polymer, about 18 parts benzene, and about 1 part of the pigment of Example VII. This mixture is coated onto an aluminum substrate to a thickness of about 8 microns and cured. The plate is then charged, exposed for about 45 seconds to a light and shadow image using a Simmons Omega D3 enlarger equipped with a tungsten light source operating at 2950°K color temperature (illumination level incident on the plate is 2.8 foot candles as measured with a Weston Illumination Meter Model No. 756), and developed as above described. The image produced is heat fused directly onto the plate. The image produced was found to be satisfactory.

Although specific components and proportions have been described in the above examples, other suitable materials, as listed above, may be used with similar results. In addition, other materials may be added to the pigment compositions to synergize, enhance, or otherwise modify their properties. The pigment compositions of this invention may be dye sensitized, if desired, or may be mixed with other photosensitive materials, both organic and inorganic.

Other modifications and ramifications of the present invention will occur to those skilled in the art upon a reading of the present disclosure. These are intended to be included within the scope of this invention.

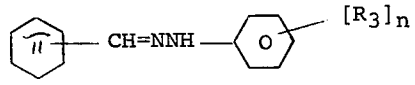
What we claimed is:

1. A method of photoelectrophoretic imaging comprising:

a. providing a layer of an imaging suspension comprising electrically photosensitive particles in an insulating liquid between at least two electrodes, at least one electrode being at least partially transparent;

b. exposing said suspension to a pattern of electromagnetic radiation to which at least a portion of said particles are sensitive and,

c. applying an electrical field across said suspension until an image made up of migrated particles is formed, said suspension comprising particles of a pigment having the formula:



wherein:

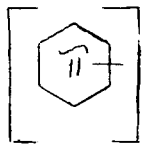


represents a condensed polycyclic aromatic group having from about 14 to about 20 carbon atoms;

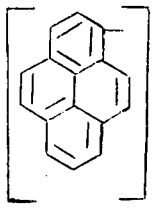
R_3 is selected from the group consisting of: H, OH, CH_3, OCH_3, C_2H_5, OC_2H_5, $COCH_3$, CO_2CH_3, COC_2H_5, $CO_2C_2H_5$, NO_2, CN, SO_2NH_2, $SO_2NHC_6H_5$, Cl, F, Br, I; and

n is a positive integer from **1–3.**

2. The method of claim **1** wherein



represents



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