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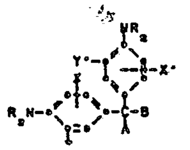
(54) Photoconductive layers containing a mixture of at least two different organic photoconductors and electrophotographic elements comprising said layers.

(57) The problem of crystallization of organic photoconductive compounds in insulating binder-containing layers, which may impair the capability of those layers to produce high-resolution images, is overcome by using as the photoconductor a mixture comprising at least two compounds of the formula:



wherein R is an alkyl, substituted alkyl, aralkyl, aryl or substituted aryl group;

each of X, X', Y, and Y', which may be the same or different, is hydrogen, alkyl, substituted alkyl, alkoxy, substituted alkoxy, hydroxyl, nitro or halogen;

each of A and B, which may be the same or different, is hydrogen, alkyl, substituted alkyl, alkoxy, substituted alkoxy, hydroxyl, halogen, unsubstituted or substituted aryl, cycloalkyl having four to ten carbon atoms and cycloalkenyl having four to eight carbon atoms; or

A and B taken together represent atoms which form with the carbon to which they are attached a substituted or unsubstituted carbocyclic ring having from 4 to 10 atoms, any alkyl, substituted alkyl, alkoxy or substituted alkoxy substituent having from 1 to 10 carbon atoms and any aryl or substituted aryl group being an unsubstituted or substituted phenyl, naphthyl or anthryl group, any substituent in a substituted aryl group being an amino, alkylamino, or dialkylamino group or a substituent as defined for X, X', Y and Y'.

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PHOTOCONDUCTIVE LAYERS AND ELEMENTS AND PROCESSES FOR USING THEM

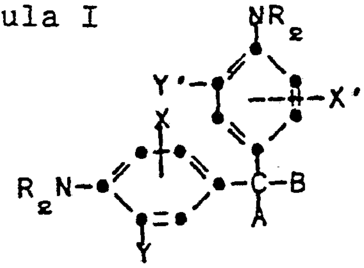
This invention provides novel photoconductive layers containing mixtures of certain organic photoconductors and novel photoconductive elements containing such layers.

The use of photoconductive elements in electrophotographic processes is well known. Such elements generally comprise a conductive support bearing a photoconductive layer. The photoconductive layer generally comprises a photoconductive material dispersed in an electrically insulating binder. Among the materials which have been described as useful organic photoconductive materials are tri-substituted methanes such as disclosed in U.S. Patent 3,820,989 by Rule and triarylmethane leuco bases such as disclosed in U.S. Patent 3,542,547 by Wilson.

Photoconductive layers comprising the organic photoconductive materials disclosed in the aforementioned patents are capable of producing high resolution images at suitable exposures. However, after a period of storage or if the element was prepared using elevated drying temperatures, elements which contain a photoconductive layer having only one photoconductor often will not perform well. Such poor electrophotographic performance is apparently due to the tendency of the organic photoconductor to migrate to the surface of the layer and crystallize out in a snake-like pattern. Such crystallization has been called the "snake" defect or "snake" problem. It impairs the capability of the photoconductive layer for producing high resolution images.

We have now discovered that this crystallization, or "snake", problem can be overcome by producing an electrophotographic layer comprising an electrically insulating binder and organic photoconductive material which contains a crystallization inhibiting mixture of at least two organic photoconductors of the formula:

Formula I



wherein

R is an alkyl, substituted alkyl, aralkyl, aryl or substituted aryl group;

each of X, X', Y and Y', which may be the same or different, is hydrogen, alkyl, substituted alkyl, alkoxy, substituted alkoxy, hydroxyl, nitro or halogen; and

each of A and B, which may be the same or differen is of hydrogen, alkyl, substituted alkyl, alkoxy, substituted alkoxy, hydroxyl, halogen, unsubstituted or substituted aryl, cycloalkyl having four to ten carbon atoms and cycloalkenyl having four to eight carbon atoms; or

A and B taken together represent atoms which form with the carbon atom to which they are attached a substituted or unsubstituted carbocyclic ring having from 4 to 10 carbon atoms;

any alkyl, substituted alkyl, alkoxy or substituted alkoxy substituent having from 1 to 10 carbon atoms and any aryl or substituted aryl group being an unsubstituted or substituted phenyl, naphthyl or anthryl group, any substituent in a substituted aryl group being an amino, alkylamino or dialkylamino group or a substituent as defined for X, X', Y and Y'.

The photoconductive elements of this invention contain one or more of such photoconductive layers on a conductive support.

Formula I, representing the class of organic photoconductors useful in the present invention, includes certain of the organic photoconductive materials disclosed in aforementioned U.S. Patent 3,542,547 and U.S. Patent 3,820,989.

Photoconductive elements comprising photoconductive layers of the type just described, are much more resistant to the formation of "snakes" resulting from crystallization of the organic photoconductors than elements comprising photoconductive layers which contain a single photoconductor represented by Formula I.

Organic photoconductors which are representative of those having the structure of Formula I, and from which a mixture of at least two photoconductors may be selected in accordance with this invention, are set out in Table I.

TABLE I

1. 4,4'-bis(diethylamino)-2,2'-dimethyltriphenylmethane
2. 4',4"-bis(diethylamino)-2,6-dichloro-2',2"-dimethyltriphenylmethane
3. 4,4'-bis(diethylamino)-2,2'-dimethyldiphenyl-α-naphthylmethane
4. 2',2"-dimethyl-4,4',4"-tris(dimethylamino)-triphenylmethane
5. 4',4"-bis(diethylamino)-4-dimethylamino-2',2"-5',5"-tetramethyltriphenylmethane
6. 4',4"-bis(diethylamino)-2-chloro-2',2"-dimethyl-4-dimethylaminotriphenylmethane
7. 4',4"-bis(diethylamino)-4-dimethylamino-2,2',2"-trimethyltriphenylmethane

8. 4',4"-bis(dimethylamino)-2-chloro-2',2"-dimethyltriphenylmethane
9. 4',4"-bis(dimethylamino)-2',2"-dimethyl-4-methoxytriphenylmethane
10. 4,4'-bis(benzylethylamino)-2,2'-dimethyltriphenylmethane
11. 4,4'-bis(diethylamino)-2,2',5,5'-tetramethyltriphenylmethane
12. 4,4'-bis(diethylamino)-2,2'-diethoxytriphenylmethane
13. 4,4'-bis(diethylamino)-2,2'-dimethyldiphenyl-β-naphthylmethane
14. 4,4'-bis(diethylamino)-2,2'-dimethyldiphenyl-9-anthrylmethane
15. 4,4',4"-trisdiethylamino-2,2',2"-trimethyltriphenylmethane
16. 1,1-bis(4-N,N-diethylamino-2-chlorophenyl)-2-phenylethane
17. 1,1-bis(4-N,N-diethylamino-2-methoxyphenyl)-2-phenylethane
18. bis(4-N,N-diethylaminophenyl)cyclopent-2-enyl methane
19. bis(4-N,N-diethylamino-2-methylphenyl)cyclobut-2-enyl methane
20. 1,1-bis(4-N,N-diethylaminophenyl)-3-phenylpropane
21. 1,1-bis(4-N,N-diethylaminophenyl)-2-phenylethane
22. 1,1-bis(4-N,N-diethylaminophenyl)butane
23. bis(4-N,N-diethylaminophenyl)cyclohexylmethane
24. 1,1-bis(4,N,N-diethylaminophenyl)-2-methylpropane
25. 1,1-bis(4-N,N-diethylaminophenyl)heptane
26. bis(4-N,N-diethylaminophenyl)cyclohex-3-enylmethane
27. 1,1-bis(4-N,N-diethylaminophenyl)-2-ethylhexane

28. 1,1-bis(4-N,N-diethylamino-2-methylphenyl)-3-phenylpropane
29. 1,1-bis(4-N,N-diethylamino-2-methylphenyl)-2-phenylethane
30. 1,1-bis(4-N,N-diethylamino-2-methylphenyl)butane
31. 1,1-bis(4-N,N-diethylamino-2-methylphenyl)cyclohexylmethane
32. 1,1-bis(4-N,N-diethylamino-2-methylphenyl)-2-methylpropane
33. 1,1-bis(4-N,N-diethylamino-2-methylphenyl)butane
34. bis(4-N,N-diethylamino-2-methylphenyl)cyclohex-3-enylmethane
35. bis(4-N,N-diethylamino-2-methylphenyl)-4-methylphenylmethane
36. bis(4-diethylamino)1,1,1-triphenylethane
37. bis(4-diethylamino)tetraphenylmethane
38. 1,1-bis(4-N,N-diethylaminophenyl)cyclohexane
39. 1,1-bis(4-di-p-tolylaminophenyl)cyclohexane
40. 1,1-bis(4-di-p-tolylaminophenyl)-2-methylpropane
41. 1,1-bis(4-N,N-diethylaminophenyl)-4-methylcyclohexane
42. 1,1-bis(4-N,N-dipropylaminophenyl)cyclohexane
43. 1,1-bis(4-N,N-diethylaminophenyl)-1-(4-methylphenyl)ethane
44. 4-N,N-diethylaminotetraphenylmethane
45. 4,4'-bis(diethylamino)-4",4"'-dichlorotetraphenylmethane
46. 4,4'-bis(dipropylamino)tetraphenylmethane
47. 4,4'-bis(diethylamino)-4"-isopropyl-2,2'-dimethyltriphenylmethane.

In addition to the organic photoconductors defined by formula I, triphenylamine type photoconductors, including substituted triphenylamines, are useful in increasing the speed of the photoconductive compositions of the present invention. Expecially useful organic photoconductors in this regard are triphenylamine, 4-diphenylaminochalcone, bis(4-diphenylaminobenzal)acetone, 4-hydroxymethyltriphenylamine, tri-2-tolylamine, 4-carboxytriphenylamine, 4-(2-hydroxyethyl)triphenylamine, 4,4',4"-trimethoxytriphenylamine and tri-p-tolylamine. Other useful triphenylamine photoconductors are disclosed in, for example, U.S. Patent 3,180,730.

The photoconductive compositions of the present invention are homogeneous or heterogeneous.

Homogeneous photoconductive compositions are prepared in a conventional manner, for example by simply admixing the selected formula I photoconductors and the electrically insulating binder in a coating solvent. Electrophotographic elements are formed from the homogeneous photoconductive compositions by simply coating the compositions on a support having a conductive layer, such as described hereinafter.

The heterogeneous compositions include aggregate photoconductive compositions of the type disclosed in U.S. Patent 3,615,415 by Light.

Aggregate photoconductive compositions may be prepared by several techniques, such as by fuming as disclosed by Light; or the so-called "dye first" technique described in Gramza et al, U.S. Patent 3,615,396; or the so-called "shearing" method described in Gramza, U.S. Patent 3,615,415; or the two-stage dilution technique described in Kryman et al U.S. Patent 3,679,408. Still another method of preparation involves preforming the finely-divided aggregate particles such as is described in Gramza et al, U.S. Patent 3,732,180 and simply storing these preformed aggregate particles until it is desired to prepare the charge-transport layer. At this time, the preformed aggregate particles may be dispersed in an appropriate coating vehicle together with the desired electrically insulating polymeric binder and coated as a layer on a suitable substrate to form a heterogeneous photoconductive element.

In a preferred embodiment of the present invention, the crystallization inhibiting mixture of at least two organic photoconductors is selected from compounds of the types bis(4-N,N-dialkylamino-2-alkylaryl)-4-alkylarylmethane; 1,1-bis(4-N,N-dialkylamino-2-alkylaryl)-2-alkylpropane and 4,4'-bis(dialkylamino)-2,2'-dialkyltriarylmethane.

If desired, a photoconductive layer of the invention can be prepared as a self-supporting layer.

The total amount of the organic photoconductors included in the layer may vary widely but preferably ranges from 5 to 40 weight percent based on the total dry weight of the layer. Each of the organic photoconductors selected may be included in the layer at a concentration up to its solubility limit in the resulting layer. The solubility of each organic photoconductor in a particular film-forming binder can be found by determining by differential thermal analysis at what concentration the organic photoconductor forms a separate phase. It is preferred to use equal weights of the organic photoconductors present.

The photoconductive layers of the invention can also be spectrally and/or chemically sensitized by the addition of effective amounts of sensitizing compounds. Sensitizing compounds useful with the photoconductive compounds of the present invention can be selected from a wide variety of materials, including such materials as pyrylium dye salts including thiapyrylium dye salts and selenapyrylium dye salts disclosed in U.S. Patent 3,250,615; fluorenes; aggretate-type sensitizers of the type described in

U.S. Patent 3,615,414; aromatic nitro compounds of the kind described in U.S. Patent 2,610,120; anthrones like those disclosed in U.S. Patent 2,670,284; quinones like those in U.S. Patent 2,670,286; benzophenones like those in U.S. Patent 2,670,287; thiazoles like those in U.S. Patent 2,732,301; mineral acids; carboxylic acids such as maleic acid, di- and trichloroacetic acids, and salicylic acid; sulphonic and phosphoric acids; and various dyes, such as cyanine (including carbocyanine), merocyanine, diarylmethane, thiazine, azine, oxazine, xanthene, phthalein, acridine, azo and anthraquinone dyes and mixtures thereof. The sensitizers preferred for use with the compounds of this invention are selected from pyrylium salts, including selenapyrylium salts and thiapyrylium salts, and cyanine dyes including carbocyanine dyes such as disclosed in U.S. Patent 3,5-7.196.

Where a sensitizing compound is employed with a binder and organic photoconductor to form a photoconductive layer, a suitable amount of the sensitizing compound may be mixed with the coating composition so that, after thorough mixing and coating, the sensitizing compound is uniformly distributed in the coated element. Other methods of incorporating the sensitizer, may, however, be employed.

The amount of sensitizer that can be added to the organic photoconductor layer to give effective increases in speed can vary widely. The optimum concentration in any given case will vary with the specific photoconductor(s) 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 total dry weight of the photoconductive layer. Normally, a sensitizer is added in an amount by weight of from 0.005 to 5.0 percent by weight.

Preferred electrically insulating binders for use in preparing the present organic photoconductive layers are film-forming, hydrophobic polymeric binders having fairly high dielectric strength. Materials of this type comprise styrene-butadiene copolymers; silicone resins; styrene-alkyd resins; silicone-alkyd resins; soya-alkyd resins; poly(vinyl chloride); poly(vinylidene chloride); vinylidene chlorideacrylonitrile copolymers; poly(vinyl acetate); vinyl acetate vinyl chloride copolymers; poly(vinyl acetals), such as poly(vinyl butyral); polyacrylic and polymethacrylic esters, such as poly(methyl methacrylate), poly(n-butyl methacrylate) and poly(isobutyl methacrylate); polystyrene; nitrated polystyrene; polymethylstyrene; isobutylene polymers; polyesters, such as poly[ethylene-co-alkylenebis(alkyleneoxyaryl)-phenylenedicarboxylate]; phenolformaldehyde resins; ketone resins; polyamides; polycarbonates; polythiocarbonates; poly[ethylene-co-isopropylidene-2,2-bis(ethyleneoxyphenylene) terephthalate]; copolymers of vinyl haloarylates; poly(ethylene-co-neopentyl terephthalate); and vinyl acetate such as poly(vinyl-m-bromobenzoate-co-vinyl acetate).

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. Patent 2,361,019 and 2,258,423. Suitable resins of the type contemplated for use in the photoconductive layers of the invention are sold under such tradenames as 'Vitel' PE-101, 'Cymac', 'Piccopale' 100, 'Saran' F-220 and 'Lexan'. Other types of insulating binders which can be used in the photoconductive layers of the invention include such materials as mineral waxes .

A variety of solvents are useful for preparing solutions or dispersions from which the photoconductive layers of the present invention can be made. For example, benzene; toluene; acetone; 2-butanone; chlorinated hydrocarbons such as methylene chloride; ethylene chloride; ethers, such as tetrahydrofuran, or mixtures of such solvents, can advantageously be employed in the practice of this invention.

Coating thicknesses of such dispersions or solutions on supports can vary widely. Normally, a wet coating thickness in the range of 0.025 mm to 2.5 mm is useful in the practice of the invention. A preferred range of wet coating thickness is from 0.050 mm to 0.15 mm.

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

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

The photoconductive layers of the present invention can be employed in photoconductive elements useful in an electrophotographic process. In a process of this type, an electrophotographic element held in the dark, is given a blanket positive or negative electrostatic charge as desired, by placing it under a corona discharge to give a uniform charge to the surface of the photoconductive layer. This charge is retained by the layer owing to the substantial dark-insulating property of the layer. The electrostatic charge on the surface of the photoconductive layer is then selectively dissipated from the surface of the layer by imagewise exposure to light by means of a conventional exposure technique to leave a latent electrostatic image on the photoconductive layer. Suitable exposure techniques include contact-printing, lens projection of an image, and reflex and bireflex techniques.

The latent electrostatic image is then developed, possibly after transfer to another surface, by treatment with a developer comprising electrostatically responsive particles having optical density. The developer is in the form of a liquid dispersion, dust, or powder and generally comprises a pigmented thermoplastic resin called a toner.

The developed image can be fixed by heating which causes the toner resin to melt or fuse into or on the image receiver element. A transfer of the toner image formed on the photoconductive layer can be made to a second support such as paper which then becomes the final print after fusing. Techniques of this type are well known in the art.

The organic photoconductive layers of the present invention can be used in electrophotographic elements having many structural variations. For example, the layers can be formed as single layers or as multiple layers on a suitable opaque or transparent conducting support. Likewise, the layers can be contiguous or spaced having layers of insulating material or other photoconductive or sensitizing material therebetween. Configurations differing from those disclosed herein are also useful.

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

Examples

A standard thermal crystallization or "snake" test consisted of heating the electrophotographic element for one minute at 90°C followed by storage at room temperature with periodical examination under 200X magnification. The time, in days, weeks or months when the defect is first observed, is recorded. This test accelerates the crystallization of the organic photoconductor present in the element. Under normal conditions the element would only be subjected to this high a temperature during a 5-10 second fixation step.

Examples 1-4:

The electrophotographic element comprised a conductive support bearing a photoconductive layer containing an electrically insulating polyester binder poly-[ethylene-co-isopropylidene-2,2-bis(ethylene oxyphenylene)-terephthalate], one or more organic photoconductors, 4-[N-butylamino]-2(p-methoxyphenyl) benzo-[b] pyrylium fluoroborate spectral sensitizer and a polysiloxane surfactant of the type described by Cawley in U.S. Patent 3,861,915. The organic photoconductor (OP) content of each element and the results of the thermal test are tabulated in Table II.

TABLE II

Example No.	Total Binder (Grams)	OP (Grams)	Total % OP (Based on Binder + OP)	Accelerated Thermal Test (Time delay prior to OP Crystallization)
1	403.0	1a (117 g)	22.5%	3 days
2	403.0	37a (117 g)	22.5%	3 days
3	80.6	35a (7.8 g) 32a (7.8 g) 1a (7.8 g)	22.5%	4 months without developing "snakes"
4	86.4	35a (10.8 g) 32a (3.6 g) 1a (7.2 g)	20.0%	1 month without developing "snakes"

"a" numbers represent organic photoconductor from Table I.

These data show that elements containing a mixture of three different organic photoconductors resist formation of snakes to a much greater extent than elements containing only one organic photoconductor.

Examples 5-6:

Aggregate photoconductive elements were formed substantially as described in Example 1 of U.S. Patent 3,615,414.

The elements comprised a conducting support and an aggregate photoconductive layer containing a binder combination of bis phenol A polycarbonate (92% by weight based on binder), a polyethylene-co-neopentyl terephthalate polyester resin (8% by weight based on total binder content of the layer) one or more organic photoconductors and aggregate forming pyrylium sensitizers. The organic photoconductor content of these aggregate photoconductive layers and the results of the thermal test are tabulated in Table III.

TABLE III

Example No.	Total Binder (Grams)	OP (Grams)	Total % OP (Based on Binder + OP	Accelerated Thermal Test (Time delay prior to OP Crystallization)
5	40.5	1a (27.0 g)	40	1 week
6	40.5	35a (9.0 g) 32a (9.0 g) 1a (9.0 g)	40	4 weeks without developing snakes

"a" numbers represent organic photoconductors from Table I.

These data show that the present invention is effective in retarding snaking in aggregate photoconductive elements.

Examples 7-9:

The electrophotographic element comprised a conductive support bearing a photoconductive layer containing an electrically insulating polyester binder consisting of about 94% by weight of poly[ethylene-co-isopropylidene-2,2'-bis(ethylene oxyphenylene)-terephthalate] and about 6% by weight of poly[ethylene-co-isopropylidene-2,2'-bis(ethylene oxymethylene)-terephthalate] 6% by weight based on binder), one or more formula I organic photoconductors, tri-p-tolylamine, a pyrylium spectral sensitizer and a polysiloxane surfactant of the type described by Cawley in U.S. Patent 3,861,915. The organic photoconductor (OP) content of each element and the results of the thermal test are tabulated in Table IV. The sensitizer used in Examples 7 and 9 was 4-[N-butylamino]-2(p-methoxyphenyl) benzo[b]-pyrylium perchlorate. The sensitizer of Example 8 was 2,4-bis(4-ethyl phenyl)-6-(2,6-diphenyl-4H-pyran-4-ylidine) methyl pyrylium fluoroborate.

The data of Table IV shows that combination of three or more formula I organic photoconductors are effective in retarding development of snakes in homogeneous photoconductive elements of the type described in these examples.

TABLE IV

Example No.	Total Binder (g)	OP (a)	Total % OP (Based on Binder + OP)	Accelerated Thermal Test (Time Delay prior to OP Crystallization)
7	50.4	1 (3.65g) 35 (3.65g) 32 (3.65g) b (3.65g)	22.5%	7 months without developing snakes
8	48	1 (4g) 35 (4g) 47 (4g)	20%	2 months without developing snakes
9	48	1 (3g) 35 (3g) 32 (3g) 47 (3g)	20%	7 months without developing snakes

a. from Table I

b. tri-p-tolylamine

Examples 10-11:

The electrophotographic element comprised a conductive support bearing a photoconductive layer containing an electrically insulating polyester binder poly-[ethylene-co-isopropylidene-2,2-bis(ethylene oxyphenylene)-terephthalate] (94% by weight based on binder) and poly-[ethylene-co-isopropylidene-2,2-bis(ethylene oxymethylene)-terephthalate] (6% by weight based on binder), three or more organic photoconductors, 2,4-bis(4-ethyl-phenyl)-6-(2,6-diphenyl-4H-pyran-4-ylidene)methyl-pyrylium fluoroborate (Example 11) or 4-[N-butylamino]-2-(p-methoxyphenyl)benzo[b]pyrylium perchlorate (Example 12) spectral sensitizer and a polysiloxane surfactant of the type described by Cawley in U.S. Patent 3,861,915. The organic photoconductor (OP) content of each element and the results of the thermal test are tabulated in Table V.

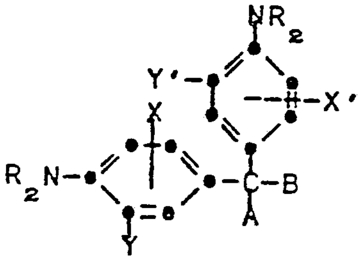
TABLE V

Example No.	Total Binder (Grams)	OP (Grams)		Total % OP (Based on Binder + OP)	Accelerated Thermal Te (Time delay prior to O crystallization)
10	48	1a	4g	20%	2 months without developing snakes
		35a	4g		
		47a	4g		
11	48	1a	3g	20%	7 months without developing snakes
		35a	3g		
		32a	3g		
		47a	3g		

(a) From Table I.

CLAIMS

1. A photoconductive layer compriaing organic photoconductive material dispersed in an electrically insulating binder characterized in that the organic photoconductive material contains a crystallization inhibiting mixture of at least two organic photoconductors of the formula:



wherein R is an alkyl, substituted alkyl, aralkyl, aryl or substituted aryl group;

each of X, X', Y and Y', which may be the same or different, is hydrogen, alkyl, substituted alkyl, alkoxy, substituted alkoxy, hydroxyl, nitro or halogen; and

each of A and B, which may be the same or different, is hydrogen, alkyl, substituted alkyl, alkoxy, substituted alkoxy, hydroxyl, halogen, unsubstituted or substituted aryl, cycloalkyl having four to ten carbon atoms and cycloalkenyl having four to eight carbon atoms; or

A and B taken together represent atoms which form with the carbon to which they are attached a substituted or unsubstituted carbocyclic ring having from 4 to 10 carbon atoms, any alkyl, substituted alkyl, alkoxy or substituted alkoxy substituent having from 1 to 10 carbon atoms and any aryl or substituted aryl group being an unsubstituted or unsubstituted phenyl, naphthyl or anthryl group, any substituent in a substituted aryl group being an amino, alkylamino or dialkylamino group or a substituent as defined for X, X', Y and Y'.

2. A layer according to Claim 1 wherein the crystallization inhibiting mixture of organic photoconductors contains at least two photoconductors each of which is a bis(4-N,N-dialkylamino-2-alkylaryl)-4-alkylarylmethane; 1,1,-bis(4-N,N-dialkylamino-2-alkylaryl)-2-alkylpropane or 4,4'-bis(dialkylamino)-2,2'-dialkyltriarylmethane.

3. A layer according to Claim 2 which contains the organic photoconductors bis(4-N,N-diethylamino-2-methylphenyl)-4-methylphenylmethane, 1,1-bis(4-N,N-diethylamino-2-methylphenyl)-2-methylpropane and 4,4'-bis(diethylamino)-2,2'-dimethyltriphenylmethane.

4. A layer according to Claim 1, 2 or 3 wherein the organic photoconductive material contains a triphenylamine type photoconductor.

5. A layer according to Claim 4 wherein the triphenylamine type photoconductor is tri-p-tolylamine.

6. A layer according to any of the preceding Claims wherein the total amount of organic photoconductors present in said layer is from 5 to 40 percent by weight.

7. A layer according to any of the preceding Claims wherein said electrophotographic layer is an aggregate photoconductive layer.

8. A layer according to any of the preceding Claims wherein the organic photoconductors are present in equal amounts by weight.

9. A layer according to any of the preceding Claims wherein the binder is bisphenol A polycarbonate or poly[ethylene-co-isopropylidene-2,2-bis(ethyleneoxyphenylene)terephthalate].

10. An electrophotographic element comprising a conductive support and a photoconductive layer according to any of the preceding Claims.

European Patent
Office

EUROPEAN SEARCH REPORT

0011980
Application number

EP 79302648.5

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
	FR - F - 84 976 (GEVAERT) + Page 8, abstract; page 2, right column, lines 29-49 + --	1,4,10
	FR - A - 1 383 461 (KODAK) + Page 1, right column; page 2, left column + --	1,4,10
	FR - A - 2 099 782 (KODAK) + Page 3 + --	1,4,10
	CH - A - 435 979 (RADIO CORPORATION) + Totality + --	1,4,10
	US - A - 3 291 600 (NICOLL) + Claims 1-10 + --	1,4,10
	US - A - 3 679 406 (KRYMAN) + Column 9, lines 52-75; column 10, lines 1-75 + ----	1,4,10

CLASSIFICATION OF THE APPLICATION (Int. Cl.³)

G 03 G 5/06
C 07 C 87/62

TECHNICAL FIELDS SEARCHED (Int.Cl.³)

G 03 G

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	11-02-1980	SALTEN

EPO Form 1503.1 06.78