

1

3,408,189

ELECTROPHOTOGRAPHIC PLATE AND PROCESS EMPLOYING PHOTOCONDUCTIVE CHARGE TRANSFER COMPLEXES

Joseph Mammino, Penfield, N.Y., assignor to Xerox Corporation, Rochester, N.Y., a corporation of New York
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ABSTRACT OF THE DISCLOSURE

Photoconductive materials are prepared from melamine resins and Lewis acids. The materials are charge transfer complexes. The photoconductive materials are used to make electrophotographic plates. Methods of using the plates are also disclosed.

This invention relates to photoconductive materials, and more particularly, to their use in electrophotography.

It is known that images may be formed and developed on the surface of certain photoconductive materials by electrostatic means. The basic xerographic process, as taught by Carlson in U.S. Patent 2,297,691, involves uniformly charging a photoconductive insulating layer and then exposing the layer to a light-and-shadow image which dissipates the charge on the areas of the layer which are exposed to light. The electrostatic latent image formed on the layer corresponds to the configuration of the light-and-shadow image. This image is rendered visible by depositing on the image layer a finely divided developing material comprising an electroscopic marking material called a toner. The powder developing material will normally be attracted to those portions of the layer which retain a charge, thereby forming a powder image corresponding to the latent electrostatic image. This powder image may be transferred to paper or other receiving surface. The paper then will bear the powder image which may subsequently be made permanent by heating or other suitable fixing means. The above general process is also described in U.S. Patents 2,357,809; 2,891,011 and 3,079,342.

That various photoconductive insulating materials may be used in making electrophotographic plates is known. Suitable photoconducting insulating materials such as anthracene, sulfur, selenium or mixtures thereof, have been disclosed by Carlson in U.S. Patent 2,297,691. These materials generally have sensitivity in the blue or near ultra-violet range, and all but selenium have a further limitation of being only slightly light sensitive. For this reason, selenium has been the most commercially accepted material for use in electrophotographic plates. Vitreous selenium however, while desirable in most aspects, suffers from serious limitations in that its spectral response is somewhat limited to the ultraviolet, blue and green regions of the spectrum and the preparation of vitreous selenium plates requires costly and complex procedures, such as vacuum evaporation. Also, selenium plates require the use of a separate conductive substrate layer, preferably with an additional barrier layer deposited thereon before deposition of the selenium photoconductor. Because of these economic and commercial considerations, there have been many recent efforts towards developing photoconductive insulating materials other than selenium for use in electrophotographic plates.

It has been proposed that various two-component materials be used in photoconductive insulating layers used in electrophotographic plates. For example, the use of inorganic photoconductive pigments dispersed in suitable binder materials to form photoconductive in-

2

ulating layers is known. It has further been demonstrated that organic photoconductive dyes and a wide variety of polycyclic compounds may be used together with suitable resin materials to form photoconductive insulating layers useful in binder-type plates. In each of these two systems, it is necessary that at least one original component used to prepare the photoconductive insulating layer be, itself, a photoconductive material.

In a third type plate, inherently photoconductive polymers are used; frequently in combination with sensitizing dyes or Lewis acids to form photoconductive insulating layers. Again, in these plates at least one photoconductive component is necessary in the formation of the layer. While the concept of sensitizing photoconductors is, itself, commercially useful, it does have the drawback of being limited to only those materials already having substantial photoconductivity.

The above discussed three types of known plates are further described in U.S. Patents 3,097,095; 3,113,022; 3,041,165; 3,126,281; 3,073,861; 3,072,479; 2,999,750; Canadian Patent 644,167 and German Patent 1,068,115.

The polymeric and binder-type organic photoconductor plates of the prior art generally have the inherent disadvantages of high cost of manufacture, brittleness, and poor adhesion to supporting substrates. A number of these photoconductive insulating layers have low temperature distortion properties which make them undesirable in an automatic electrophotographic apparatus which often includes powerful lamps and thermal fusing devices which tend to heat the xerographic plate. Also, the choice of physical properties has been limited by the necessity of using only inherently photoconductive materials.

Inorganic pigment-binder plates are limited in usefulness because they are often opaque and are thus limited to use in systems where light transmission is not required. Inorganic pigment-binder plates have the further disadvantages of being non-reusable due to high fatigue and rough surfaces which make cleaning difficult. Still another disadvantage is that the materials used have been limited to those having inherent photoconductive insulating properties.

It is, therefore, an object of this invention to provide a photoconductive insulating material suitable for use in electrophotographic plates devoid of the above-noted disadvantages.

Another object of this invention is to provide an economical method for the preparation of photoconductive insulating materials wherein none of the required components is by itself substantially photoconductive.

Another object of this invention is to provide a photoconductive insulating material suitable for use in electrophotographic plates in both single use and reusable systems.

Yet still another object is to provide a photoconductive insulating layer for an electrophotographic plate which is substantially resistant to abrasion and has a relatively high distortion temperature.

Yet, a further object of this invention is to provide an electrophotographic plate having a wide range of useful physical properties.

A still further object of this invention is to provide photoconductive insulating layers which may be cast into self-supporting binder-free photoconductive films and structures.

Still another object of this invention is to provide a novel combination of initially non-photoconductive insulating materials suitable for use in the manufacture of the photoconductive insulating layer of a xerographic plate which are easily coated on a desired substrate or combined with a conductive layer.

Another object is to provide a transparent self-supporting photoconductive film adapted for xerographic imaging which does not require a conductive backing.

A still further object of this invention is to provide a photoconductive insulating material which may be made substantially transparent and which is particularly adapted for use in systems where light transmission is required.

The foregoing objects and others are accomplished in accordance with this invention, generally speaking, by providing a photoconductive material adapted for use in electrophotographic plates which is obtained by complexing:

- (A) A suitable Lewis acid with
- (B) A melamine resin.

It should be noted that neither of the above two components (A and B) used to make the photoconductor of this invention is by itself photoconductive; rather, they are each non-photoconductive.

After the above substantially non-photoconductive Lewis acid is mixed or otherwise complexed with said substantially non-photoconductive resinous material, a highly desirable photoconductive insulating material is obtained which may be either cast as a self-supporting layer or may be deposited on a suitable supporting substrate. Any other suitable method of preparing a photoconductive plate from the above photoconductive material may be used.

It has been found by the present invention that electron acceptor complexing may be used to render inherently non-photoconductive electron donor type insulators photoconductive. This greatly increases the range of useful materials for electrophotography.

A Lewis acid is any electron acceptor relative to other materials present in the system. A Lewis acid will tend to accept electrons furnished by an electron donor (or Lewis base) in the process of forming a chemical compound or, in the present invention, a charge transfer complex.

A "Lewis Acid" is defined for the purposes of this invention as any electron accepting material relative to the polymer to which it is complexed.

A "charge-transfer complex" may be defined as a molecular complex between substantially neutral electron donor and acceptor molecules, characterized by the fact that photo-excitation produces internal electron transfer to yield a temporary excited state in which the donor is more positive and the acceptor more negative than in the ground state.

It is believed that the donor-type insulating resins of the present invention are rendered photoconductive by the formation of charge transfer complexes with electron acceptors or Lewis acids and that these complexes, once formed, constitute the photoconductive elements of the plates.

Broadly speaking, charge transfer complexes are loose associations containing electron donors and acceptors, frequently in stoichiometric ratios, which are characterized as follows:

- (A) Donor-acceptor interaction is weak in the neutral ground state, i.e., neither donor nor acceptor is appreciably perturbed by the other in the absence of photo-excitation.
- (B) Donor-acceptor interaction is relatively strong in the photo-excited state, i.e., the components are at least partially ionized by photo-excitation.
- (C) When the complex is formed, one or more new absorption bands appear in the near ultraviolet or visible region (wave lengths between 3200-7500 Angstrom units) which are present in neither donor alone nor acceptor alone, but which are instead a property of the donor-acceptor complex.

Both the intrinsic absorption bands of the donor and the charge transfer bands of the complex may be used to excite photoconductivity.

"Photoconductive insulator" for the purposes of this in-

vention is defined with reference to the practical application in electrophotographic imaging. It is generally considered that any insulator may be rendered "photoconductive" through excitation by sufficiently intense radiation of sufficiently short wave lengths. This statement applies generally to inorganic as well as to organic materials, including the inert binder resins used in binder plates, and the electron acceptor type activators and aromatic resins used in the present invention. However, the short wave length radiation sensitivity is not useful in practical imaging systems because sufficiently intense sources of wave lengths below 3200 Angstrom units are not available, because such radiation is damaging to the human eye and because this radiation is absorbed by glass optical systems. Accordingly, for the purposes of this application, the term "photoconductive insulator" includes only those materials which may be characterized as follows:

- (1) They may be formed into continuous films which are capable of retaining an electrostatic charge in the absence of actinic radiation.
- (2) These films are sufficiently sensitive to illumination of wave lengths longer than 3200 Angstrom units to be discharged by at least one half by a total flux of at most 10^{14} quanta/cm.² of absorbed radiation.

This definition excludes the resins and Lewis acids of our disclosure when used individually from the class of "photoconductive insulators."

The melamine resins used in the present invention may be prepared in any conventional manner. For example, any of the synthesis described in "Amino Resins," by John F. Blais, Reinhold Publishing Corp., New York (1959), may be used. In general melamine resins are prepared by reacting one mole of melamine (2,4,6-triamino-1,3,5-triazine) with at least three moles of any suitable aldehyde, such as formaldehyde. The resulting methylol melamine may be further modified before condensation to resinous polymers.

Any suitable melamine resin may be used in the present invention. Optimum sensitivity has been obtained with hexamethoxymethyl melamine and butylated melamine formaldehyde resins. These, therefore, are the preferred resins. Any other suitable melamine resin may be used where desired. Typical melamine resins include condensation products of trimethylol melamine, dimethylol melamine, thiomethylol melamine. Any suitable Lewis acid can be complexed with the above-noted melamine resins to form the desired photoconductive material. While the mechanism of the complex chemical interaction involved in the present process is not completely understood, it is believed that a "charge transfer complex" is formed having absorption bands characteristics of neither of the two components considered individually. The mixture of the two non-photoconductive components seems to have a synergistic effect which is much greater than additive.

Best results are obtained when using these preferred Lewis acids: 2,4,7-trinitro-9-fluorenone; tetrachlorophthalic anhydride, 9-(dicyanomethylene)-2,4,7-trinitrofluorene; 2,3-dichloro-1,4-naphthoquinone and mixtures thereof.

Other typical Lewis acids include quinones, such as

- p-benzo-quinone,
- 2,5-dichlorobenzoquinone,
- 2,6-dichlorobenzoquinone,
- chloranil,
- naphthoquinone-(1,4),
- 2-methylantraquinone,
- 1,4-di-methyl-antraquinone,
- 1-chloroantraquinone,
- anthraquinone-2-carboxylic acid,
- 1,5-dichloroantraquinone,
- 1-chloro-4-nitroantraquinone,

phenanthrenequinone,
acenaphthenequinone,
pyranthrenequinone,
chrysenequinone,
thionaphthene-quinone,
anthraquinone-1,8-disulfonic acid, and
anthraquinone-2-aldehyde,
triphtaloly-benzene-aldehydes, such as
bromal,
4-nitrobenzaldehyde,
2,6-di-chlorobenzaldehyde-2,
ethoxy-1-naphthaldehyde,
anthracene-9-aldehyde,
pyrene-3-aldehyde,
oxindole-3-aldehyde,
pyridine-2,6-dialdehyde,
biphenyl-4-aldehyde;

organic phosphonic acids such as 4-chlor-3-nitrobenzene-phosphonic acid; nitrophenols, such as 4-nitrophenol, and picric acid; acid anhydrides, for example, acetic-anhydride, succinic anhydride, maleic anhydride, phthalic anhydride, tetrachlorophthalic anhydride, perylene-3,4,9,10-tetracarboxylic acid and chrysene-2,3,8,9-tetracarboxylic anhydride, di-bromo maleic acid anhydride; metal-halides of the metals and metalloids of the Groups IB, II through to Group VIII of the periodical system, for example:

aluminum chloride,
zinc chloride,
ferric chloride,
tin tetrachloride (stannic chloride),
arsenic trichloride,
stannous chloride,
antimony pentachloride,
magnesium chloride,
magnesium bromide,
calcium bromide,
calcium iodide,
strontium bromide,
chromic bromide,
manganous chloride,
cobaltous chloride,
cobaltic chloride,
cupric bromide,
ceric chloride,
thorium chloride,
arsenic triiodide;
boron halide compounds, for example:
boron trifluoride, and
boron trichloride, and ketones, such as
acetophenone benzophenone,
2-acetyl-naphthalene,
benzil,
benzoin,
5-benzoyl acenaphthene,
biacenedione,
9-acetyl-anthracene,
9-benzoyl-anthracene,
4-(4-dimethylamino-cinnamoyl)-1-acetylbenzene,
acetoacetic acid anilide,
indandione-(1,3),
(1,3-diketo-hydrindene),
acenaphthene quinone-dichloride,
anisil,
2,2-pyridil and
furil.

Additional Lewis acids are mineral acids such as the hydrogen halides,
sulphuric acid and phosphoric acid;
organic carboxylic acids, such as
acetic acid and the substitution products thereof,
monochloro-acetic acid,
dichloroacetic acid,

- trichloro-acetic acid,
phenylacetic acid, and
6-methyl-coumarinylacetic acid (4);
maleic acid,
5 cinnamic acid,
benzoic acid,
1-(4-diethyl-amino-benzoyl)-benzene-2-carboxylic acid,
phthalic acid, and
tetra-chlorophthalic acid,
10 alpha-beta-dibromo-beta-formyl-acrylic acid (mucobromic acid),
dibromo-maleic acid,
2-bromo-benzoic acid,
gallic acid,
15 3-nitro-2-hydroxyl-1-benzoic acid,
2-nitro phenoxy-acetic acid,
2-nitro-benzoic acid,
3-nitro-benzoic acid,
4-nitro-benzoic acid,
20 3-nitro-4-ethoxy-benzoic acid,
2-chloro-4-nitro-1-benzoic acid,
2-chloro-4-nitro-1-benzoic acid,
3-nitro-4-methoxy-benzoic acid,
4-nitro-1-methyl-benzoic acid,
25 2-chloro-5-nitro-1-benzoic acid,
3-chloro-6-nitro-1-benzoic acid,
4-chloro-3-nitro-1-benzoic acid,
5-chloro-3-nitro-2-hydroxy-benzoic acid,
4-chloro-2-hydroxy-benzoic acid,
30 2,4-dinitro-1-benzoic acid,
2-bromo-5-nitro-benzoic acid,
4-chlorophenyl-acetic acid,
2-chloro-cinnamic acid,
2-cyano-cinnamic acid,
35 2,4-dichlorobenzoic acid,
3,5-dinitro-benzoic,
3,5-dinitro-salicylic acid,
malonic acid,
mucic acid,
40 acetosalicylic acid,
benzilic acid,
butane-tetracarboxylic acid,
citric acid,
cyano-acetic acid,
45 cyclohexane-dicarboxylic acid,
cyclohexane-carboxylic acid,
9,10-dichloro-stearic acid,
fumaric acid,
itaconic acid,
50 levulinic acid (levulic acid),
malic acid,
succinic acid,
alpha-bromo-stearic acid,
citraconic acid,
55 dibromo-succinic acid,
pyrene-2,3,7,8-tetra-carboxylic acid,
tartaric acid;
organic sulphonic acids, such as
4-toluene sulphonic acid, and
60 benzene sulphonic acid,
2,4-dinitro-1-methyl-benzene-6-sulphonic acid,
2,6-dinitro-1-hydroxy-benzene-4-sulphonic acid,
2-nitro-1-hydroxy-benzene-4-sulphonic acid,
4-nitro-1-hydroxy-2-benzene-sulphonic acid,
65 3-nitro-2-methyl-1-hydroxy-benzene-5-sulphonic acid,
6-nitro-4-methyl-1-hydroxy-benzene-2-sulphonic acid,
4-chloro-1-hydroxy-benzene-3-sulphonic acid,
2-chloro-3-nitro-1-methyl-benzene-5-sulphonic acid and
2-chloro-1-methyl-benzene-4-sulphonic acid.
- 70 The following examples will further define the present invention. Parts and percentages are by weight unless otherwise indicated. The examples below should be considered to illustrate various preferred embodiments of the present invention.
- 75 In each example, the substance to be evaluated is coated

from solution by suitable means onto a conductive substrate and dried. The coated plate is connected to ground and the layer is electrically charged in the dark by a corona discharge device (as described by Carlson in U.S. Patent 2,588,699) to saturation potential using a needle-point scorotron powered by a high voltage power supply manufactured by High Volt Power Supply Company, Condenser Products Division, Model PS-10-1M operating at 7 kilovolts while maintaining the grid potential at 0.9 kilovolt using a Kepco, Incorporated regulated D.C. supply (0-1500 volts). Charging time is 15 seconds.

The electrostatic potential due to the charge is then measured with a transparent electrometer probe without touching the layer or affecting the charge. The signal generated in the probe by the charged layer is amplified and fed into a Mosely Autograf recorder, Model 680. The graph directly plotted by the recorder indicates the magnitude of the charge on the layer and rate of decay of the charge with time. After a period of about 15 seconds, the layer is illuminated by shining light onto the layer through the transparent probe using an incandescent lamp operating at 2800° K. color temperature. The illumination level is measured with a Weston Illumination Meter, Model No. 756, and is recorded in the table. The light discharge rate is measured for a period of 15 seconds or until a steady residual potential is reached.

The numerical difference in the rate of discharge of the charge on the layer with time in the light minus the rate of discharge of the charge on the layer in the dark is considered to be a measure of the light sensitive of the layer.

A practical test is also made on each material under study which shows photoconductivity. An electrophotographic image is produced by charging the material by corona discharge, exposing the material by projection to a light-and-shadow image and cascade developing the electrostatic latent image by the method described by Walkup in U.S. Patent 2,618,551. Details of this procedure are given in Example I.

EXAMPLE I

About 4 parts Cymel 301, hexamethoxymethylmelamine from American Cyanamide, is dissolved in about 50 parts of toluene. To this solution is added a solution consisting of about 1 part 2,4,7-trinitro-9-fluorenone (Eastern Chemical Co.) dissolved in a mixture of about 4 parts cyclohexanone and about 20 parts toluene. The solution is coated to a dry thickness of about 5 microns thickness onto a 5 mil aluminum plate (type 1145-H19 sold by Aluminum Company of America) by flow coating. The coating is dried for about 5 days at about 120° C.

A portion of this plate is charged to a positive potential of about 20 volts by means of a corona discharge in the manner described by Carlson in U.S. Patent 2,588,699. The charged plate is then exposed to an image for about 15 seconds by projection using a Simmons Omega D3 Enlarger equipped with a F4.5 lens and a tungsten light source operating at 3200° K. color temperature. The light exposure is about 72 foot-candle-seconds. The plate is then developed with a liquid developer as described by Metcalfe in U.S. Patent 2,907,674. The image on the receiving sheet corresponds to the original projected image.

Another portion of the above plate is electrometered as previously described and the results are tabulated in Table I.

EXAMPLE II

The tests of Example I are repeated, except that the plate is charged to a negative potential of about 12 volts. Again, an image conforming to the original is produced with an appropriate liquid developer as in Example I. Plate sensitivity is measured and recorded in Table I.

EXAMPLE III

A coating solution is prepared as described in Example

I except that the 2,4,7-trinitro fluorenone is not included. The solution is applied onto an aluminum plate as before and cured in an oven for about 5 days at about 120° C. The plate is charged, exposed and developed as in Example I. No image is observed on the plate. Another portion of the plate is electrometered and the results are tabulated in the table. As indicated by the table, the plate without the Lewis acid has no photosensitivity.

EXAMPLE IV

The experiment of Example II is repeated, with the plate charged to a negative potential and no 2,4,7-trinitro-9-fluorenone in the coating solution. As indicated in Table I, this plate has no photosensitivity.

EXAMPLE V

About 1 part of 2,4,7-trinitro-9-fluorenone is dissolved in about 20 parts toluene and about 4 parts cyclohexanone. To this is added about 4 parts Cymel 248-8, a butylated melamine formaldehyde resin, available from American Cyanamide. The solution is flow coated onto an aluminum substrate to a dry thickness of about 7 microns, and dried for about 18 hours at about 80° C.

A portion of this plate is charged to a negative potential of about 490 volts by corona discharge. The charged plate is then exposed to an image for about 15 seconds using a Simmons Omega D3 Enlarger equipped with an F4.5 lens and a tungsten lamp. Total exposure is about 70 foot-candle-seconds. The plate is then developed by cascade as described by Walkup in U.S. Patent 2,618,551. The developed image is transferred to a paper sheet in the manner described by Schaffert in U.S. Patent 2,576,047. The image on the receiving sheet is of good quality, conforming to the original. The plate is then ready for cleaning and reuse, as by the above process.

Another portion of the plate is then electrometered as previously described and the results are tabulated in Table I.

EXAMPLE VI

The tests of Example V are repeated, except that no 2,4,7-trinitro-9-fluorenone is included in the coating solution. As indicated in Table I, this plate shows no photosensitivity.

EXAMPLE VII

About 2 parts of Lucite 2042, an ethyl methacrylate resin manufactured by E. I. du Pont de Nemours and Company is dissolved in about 10 parts of methyl ethyl ketone. The solution is applied onto an aluminum plate to a thickness of about 5 microns and cured. The plate is electrometered with both positive and negative charge as described above and the results are tabulated.

This plate is used as a control. As indicated in the table, this resin, when used alone, has no photosensitivity.

EXAMPLE VIII

About 0.2 part of 2,4,7-trinitrofluorenone is added to the resin coating solution prepared as described in Example VII above. This solution is applied onto an aluminum sheet to a thickness of about 5 microns and dried. The plate is electrometered and the results are tabulated.

This plate indicates that the addition of a Lewis acid to an inert resin does not result in photosensitive response. This indicates that Lewis acids alone are not photosensitive.

EXAMPLE IX

A coating solution is prepared as described in Example V except that 9-(dicyanomethylene)-2,4,7-trinitrofluorenone is used in place of the 2,4,7-trinitrofluorenone. The solution is coated onto an aluminum plate as before and dried in an oven for about 18 hours at about 80° C. A portion of the plate is charged, exposed, and developed as in Example I. A positive image of good quality results.

EXAMPLE X

A coating solution is prepared as in Example V above,

except that the 2,4,7-trinitro fluorenone is replaced with 2,3 - dichloro-1,4-naphthoquinone. The mixture is coated onto an aluminum substrate and dried. The plate is charged, exposed and developed as in Example I above. A positive image of good quality is produced on this plate.

7. A process for the preparation of a photoconductive charge transfer complex material which comprises mixing a Lewis acid and a melamine resin, said charge transfer complex having at least one new absorption band within a range of from about 3200 to about 7500 Angstrom units.

Example	Initial Potential (volts)	Light Dis-charge (volts/sec.)	Dark Dis-charge (volts/sec.)	Residual Potential after 15 sec. (v.)	Illumination Intensity (foot candles)	Sensitivity
I.....	+20	9.6	0	2	57	16.8
II.....	-12	5.6	0	1	57	9.8
III.....	+18	2.0	2.0	5	57	0
IV.....	-14	2.0	2.0	5	57	0
V.....	-490	26.7	10.6	340	57	28.3
VI.....	-310	10.6	10.6	200	57	0
VII.....	+460	4.4	4.4	+390	57	0
	-500	5.2	5.2	-410	57	0
VIII.....	+420	0	0	+420	57	0
	-460	0	0	-450	57	0

In the above table, sensitivity represents the initial discharge rate upon illumination in volts/sec. per 100 foot-candle-seconds of exposure corrected for the rate of dark discharge. As shown by Examples I, II and V, a mixture of a melamine resin and a Lewis acid is photoconductive. Examples III, IV and VI show that a melamine resin used alone, with no Lewis acid, is not photoconductive. As shown by Example VII, Lucite 2042, is not photoconductive. Example VIII shows that the Lewis acids used in Examples I, II, V and VIII are not photoconductive in an inert Lucite binder.

Although specific materials and conditions were set forth in the above examples, these were merely illustrative of the present invention. Various other compositions, such as the typical materials listed above and various conditions where suitable, may be substituted for those given in the examples with similar results. The photoconductive composition of this invention may have other materials or colorants mixed therewith to enhance, sensitize, synergize or otherwise modify the photoconductive properties of the composition. The photoconductive compositions of this invention, where suitable, may be used in other imaging processes, such as those disclosed in copending applications Ser. Nos. 384,737; 384,680 and 384,681, where their electrically photosensitive properties are beneficial.

Many other modifications of the present invention will occur to those skilled in the art upon a reading of this disclosure. These are intended to be encompassed within the spirit of this invention.

What is claimed is:

1. A photoconductive charge transfer complex material comprising a mixture of a Lewis acid and a melamine resin, said photoconductive charge transfer complex having at least one new absorption band within a range of from about 3200 to about 7500 Angstrom units.

2. The photoconductive material of claim 1 wherein said melamine resin is a butylated melamine formaldehyde resin.

3. The photoconductive material of claim 1 wherein said melamine resin is a hexamethoxymethylmelamine resin.

4. The photoconductive charge transfer complex material of claim 1 comprising from about 1 to about 100 parts by weight of said resin for every one part of said Lewis acid.

5. The photoconductive charge transfer complex material of claim 1 wherein said Lewis acid is selected from the group consisting of 2,4,7-trinitro-9-fluorenone; tetrachlorophthalic anhydride; 9-(dicyanomethylene)-2,4,7-trinitrofluorene; 2,3-dichloro-1,4-naphthoquinone, and mixtures thereof.

6. The charge transfer complex material of claim 1 wherein said Lewis acid comprises 2,4,7-trinitro-9-fluorenone.

8. The process of claim 7 wherein from about 1 to about 100 parts by weight of resin are mixed with every one part of Lewis acid.

9. The process of claim 7 wherein said melamine resin is a hexamethoxymethylmelamine resin.

10. The process of claim 7 wherein said melamine resin is a butylated melamine formaldehyde resin.

11. The process of claim 7 wherein said Lewis acid is selected from the group consisting of 2,4,7-trinitro-9-fluorenone; tetrachlorophthalic anhydride; 9-(dicyanomethylene)-2,4,7-trinitrofluorene; 2,3-dichloro-1,4-naphthoquinone, and mixtures thereof.

12. The process of claim 7 wherein said Lewis acid comprises 2,4,7-trinitro-9-fluorenone.

13. An electrophotographic plate comprising a support substrate having fixed to the surface thereof a photoconductive charge transfer complex material comprising a mixture of a Lewis acid and a melamine resin, said photoconductive charge transfer complex having at least one new absorption band within the range of from about 3200 to about 7500 Angstrom units.

14. The electrophotographic plate of claim 13 wherein said Lewis acid is selected from the group consisting of 2,4,7-trinitro-9-fluorenone; tetrachlorophthalic anhydride; 9-(dicyanomethylene)-2,4,7-trinitrofluorene; 2,3-dichloro-1,4-naphthoquinone, and mixtures thereof.

15. The electrophotographic plate of claim 13 wherein said Lewis acid comprises 2,4,7-trinitro-9-fluorenone.

16. The electrophotographic plate of claim 13 wherein said melamine resin is a butylated melamine formaldehyde resin.

17. The electrophotographic plate of claim 13 wherein said melamine resin is a hexamethoxymethylmelamine resin.

18. The electrophotographic plate of claim 13 comprising from about 1 to about 100 parts by weight of said resin for every one part of said Lewis acid.

19. A method of forming a latent electrostatic charge pattern comprising charging the electrophotographic plate of claim 13 and exposing said plate to a pattern of activating electromagnetic radiation.

20. A method of forming a latent electrostatic pattern wherein the plate of claim 13 is electrostatically charged in an image pattern.

21. An electrophotographic process wherein the plate of claim 13 is electrically charged, exposed to an image pattern to be reproduced and developed with electrically attractable marking particles.

22. An electrophotographic process wherein the plate of claim 13 is electrostatically charged in an image pattern and developed with electrically attractable marking particles.

23. The process of claim 21 further including the steps of transferring said marking particles to the surface of a

11

receiving sheet, and recharging, exposing, and developing said plate to produce at least more than one copy of the original.

24. The process of claim 21 further including the steps of transferring said marking particles to the surface of a receiving sheet, and recharging, exposing and developing said plate to produce at least more than one copy of the original.

12

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NORMAN G. TORCHIN, *Primary Examiner.*

JOHN C. COOPER, *Assistant Examiner.*