INTERFACIAL LAYER AND COATING SOLUTION FOR FORMING THE SAME
GRENZFLÄCHENSCHICHT UND BESCHICHTUNGSLÖSUNG UND ZUM BILDEN DAVON
COUCHE D'INTERFACE ET SOLUTION DE REVÊTEMENT POUR LA FORMER

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EP-A2-0789051
DE-A1-102007040567
US-A-5110700
US-A-5925701
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The present invention relates to an aqueous-based coating solution for forming an interfacial layer that is useful in imaging apparatus members and components, for use in electrostatographic, including digital, apparatuses. The invention further relates to an imaging member comprising an interfacial layer which is crosslinked and formed from said aqueous-based coating solution.

In electrophotographic or electrostatographic printing, the charge retentive surface, typically known as a photoreceptor, is electrostatically charged, and then exposed to a light pattern of an original image to selectively discharge the surface in accordance therewith. The resulting pattern of charged and discharged areas on the photoreceptor form an electrostatic charge pattern, known as a latent image, conforming to the original image. The latent image is developed by contacting it with a finely divided electrostatically attractable powder known as toner. Toner is held on the image areas by the electrostatic charge on the photoreceptor surface. Thus, a toner image is produced in conformity with a light image of the original being reproduced or printed. The toner image may then be transferred to a substrate or support member (e.g., paper) directly or through the use of an intermediate transfer member, and the image affixed thereto to form a permanent record of the image to be reproduced or printed. Subsequent to development, excess toner left on the charge retentive surface is cleaned from the surface. The process is useful for light lens copying from an original or printing electronically generated or stored originals such as with a raster output scanner (ROS), where a charged surface may be imagewise discharged in a variety of ways.

The described electrostatographic copying process is well known and is commonly used for light lens copying of an original document. Analogous processes also exist in other electrostatographic printing applications such as, for example, digital laser printing or ionographic printing and reproduction where charge is deposited on a charge retentive surface in response to electronically generated or stored images. To charge the surface of a photoreceptor, a contact type charging device has been used. The contact type charging device includes a conductive member which is supplied a voltage from a power source with a D.C. voltage superimposed with an A.C. voltage of no less than twice the level of the D.C. voltage. The charging device contacts the image bearing member (photoreceptor) surface, which is a member to be charged. The outer surface of the image bearing member is charged with the rubbing friction at the contact area. The contact type charging device charges the image bearing member to a predetermined potential. Typically the contact type charger is in the form of a roll charger such as that disclosed in U.S. Pat. No. 4,387,980. Other charging methods are further disclosed in U.S. Pat. No. 7,295,797.

Multilayered photoreceptors or imaging members have at least two layers, and may include a substrate, a conductive layer, an optional undercoat layer (sometimes referred to as a "charge blocking layer" or "hole blocking layer"), an optional adhesive layer, a photogenerating layer (sometimes referred to as a "charge generation layer," "charge generating layer," or "charge generator layer"), a charge transport layer, and an optional overcoating layer in either a flexible belt form or a rigid drum configuration. In the multilayer configuration, the active layers of the photoreceptor are the charge generation layer (CGL) and the charge transport layer (CTL). Enhancement of charge transport across these layers provides better photoreceptor performance. Multilayered flexible photoreceptor members may include an anti-curl layer on the backside of the substrate, opposite to the side of the electrically active layers, to render the desired photoreceptor flatness.

The multilayered photoreceptors may also include an interfacial layer. The role of interfacial layer (IFL) in an organic photoreceptor is to promote the adhesion between charge blocking layer and charge generation layer. The IFL is generally thinner than 800 A. In belt photoreceptors, the material in IFL is a polyester resin which is also very soluble in solvents used in charge generation layer coating. Thus, the drying condition for charge generation layer coating will impact the function of IFL. For example, if the drying for the charge generation layer is too slow, the IFL could be dissolved into the charge generation layer and subsequently the photosensitive pigment in the charge generation layer could directly penetrate into the silane blocking layer or even into conductive substrate. This occurrence will cause two problems: (1) poor adhesion in photoreceptor device; (2) charge leaking during imaging process. One solution to such a problem is to coat a thick IFL. However, thicker IFLs usually lead to high residual voltage during photo-induced discharging. Thus, it is desirable to develop a thin but robust IFL which can provide high speed and high performance photoreceptors.

Conventional photoreceptors are disclosed in the following patents, a number of which describe the presence of light scattering particles in the undercoat layers: Yu, U.S. Pat. No. 5,660,961; Yu, U.S. Pat. No. 5,215,839; and Katayama et al., U.S. Pat. No. 5,958,638. The term "photoreceptor" or "photocoductor" is generally used interchangeably with the terms "imaging member." The term "electrostatographic" includes "electrophotographic" and "xerographic." The terms "charge transport molecule" are generally used interchangeably with the terms "hole transport molecule."

US-A-5925701 discloses aqueous dispersions for the preparation of polymeric layers for use in imaging elements and printing media, such as thermal dye transfer or ink jet ink receiver elements or printing media. The dispersions comprise a dispersed polymer, a hydrated metal salt of a strong acid, and a polymeric surfactant. The polymer may be a polyester resin. Examples of the metal salts include sulfates, nitrates, chlorides, trichloroacetates, bromides, and tosylates.
DE-A-102007040567 discloses a polyester dispersion for use in coating papers, nonwovens, webs, or membranes. The dispersion contains a copolyester, a dispersing agent, and water. The dispersion may further contain an additive such as a silver salt.

EP-A-2019338 discloses a process for the preparation of a toner in which an aqueous emulsion containing polymer primary particles is mixed with a surfactant and a charge control agent. The polymer primary particles may be particles of a polyester resin. The charge control agent may be a metal salt or metal complex of salicylic acid.

EP-A-789051 discloses a polyester film laminate which is used as a surface protective material for glass plates. The laminate comprises a coating layer formed from an aqueous composition containing a polyester resin. The aqueous composition may further contain an antistatic agent and a surfactant.


US-A-5110700 discloses the use of a coating solution containing a polyester resin dissolved in an organic solvent for the preparation of an adhesive layer between a charge blocking layer and a charge generating layer.

The present invention provides:

1. An aqueous-based coating solution for forming an interfacial layer, comprising:
   - a charge control agent;
   - a surfactant;
   - a polyester resin; and
   - a solvent,
   wherein said charge control agent is selected from the group consisting of zinc salicylate, calcium salicylate, aluminum salicylate, chromium salicylate, boron salicylate, zirconium salicylate, iron salicylate, and mixtures thereof, and
   wherein said solvent is selected from the group consisting of methanol, methyl ethyl ketone, ethanol, propanol, tetrahydrofuran, acetone, dimethylformamide, N-methylpyrrolidinone, and mixtures thereof.

2. The coating solution of (1), wherein the polyester resin is prepared by a reaction of dicarboxylic acids and diols.

3. The coating solution of (1), wherein the polyester resin is present in the coating solution in an amount of from 0.05 to 50 percent by weight of the total weight of the coating solution, or wherein the polyester resin is a copolymer of terephthalic acid, dodecenylsuccinic anhydride, trimellitic acid, fumaric acid, Bisphenol A ethylenoxide adducts, and Bisphenol A propylene oxide adducts, or wherein the polyester resin has a weight average molecular weight (Mw) of from 5000 to 100,000, or wherein the polyester resin has a glass transition temperature of from 0 to 100°C, or wherein the polyester resin has an acid value of from 1 to 50 mg KOH/g.

4. The coating solution of (1), wherein the charge control agent is present in the coating solution in an amount of from 0.005 to 20 percent by weight of the total weight of the coating solution.

5. The coating solution of (1), wherein the surfactant is an anionic surfactant, or wherein the surfactant is selected from the group consisting of sodium dodecylbenzenesulfonate, sodium dodecyl sulfate, sodium dodecylbenzenephthalate sulfate, dialkyl benzenealkyl, sulfates, sulfonates, adipic acid, hexadecylidiphenyloxide disulfonate, and mixtures thereof.

6. The coating solution of (1), wherein the surfactant is present in the coating solution in an amount of from 0.0001 to 10 percent by weight of the total weight of the coating solution.

7. The coating solution of (1), wherein the solvent is present in the coating solution in an amount of from 10 to 99.9 percent by weight of the total weight of the coating solution.

8. An imaging member, comprising:
a substrate;

a charge blocking layer disposed on the substrate;

an interfacial layer disposed on the charge blocking layer; and

a charge imaging layer,

wherein the interfacial layer is disposed between the charge blocking layer and the charge imaging layer, and

further wherein the interfacial layer is crosslinked and formed from the aqueous-based coating solution of claim 1.

(9) The imaging member of (8), wherein the interfacial layer has a thickness of from 0.01 to 5 micrometers.

[0014] The present embodiments disclose an aqueous polyester coating solution that contains a surfactant and a charge control agent that, when coated and dried on a substrate, cross-links to form a layer suitable to serve as an adhesion promoting interfacial layer in organic photoreceptors. The coating solution allows facilitates operated with no organic volatiles for the interfacial layer and provides a thin but robust and uniform interfacial layer. Moreover, testing of the electrical properties of the inventive photoreceptors demonstrated low discharge residual voltage, very stable cycling performance, low dark decay and low depletion.

[0015] In electrostatographic reproducing or digital printing apparatuses using a photoreceptor, a light image is recorded in the form of an electrostatic latent image upon a photosensitive member and the latent image is subsequently rendered visible by the application of a developer mixture. The developer, having toner particles contained therein, is brought into contact with the electrostatic latent image to develop the image on an electrostatographic imaging member which has a charge-retentive surface. The developed toner image can then be transferred to a copy substrate, such as paper, that receives the image via a transfer member.

[0016] The exemplary embodiments of this disclosure are described below with reference to the drawing.

[0017] The Figure shows an imaging member having a belt configuration according to the embodiments. As shown, the belt configuration is provided with an anti-curl back coating 1, a supporting substrate 10, an electrically conductive ground plane 12, an undercoat layer 14, an adhesive layer 16, a charge generation layer 18, and a charge transport layer 20. An optional overcoat layer 32 and ground strip 19 may also be included. An exemplary photoreceptor having a belt configuration is disclosed in U.S. Patent No. 5,069,993.

The Overcoat Layer

[0018] Other layers of the imaging member may include, for example, an optional overcoat layer 32. An optional overcoat layer 32, if desired, may be disposed over the charge transport layer 20 to provide imaging member surface protection as well as improve resistance to abrasion. In embodiments, the overcoat layer 32 may have a thickness ranging from 0.1 micrometer to 10 micrometers or from 1 micrometer to 10 micrometers, or in a specific embodiment, about 3 micrometers. These overcoating layers may include thermoplastic organic polymers or inorganic polymers that are electrically insulating or slightly semi-conductive. For example, overcoat layers may be fabricated from a dispersion including a particulate additive in a resin. Suitable particulate additives for overcoat layers include metal oxides including aluminum oxide, non-metal oxides including silica or low surface energy polytetrafluoroethylene (PTFE), and combinations thereof. Suitable resins include those described above as suitable for photogenerating layers and/or charge transport layers, for example, polyvinyl acetates, polyvinylbutyrals, polyvinylchlorides, vinylchloride and vinyl acetate copolymers, carboxyl-modified vinyl chloride/vinyl acetate copolymers, hydroxyl-modified vinyl chloride/vinyl acetate copolymers, carboxyl- and hydroxyl-modified vinyl chloride/vinyl acetate copolymers, polyvinyl alcohols, polycarbonates, polyesters, polyurethanes, polyurethanes, polybutadienes, polysulfones, polyarylethers, polysulfones, polyethersulfones, polyethylene, polylethene, polypropylene, polyethylene sulfides, polysiloxanes, polyacrylates, polyvinyl acetals, polyamides, polyimides, amino resins, phenylene oxide resins, terephthalic acid resins, phenoxy resins, epoxy resins, phenolic resins, polystyrene and acrylonitrile copolymers, poly-N-vinylpyrrolidinones, acrylate copolymers, alkyl resins, cellulose film formers, polycarbonates, styrene-butadiene copolymers, vinylidenechloridevinylchloride copolymers, vinylacetate-vinylidenechloride copolymers, styrene-alkyd resins, polyvinylcarbazoles, and combinations thereof. Overcoating layers may be continuous and have a thickness of at least 0.5 micrometer, or no more than 10 micrometers, and in further embodiments have a thickness of at least 2 micrometers, or no more than 6 micrometers.
The Substrate

[0019] The photoreceptor support substrate 10 may be opaque or substantially transparent, and may comprise any suitable organic or inorganic material having the requisite mechanical properties. The entire substrate can comprise the same material as that in the electrically conductive surface, or the electrically conductive surface can be merely a coating on the substrate. Any suitable electrically conductive material can be employed, such as for example, metal or metal alloy. Electrically conductive materials include copper, brass, nickel, zinc, chromium, stainless steel, conductive plastics and rubbers, aluminum, semitransparent aluminum, steel, cadmium, silver, gold, zirconium, niobium, tantalum, vanadium, hafnium, titanium, niobium, tungsten, molybdenum, paper rendered conductive by the inclusion of a suitable material therein or through conditioning in a humid atmosphere to ensure the presence of sufficient water content to render the material conductive, indium, tin, metal oxides, including tin oxide and indium tin oxide, and the like. It could be single metallic compound or dual layers of different metals and/or oxides.

[0020] The substrate 10 can also be formulated entirely of an electrically conductive material, or it can be an insulating material including inorganic or organic polymeric materials, such as MYLAR, a commercially available biaxially oriented polyethylene terephthalate from DuPont, or polyethylene naphthalate available as KALEDEX 2000. The substrate may have a ground plane layer 12 comprising a conductive titanium or titanium/zirconium coating. Alternatively, the substrate may have a layer of an organic or inorganic material having a semiconductive surface layer, such as indium tin oxide, aluminum, titanium, and the like, or having a conductive surface layer being made exclusively of a conductive material such as, aluminum, chromium, nickel, brass, other metals and the like. The thickness of the support substrate depends on numerous factors, including mechanical performance and economic considerations.

[0021] The substrate 10 may have a number of many different configurations, such as for example, a plate, a cylinder, a drum, a scroll, an endless flexible belt, and the like.

[0022] In the case of the substrate being in the form of a belt, as shown in the Figure, the belt can be seamless or seamless. In embodiments, the photoreceptor herein is in a drum configuration.

[0023] The thickness of the substrate 10 depends on numerous factors, including flexibility, mechanical performance, and economic considerations. The thickness of the support substrate 10 of the present embodiments may be at least 500 micrometers, or no more than 3,000 micrometers, or be at least 750 micrometers, or no more than 2500 micrometers.

[0024] An exemplary substrate support 10 is not soluble in any of the solvents used in each coating layer solution, is optically transparent or semi-transparent, and is thermally stable up to a high temperature of 150 °C. A substrate support 10 used for imaging member fabrication may have a thermal contraction coefficient ranging from 1 x 10^{-5} per °C to 3 x 10^{-5} per °C and a Young’s Modulus of between 5 x 10^{-5} psi (3.5 x 10^{-4} kg/cm²) and 7 x 10^{-5} psi (4.9 x 10^{-4} kg/cm²).

The Hole Blocking Layer

[0025] After deposition of the electrically conductive ground plane layer, the hole blocking layer 14 may be applied thereto. Electron blocking layers for positively charged photoreceptors allow holes from the imaging surface of the photoreceptor to migrate toward the conductive layer. For negatively charged photoreceptors, any suitable hole blocking layer capable of forming a barrier to prevent holes injection from the conductive layer to the opposite photoconductive layer may be utilized. The hole blocking layer may include polymers such as polyvinylbutyral, epoxy resins, polyesters, polysiloxanes, polyamides, polyurethanes and the like, or may be nitrogen containing siloxanes or nitrogen containing titanium compounds such as trimethoxysilyl propylene diamide, hydrolyzed trimethoxysilyl propyl ethylene diamine, N-beta-(aminooethyl) gamma-aminopropyl trimethoxy silane, isopropyl 4-aminobenzene sulfonil, di(dodecylbenzene sulfonil) titanate, isopropyl di(4-aminobenzoyl)isostearoyl titanate, isopropyl tri(N-ethylamino-ethylamino) titanate, isopropyl trianthranil titanate, isopropyl tri(N,N-dimethylethylamino) titanate, titanium-4-amino benzene sulfonate oxyacetate, titanium 4-aminobenzoate isostearate oxyacetate, [H₂N(CH₂)₄]CH₃Si(OCH₃)₂, (gamma-aminobutylyl) methyl diethoxysilane, and [H₂N(CH₂)₂]CH₃Si(OCH₃)₂ (gamma-aminopropyl) methyl diethoxysilane, as disclosed in U.S. Pat. Nos. 4,338,387, 4,286,033 and 4,291,110.

[0026] General embodiments of the undercoat layer may comprise a metal oxide and a resin binder. The metal oxides that can be used with the embodiments herein include, but are not limited to, titanium oxide, zinc oxide, tin oxide, aluminum oxide, silicon oxide, zirconium oxide, indium oxide, molybdenum oxide, and mixtures thereof. Undercoat layer binder materials may include, for example, polyesters, MOR-ESTER 49,000 from Morton International Inc., VITEL PE-100, VITEL PE-200, VITEL PE-200D, and VITEL PE-222 from Goodyear Tire and Rubber Co., polyarylates such as ARDEL from AMOCO Production Products, polysulfone from AMOCO Production Products, polyurethanes, and the like.

[0027] The hole blocking layer should be continuous and have a thickness of less than 0.5 micrometer because greater thicknesses may lead to undesirably high residual voltage. A hole blocking layer of between 0.005 micrometer and 1 micrometer is used because charge neutralization after the exposure step is facilitated and optimum electrical performance is achieved. A thickness of between 0.03 micrometer and 0.06 micrometer is used for hole blocking layers for optimum electrical behavior. The blocking layer may be applied by any suitable conventional technique such as spraying,
The Charge Generation Layer

[0028] The charge generation layer 18 may thereafter be applied to the undercoat layer 14. Any suitable charge
generating binder including a charge generating/ photoconductive material, which may be in the form of particles and
dispersed in a film forming binder, such as an inactive resin, may be utilized. Examples of charge generating materials
include, for example, inorganic photoconductive materials such as amorphous selenium, trigonal selenium, and selenium
alloys selected from the group consisting of selenium-tellurium, selenium-tellurium-arsenic, selenium arsenide and mix-
tures thereof, and organic photoconductive materials including various phthalocyanine pigments such as the X-form
of metal free phthalocyanine, metal phthalocyanines such as vanadyl phthalocyanine and copper phthalocyanine, hydroxy
gallium phthalocyanines, chlorogallium phthalocyanines, titanyl phthalocyanines, quinacridones, dibromo anthanthrone
pigments, benzimidazole perylene, substituted 2,4-diamino-triazines, polynuclear aromatic quinones, enzimidazole
perylene, and the like, and mixtures thereof, dispersed in a film forming polymeric binder. Selenium, selenium alloy,
benzimidazole perylene, and the like and mixtures thereof may be formed as a continuous, homogeneous charge
generation layer. Benzimidazole perylene compositions are well known and described, for example, in U.S. Patent No.
4,587,189. Multi-charge generation layer compositions may be used where a photoconductive layer enhances or reduces
the properties of the charge generation layer. Other suitable charge generating materials known in the art may also be
utilized, if desired. The charge generating materials selected should be sensitive to activating radiation having a wave-
length between 400 and 900 nm during the imagewise radiation exposure step in an electrophotographic imaging process
to form an electrostatic latent image. For example, hydroxygallium phthalocyanine absorbs light of a wavelength of from
370 to 950 nanometers, as disclosed, for example, in U.S. Pat. No. 5,756,245.

[0029] A number of titanyl phthalocyanines, or oxytitanium phthalocyanines for the photoconductors illustrated herein
are photogenerating pigments known to absorb near infrared light around 800 nanometers, and may exhibit improved
sensitivity compared to other pigments, such as, for example, hydroxygallium phthalocyanine. Generally, titanyl phthal-
cyanine is known to have five main crystal forms known as Types I, II, III, X, and IV. For example, U.S. Patents 5,189,155
and 5,189,156 disclose a number of methods for obtaining various polymorphs of titanyl phthalocyanine. Additionally,
U.S. Patents 5,189,155 and 5,189,156 are directed to processes for obtaining Types I, X, and IV phthalocyanines. U.S.
Patent 5,153,094 relates to the preparation of titanyl phthalocyanine polymorphs including Types I, II, III, and IV poly-
morphs. U.S. Patent 5,166,339 discloses processes for preparing Types I, IV, and X titanyl phthalocyanine polymorphs,
as well as the preparation of two polymorphs designated as Type Z-1 and Type Z-2.

[0030] Any suitable inactive resin materials may be employed as a binder in the charge generation layer 18, including
those described, for example, in U.S. Patent No. 3,121,006. Organic resinous binders include thermoplastic and ther-
mosetting resins such as, for example, inorganic resinous binders such as thermoset polymer resins, polystyrene resins,
polyesters, polyurethanes, polystyrene resins, polystyrene, polyanylethers, polyarylsulfones, polyolefinic resins, poly-
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The Charge Transport Layer

[0033] In a drum photoreceptor, the charge transport layer comprises a single layer of the same composition. As such, the charge transport layer will be discussed specifically in terms of a single layer 20, but the details will be also applicable to an embodiment having dual charge transport layers. The charge transport layer 20 is thereafter applied over the charge generation layer 18 and may include any suitable transparent organic polymer or non-polymeric material capable of supporting the injection of photogenerated holes or electrons from the charge generation layer 18 and capable of allowing the transport of these holes/electrons through the charge transport layer to selectively discharge the surface charge on the imaging member surface. In one embodiment, the charge transport layer 20 not only serves to transport holes, but also protects the charge generation layer 18 from abrasion or chemical attack and may therefore extend the service life of the imaging member. The charge transport layer 20 can be a substantially non-photoconductive material, but one which supports the injection of photogenerated holes from the charge generation layer 18.

[0034] The layer 20 is normally transparent in a wavelength region in which the electrophotographic imaging member is to be used when exposure is affected there to ensure that most of the incident radiation is utilized by the underlying charge generation layer 18. The charge transport layer should exhibit excellent optical transparency with negligible light absorption and no charge generation or charge trapping when exposed to a wavelength of light useful in xerography, e.g., 400 to 900 nanometers. In the case when the photoreceptor is prepared with the use of a transparent substrate 10 and also a transparent or partially transparent conductive layer 12, image wise exposure or erase may be accomplished through the substrate 10 with all light passing through the back side of the substrate. In this case, the materials of the layer 20 need not transmit light in the wavelength region of use if the charge generation layer 18 is sandwiched between the substrate and the charge transport layer 20. The charge transport layer 20 in conjunction with the charge generation layer 18 is an insulator to the extent that an electrostatic charge placed on the charge transport layer is not conducted in the absence of illumination. The charge transport layer 20 should trap minimal charges as the charge passes through it during the discharging process.

[0035] The charge transport layer 20 may include any suitable charge transport component or activating compound useful as an additive dissolved or molecularly dispersed in an electrically inactive polymeric material, such as a polycarbonate binder, to form a solid solution and thereby making this material electrically active. "Dissolved" refers, for example, to forming a solution in which the small molecule is dissolved in the polymer to form a homogeneous phase; and molecularly dispersed in embodiments refers, for example, to charge transporting molecules dispersed in the polymer, the small molecules being dispersed in the polymer on a molecular scale. The charge transport component may be added to a film forming polymeric material which is otherwise incapable of supporting the injection of photogenerated holes from the charge generation material and incapable of allowing the transport of these holes through. This addition converts the electrically inactive polymeric material to a material capable of supporting the injection of photogenerated holes from the charge generation layer 18 and capable of allowing the transport of these holes through the charge transport layer 20 in order to discharge the surface charge on the charge transport layer. The high mobility charge transport component may comprise small molecules of an organic compound which cooperate to transport charge between molecules and ultimately to the surface of the charge transport layer. For example, but not limited to, N,N'-diphenyl-N,N-bis(3-methyl phenyl)-1,1'-biphenyl-4,4'-diamine (TPD), other arylamines like triphenyl amine, N,N,N',N'-tetra-p-tolyl-1,1'-biphenyl-4,4'-diamine (TM-TPD), and the like.

[0036] A number of charge transport compounds can be included in the charge transport layer, which layer generally is of a thickness of from 5 to 75 micrometers, and more specifically, of a thickness of from 15 to 40 micrometers. Examples of charge transport components are aryl amines of the following formulas/structures:

\[
\begin{align*}
\text{and}
\end{align*}
\]
wherein X is a suitable hydrocarbon like alkyl, alkoxy, aryl, and derivatives thereof; a halogen, or mixtures thereof, and especially those substituents selected from the group consisting of Cl and CH$_3$; and molecules of the following formulas

\[
\begin{align*}
X & \quad Y & & Z \\
\end{align*}
\]

and

\[
\begin{align*}
X & \quad Y & & Z \\
\end{align*}
\]

wherein X, Y and Z are independently alkyl, alkoxy, aryl, a halogen, or mixtures thereof, and wherein at least one of Y and Z are present.

Alkyl and alkoxy contain, for example, from 1 to 25 carbon atoms, and more specifically, from 1 to 12 carbon atoms, such as methyl, ethyl, propyl, butyl, pentyl, and the corresponding alkoxides. Aryl can contain from 6 to 36 carbon atoms, such as phenyl, and the like. Halogen includes chloride, bromide, iodide, and fluoride. Substituted alcohols, aldehydes, and amines can also be selected in embodiments. Examples of specific aryl amines that can be selected for the charge transport layer include N,N'-diphenyl-N,N'-bis(alkylphenyl)-1,1-biphenyl-4,4'-diamine wherein alkyl is selected from the group consisting of methyl, ethyl, propyl, butyl, hexyl, and the like; N,N'-diphenyl-N,N'-bis(halophenyl)-1,1'-biphenyl-4,4'-diamine wherein the halo substituent is a chloro substituent; N,N'-bis(4-butylphenyl)-N,N'-di-p-toly1-[p-terphenyl]-4,4'-diamine, N,N'-bis(4-buty1phenyl)-N,N'-di-m-toly1-[p-terphenyl]-4,4'-diamine, N,N'-bis(4-buty1phenyl)-N,N'-di-o-tolyl-[p-terphenyl]-4,4'-diamine, N,N'-bis(4-buty1phenyl)-N,N'-bis-(4-isopropylphenyl)-[p-terphenyl]-4,4'-diamine, N,N'-bis(4-buty1phenyl)-N,N'-bis-(2-ethyl-6-methylphenyl)-[p-terphenyl]-4,4'-diamine, N,N'-bis(4-buty1phenyl)-N,N'-bis-(2,5-dimethylphenyl)-[p-terphenyl]-4,4'-diamine, N,N'-diphenyl-N,N'-bis(3-chlorophenyl)-[p-terphenyl]-4,4'-diamine, and the like. Other known charge transport layer molecules may be selected in embodiments, reference for example, U.S. Patents 4,921,773 and 4,464,450.

Examples of the binder materials selected for the charge transport layers include components, such as those described in U.S. Patent 3,121,006. Specific examples of polymer binder materials include polycarbonates, polyarylates, acrylate polymers, vinyl polymers, cellulose polymers, polyesters, polysiloxanes, polyamides, polyurethanes, poly(cyclo olefins), and epoxies, and random or alternating copolymers thereof. In embodiments, the charge transport layer, such as a hole transport layer, may have a thickness of at least 10 μm, or no more than 40 μm.

Examples of components or materials optionally incorporated into the charge transport layers or at least one charge transport layer to, for example, enable improved lateral charge migration (LCM) resistance include hindered phenolic antioxidants such as tetrakis methylene(3,5-di-tert-butyl-4-hydroxy hydrocinnamate) methane (IRGANOX® 1010, available from Ciba Specialty Chemical), butylated hydroxytoluene (BHT), and other hindered phenolic antioxidants including SUMILIZER™ BHT-R, MDP-S, BBM-S, WX-R, NW, BP-76, BP-101, GA-80, GM and GS (available from Sumitomo Chemical Co., Ltd.), IRGANOX® 1035, 1076, 1098, 1135, 1141, 1222, 1330, 1425WL, 1520L, 245, 259,
3114, 3790, 5057 and 565 (available from Ciba Specialties Chemicals), and ADEKA STAB™ AO-20, AO-30, AO-40, AO-50, AO-60, AO-70, AO-80 and AO-330 (available from Asahi Denka Co., Ltd.); hindered amine antioxidants such as SANOL™ LS-2626, LS-765, LS-770 and LS-744 (available from SANKYO Co., Ltd.), TINUVIN® 144 and 622LD (available from Ciba Specialties Chemicals), MARK™ LA57, LA67, LA62, LA68 and LA63 (available from Asahi Denka Co., Ltd.), and SUMILIZER® TPS (available from Sumitomo Chemical Co., Ltd.); thioether antioxidants such as SUMILIZER® TP-D (available from Sumitomo Chemical Co., Ltd.); phosphite antioxidants such as MARK™ 2112, PEP-8, PEP-24G, PEP-36, 329K and HP-10 (available from Asahi Denka Co., Ltd.); other molecules such as bis(4-diethylamino-2-methylphenyl) phenylmethane (BDETPM), bis-[2-methyl-4-(N-2-hydroxyethyl-N-ethyl-aminophenyl)]-phenylmethane (DHTPM), and the like. The weight percent of the antioxidant in at least one of the charge transport layer is from 0 to 20, from 1 to 10, or from 3 to 8 weight percent.

The charge transport layer should be an insulator to the extent that the electrostatic charge placed on the hole transport layer is not conducted in the absence of illumination at a rate sufficient to prevent formation and retention of an electrostatic latent image thereon. The charge transport layer is substantially nonabsorbing to visible light or radiation in the region of intended use, but is electrically “active” in that it allows the injection of photogenerated holes from the photoconductive layer, that is the charge generation layer, and allows these holes to be transported through itself to selectively discharge a surface charge on the surface of the active layer.

Any suitable and conventional technique may be utilized to form and thereafter apply the charge transport layer mixture to the supporting substrate layer. The charge transport layer may be formed in a single coating step or in multiple coating steps. Dip coating, ring coating, spray, gravure or any other drum coating methods may be used.

Drying of the deposited coating may be effected by any suitable conventional technique such as oven drying, infra red radiation drying, air drying and the like. The thickness of the charge transport layer after drying is from 10 μm to 40 μm or from 12 μm to 36 μm for optimum photoelectrical and mechanical results. In another embodiment the thickness is from 14 μm to 36 μm.

The Adhesive Interfacial Layer

A separate adhesive interfacial layer is provided in certain configurations, such as for example, in flexible web configurations. In the embodiment illustrated in the Figure, the interfacial layer is situated between the blocking layer 14 and the charge generation layer 18. The interfacial layer may include a copolyester resin. Exemplary polyester resins which may be utilized for the interfacial layer include polyarylatepolyvinylbutyral, such as ARDEL POLYARYLATE (U-100) commercially available from Toyota Hsutsu Inc., VITEL PE-100, VITEL PE-200, VITEL PE-200D, and VITEL PE-222, all from Bostik, 49,000 polyester from Rohm Hass, polyvinyl butyral, and the like. The adhesive interfacial layer may be applied directly to the hole blocking layer 14. Thus, the adhesive interfacial layer in embodiments is in direct contiguous contact with both the underlying hole blocking layer 14 and the overlying charge generator layer 18 to enhance adhesion bonding to provide linkage.

Any suitable and conventional technique may be used to mix and thereafter apply the adhesive layer coating mixture to the hole blocking layer. Application techniques may include spraying, dip coating, roll coating, wire wound rod coating, and the like. Drying of the deposited wet coating may be effected by any suitable conventional process, such as oven drying, infra red radiation drying, air drying and the like. Drying of the deposited wet coating may have a thickness of at least 0.01 micrometers, or no more than 5 micrometers after drying. In embodiments, the dried thickness is from 0.03 micrometers to 1 micrometer.

In present embodiments, the interfacial layer is cross-linked and formed from a polyester aqueous coating solution prepared through a phase inversion process. The interfacial layers formed from the coating solution exhibit numerous advantages over interfacial layers formed from conventional coating solutions. In the chemical structure of the polyester resin for IFL, there are unsaturated C=C double bonds in the repeat units. The C=C double bonds in the polyester resin can be polymerized by a free radical initiator, such as for example, benzoyl peroxide, or UV radiation. By heat drying of the coating, cross-linking is promoted and forms an interfacial layer that will not dissolve into the charge generation layer during formation of the respective layers.

The coating solution contains a surfactant to improve coating uniformity.

In particular embodiments, the addition of about 3% of a charge control agent, such as zinc salicylate, improves electrical properties of the subsequently formed photoreceptor. Zinc salicylate has the chemical structure shown below:
When the hand-fabricated device was tested in the Xerox-4000 scanner, resultant electrical properties were very good after 10,000 cycles. The IFL was also stored at high relative humidity and peel tested for adhesion. It was discovered that relative humidity had no effect upon adhesion.

The coating solution for forming an interfacial layer comprises a polyester resin, a charge control agent, a surfactant, and a solvent, wherein the coating solution is aqueous-based. The polyester resin may be prepared by the reaction of dicarboxylic acids and diols. The acids can be selected from fumaric acid, malonic acid, itaconic acid, 2-methylitaconic acid, maleic acid, maleic anhydride, adipic acid, succinic acid, suberic acid, 2-ethyl succinic acid, glutaric acid, dodecylsuccinic acid, 2-methyladipic acid, pimelic acid, azelaic acid, sebacic acid, terephthalic acid, isophthalic acid, phthalic acid, 1,2-cyclohexanediol acid, 1,3-cyclohexanediol acid, 1,4-cyclohexanediol acid, or there is selected dialkyl esters wherein alkyl contains from 2 to 22 carbon atoms, and are esters of malonate, succinate, fumarate, itaconate, terephthalate, isophthalate, phthalate, cyclohexanediolates, mixtures thereof, and which diacids are optionally selected in an amount of from 0.95 mole equivalent to 1.1 mole equivalents, based on about 1 mole equivalent of organic diol utilized.

The diols can be selected from 1,2-propanediol, 1,3-propanediol, 1,3-butanediol, pentylene glycol, hexylene glycol, diphenol, neopentyl glycol, diethylene glycol, dipropyylene glycol, 2,2-bis-(4-hydroxy phenyl) propane, 2,2-bis-(3-hydroxy phenyl) propane, 2,2-bis-(2-hydroxy phenyl) propane, 2,2-bis-(5-hydroxy phenyl) propane, bisphenol A, ethoxylated bisphenol A, bis-(4-hydroxy phenyl) methane, 1,1-bis-(4-hydroxy phenyl) ethane, cis-1,4-dihydroxy-cyclohexane, trans-1,4-dihydroxy-cyclohexane, cis-1,2-dihydroxy-cyclohexane, trans-1,2-dihydroxy-cyclohexane, trans-1,3-dihydroxy-cyclohexane, cis-1,3-dihydroxy-cyclohexane, which diol is optionally selected in an amount of from 0.90 mole equivalents to 1.1 mole equivalents, based on about 1 mole equivalent of dicarboxylic acid utilized. The polyester resin may be present in the coating solution in an amount of from 0.05 percent to 50 percent by weight of the total weight of the coating solution. In specific embodiments, the polyester resin used for the IFL is a copolymer of terephthalic acid, dodecylsuccinic anhydride, trimellitic acid, fumaric acid, Bisphenol A ethylenoxide adducts, and Bisphenol A propylenoxide adducts. The weight average molecular weight (Mw) of this polyester resin is about 45,000, the glass transition temperature of this polyester resin is about 56 °C, and the acid value of this polyester resin is about 15 mgKOH/g. In further embodiments, the polyester resin has a weight average molecular weight (Mw) from 5000 to 100,000, a glass transition temperature of from 0 to 100°C, and an acid value of from 1 to 50 mgKOH/g. The charge control agent is selected from the group consisting of zinc salicylate; calcium salicylate, aluminum salicylate, chromium salicylate, iron salicylate, and mixtures thereof. The charge control agent may be present in the coating solution in an amount of from 0.005 percent to 20 percent by weight of the total weight of the coating solution.

The solvent is selected from the group consisting of methanol, methyl ethyl ketone, ethanol, propanol, tetrahydrofuran, acetone, dimethylformamide, N-methylpyrrolidinone, and mixtures thereof. In embodiments, the solvent is present in the coating solution in an amount of from 10 percent to 99.9 percent by weight of the total weight of the coating solution.

The anti-curl back coating layer

The anti-curl back coating 1 may comprise organic polymers or inorganic polymers that are electrically insulating or slightly semi-conductive. The anti-curl back coating provides flatness and/or abrasion resistance.

Anti-curl back coating 1 may be formed at the back side of the substrate 2, opposite to the imaging layers. The anti-curl back coating may comprise a film forming resin binder and an adhesion promoter additive. The resin binder may be the same as the resin binders of the charge transport layer discussed above. Examples of film forming resins include polyacrylate, polystyrene, bisphenol-based polycarbonate, poly(4,4’-isopropilidene diphenyl carbonate), 4,4’-cyclohexylidene diphenyl polycarbonate, and the like. Adhesion promoters used as additives include 49,000 (du
Pont), Vitel PE-100, Vitel PE-200, Vitel PE-307 (Goodyear), and the like. Usually from 1 to 15 weight percent adhesion promoter is selected for film forming resin addition. The thickness of the anti-curl back coating is at least 3 micrometers, or no more than 35 micrometers, or about 14 micrometers.

In addition, in the present embodiments using a belt configuration, the charge transport layer may consist of a single pass charge transport layer or a dual pass charge transport layer (or dual layer charge transport layer) with the same or different transport molecule ratios. In these embodiments, the dual layer charge transport layer has a total thickness of from 10 μm to 40 μm. In other embodiments, each layer of the dual layer charge transport layer may have an individual thickness of from 2 μm to 20 μm. Moreover, the charge transport layer may be configured such that it is used as a top layer of the photoreceptor to inhibit crystallization at the interface of the charge transport layer and the overcoat layer. In another embodiment, the charge transport layer may be configured such that it is used as a first pass charge transport layer to inhibit microcrystallization occurring at the interface between the first pass and second pass layers.

Various exemplary embodiments encompassed herein include a method of imaging which includes generating an electrostatic latent image on an imaging member, developing a latent image, and transferring the developed electrostatic image to a suitable substrate.

EXAMPLES

The example set forth herein below is illustrative of different compositions and conditions that can be used in practicing the present embodiments. All proportions are by weight unless otherwise indicated.

Example 1

Polyester Aqueous Solution Preparation

Polyester resin 77.0 Kilograms (kg), isopropanol 6.9 kg, and methyl ethyl ketone 38.5 kg were mixed at 40 °C for about 2 hours to get a clear polymer solution. With vigorous stirring, 10 wt% NH₄OH (2.57 kg) was added slowly. About 10 minutes after the addition, 231 kg of de-ionized water was added in 2 hours. After the addition of water, the milky mixture was distilled under reduced pressure (38 KPa absolute pressure) to remove organic solvents. The final polyester aqueous emulsion contained less than 50 ppm organic volatiles, with solid content about 29 wt.% and medium particle size D₅₀ by volume about 187 nm.

Preparation of IFL Coating Solutions:

For Sample ID #1, the cross-linked IFL, free radical initiator benzoyl peroxide 0.035 g and zinc salicylate 0.013 g were dissolved in 3 g of methyl ethyl ketone. This solution was then added into a mixture of 54.2 g of de-ionized water, 1.5 g of the above polyester emulsion and surfactant sodium deodecylbenzene sulfonate 0.003 g. After mixed for 30 minutes, the aqueous emulsion is ready for coating.

For Sample ID#2, the non cross-linkable IFL, the same procedure in Sample ID#1 was used. However, in the formulation, no initiator (benzoyl peroxide) and no charge control agent (zinc salicylate) were added to the solution.

IFL Coating and Drying

The polyester aqueous solution prepared above was coated on a titanium/zirconium metallized polyester substrate with silane charge blocking layer on the top, using a 0.0005-mil bar. After being dried in an air-flowing hood, the coated substrate was dried in a 120 °C oven for 1 minute.

Fabrication of Full Photoreceptor Devices

On the above prepared substrate with the inventive IFL layer, charge generation layer and charge transport layer were formed by hand-coating, using conventional solutions for the respective layers, as described in US patent 7344809. The full devices incorporated Sample ID#1 and Sample ID#2 from the above IFL coating process.

Electrical Property Testing

The full photoreceptor devices were tested by a XEROX 4000 scanner. The electrical properties of the samples are shown in Table 1. This table contains the electrical properties of the photoreceptor devices after 10,000 cycling test. V₀ is the applied voltage at time zero, V_cyc-up is the erase voltage change after 10,000 cycling test. Although the samples
were hand-coated, the devices still exhibited very good electrical properties, such as low cycle-up voltage \( V_{\text{cyc-up}} \) and low dark decay voltage \( V_{\text{dd}} \).

### Table 1

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>( V_0 )</th>
<th>( V_{\text{dd}} )</th>
<th>( V_{\text{cyc-up}} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1 Cross-linked IFL</td>
<td>800</td>
<td>24.6</td>
<td>-8.4</td>
</tr>
<tr>
<td>#2</td>
<td>800</td>
<td>23.0</td>
<td>31.2</td>
</tr>
</tbody>
</table>

### Claims

1. An aqueous-based coating solution for forming an interfacial layer, comprising:
   a charge control agent;
   a surfactant;
   a polyester resin; and
   a solvent,
   wherein said charge control agent is selected from the group consisting of zinc salicylate, calcium salicylate, aluminum salicylate, chromium salicylate, boron salicylate, zirconium salicylate, iron salicylate, and mixtures thereof, and
   wherein said solvent is selected from the group consisting of methanol, methyl ethyl ketone, ethanol, propanol, tetrahydrofuran, acetone, dimethylformamide, N-methylpyrrolidinone, and mixtures thereof.

2. The coating solution of claim 1, wherein the polyester resin is prepared by a reaction of dicarboxylic acids and diols.

3. The coating solution of claim 1, wherein the polyester resin is present in the coating solution in an amount of from 0.05 to 50 percent by weight of the total weight of the coating solution, or
   wherein the polyester resin is a copolymer of terephthalic acid, dodecenylsuccinic anhydride, trimellitic acid, fumaric acid, Bisphenol A ethylenoxide adducts, and Bisphenol A propylenoxide adducts, or
   wherein the polyester resin has a weight average molecular weight (Mw) of from 5000 to 100,000, or
   wherein the polyester resin has a glass transition temperature of from 0 to 100°C, or
   wherein the polyester resin has an acid value of from 1 to 50 mg KOH/g.

4. The coating solution of claim 1, wherein the charge control agent is present in the coating solution in an amount of from 0.005 to 20 percent by weight of the total weight of the coating solution.

5. The coating solution of claim 1, wherein the surfactant is an anionic surfactant, or
   wherein the surfactant is selected from the group consisting of sodium dodecybenzenesulfonate, sodium dodecyl-sulfate, sodium dodecylphthalene sulfonate, dodecyl benzenealkyl, sulfates, sulfonates, adipic acid, hexadecylphenoxydisulfonate, and mixtures thereof.

6. The coating solution of claim 1, wherein the surfactant is present in the coating solution in an amount of from 0.0001 to 10 percent by weight of the total weight of the coating solution.

7. The coating solution of claim 1, wherein the solvent is present in the coating solution in an amount of from 10 to 99.9 percent by weight of the total weight of the coating solution.

8. An imaging member, comprising:
   a substrate;
   a charge blocking layer disposed on the substrate;
   an interfacial layer disposed on the charge blocking layer; and
   a charge imaging layer,
   wherein the interfacial layer is disposed between the charge blocking layer and the charge imaging layer, and
   further
   wherein the interfacial layer is crosslinked and formed from the aqueous-based coating solution of claim 1.
9. The imaging member of claim 8, wherein the interfacial layer has a thickness of from 0.01 to 5 micrometers.

**Patentansprüche**

1. Beschichtungslösung auf wässriger Basis zum Bilden einer Grenzflächenschicht, umfassend:
   - ein Ladungskontrollmittel;
   - eine oberflächenaktive Substanz;
   - ein Polyesterharz; und
   - ein Lösungsmittel,

2. Beschichtungslösung nach Anspruch 1, wobei das Polyesterharz durch eine Reaktion vonDicarbonsäuren und Diolen hergestellt wird.

3. Beschichtungslösung nach Anspruch 1, wobei das Polyesterharz in der Beschichtungslösung in einer Menge von 0,05 bis 50 Gewichtsprozent, bezogen auf das Gesamtgewicht der Beschichtungslösung, vorhanden ist, oder wobei das Polyesterharz ein Copolymer von Terephthalsäure, Dodecenylenbersteinsäureanhydrid, Trimellitsäure, Fumarsäure, Bisphenol-A-Ethlenoxido-Addukten, und Bisphenol-A-Propylenoxid-Addukten ist, oder wobei das Polyesterharz eine Molekulargewicht (Mw) von 5000 bis 100000 aufweist, oder wobei das Polyesterharz eine Glasübergangstemperatur von 0 bis 100 °C aufweist, oder wobei das Polyesterharz eine Säurezahl von 1 bis 50 mg KOH/g aufweist.

4. Beschichtungslösung nach Anspruch 1, wobei das Ladungskontrollmittel in der Beschichtungslösung in einer Menge von 0,005 bis 20 Gewichtsprozent, bezogen auf das Gesamtgewicht der Beschichtungslösung, vorhanden ist.

5. Beschichtungslösung nach Anspruch 1, wobei die oberflächenaktive Substanz eine anionische oberflächenaktive Substanz ist, oder wobei die oberflächenaktive Substanz ausgewählt ist aus der Gruppe bestehend aus Natriumdodecylbenzolsulfonat, Natriumdodecylsulfat, Natriumdodecylphosphat, Dialkyldiphenyloxiddisulfonat, Diakylbenzolalkyl, Sulfaten, Sulfonaten, Adipinsäure, Hexadecyldiphenyloxiddisulfonat und Mischungen davon.

6. Beschichtungslösung nach Anspruch 1, wobei die Oberflächenaktiv Substanz in der Beschichtungslösung in einer Menge von 0,0001 bis 10 Gewichtsprozent, bezogen auf das Gesamtgewicht der Beschichtungslösung, vorhanden ist.


8. Bilderzeugungselement, umfassend:
   - ein Substrat;
   - eine Grenzflächenschicht, die auf dem Substrat angeordnet ist;
   - eine Grenzflächenschicht, die auf der Ladungsblockierungsschicht angeordnet ist; und
   - eine Ladungsbilderzeugungsschicht,
   wobei die Grenzflächenschicht zwischen der Ladungsblockierungsschicht und der Ladungsbilderzeugungsschicht angeordnet ist, und außerdem wobei die Grenzflächenschicht vernetzt ist und aus der Beschichtungslösung auf wässriger Basis nach Anspruch 1 gebildet ist.

9. Bilderzeugungselement nach Anspruch 8, wobei die Grenzflächenschicht eine Dicke von 0,01 bis 5 Mikrometer aufweist.
**Revendications**

1. Solution de revêtement à base aqueuse pour former une couche interfaciale, comprenant :
   - un agent de régulation de charge ;
   - un tensioactif ;
   - une résine de polyester ; et
   - un solvant,
   dans laquelle ledit agent de régulation de charge est choisi dans le groupe constitué du salicylate de zinc, du salicylate de calcium, du salicylate d'aluminium, du salicylate de chrome, du salicylate de bore, du salicylate de zirconium, du salicylate de fer, et de mélanges de ceux-ci, et
   dans laquelle ledit solvant est choisi dans le groupe constitué de méthanol, de méthyléthylcétone, d'éthanol, de propanol, de tétrahydrofuranne, d'acétone, de diméthylformamide, de N-méthylpyrrolidinone, et de mélanges de ceux-ci.

2. Solution de revêtement de la revendication 1, dans laquelle la résine de polyester est préparée par une réaction d'acides dicarboxylliques et de diols.

3. Solution de revêtement de la revendication 1, dans laquelle la résine de polyester est présente dans la solution de revêtement en une quantité allant de 0,05 à 50 pour cent en poids du poids total de la solution de revêtement, ou dans laquelle la résine de polyester est un copolymère d'acide téréphtalique, d'anhydride dodécénylsuccinique, d'acide trimellitique, d'acide fumarique, de produits d'addition de bisphénol A-oxyde d'éthylène, et de produits d'addition de bisphénol A-oxyde de propylène, ou
dans laquelle la résine de polyester a un poids moléculaire moyen en poids (Mw) allant de 5000 à 100000, ou
dans laquelle la résine de polyester a une température de transition vitreuse allant de 0 à 100°C, ou
dans laquelle la résine de polyester a un indice d'acidité allant de 1 à 50 mg KOH/g.

4. Solution de revêtement de la revendication 1, dans laquelle l'agent de régulation de charge est présent dans la solution de revêtement en une quantité allant de 0,005 à 20 pour cent en poids du poids total de la solution de revêtement.

5. Solution de revêtement de la revendication 1, dans laquelle le tensioactif est un tensioactif anionique, ou dans laquelle l'agent tensioactif est choisi dans le groupe constitué de dodécylbenzènesulfonate de sodium, de dodécylsulfate de sodium, de dodécylnaphtalène sulfate de sodium, de dialkylbenzènealkyle, de sulfates, de sulphonates, d'acide adipique, d'hexadécyldiphényloxyde disulfonate, et de mélanges de ceux-ci.

6. Solution de revêtement de la revendication 1, dans laquelle l'agent tensioactif est présent dans la solution de revêtement en une quantité allant de 0,0001 à 10 pour cent en poids du poids total de la solution de revêtement.

7. Solution de revêtement de la revendication 1, dans laquelle le solvant est présent dans la solution de revêtement en une quantité allant de 10 à 99,9 pour cent en poids du poids total de la solution de revêtement.

8. Élément de formation d'image, comprenant :
   - un substrat ;
   - une couche de blocage de charge disposée sur le substrat ;
   - une couche interfaciale disposée sur la couche de blocage de charge ; et
   - une couche de formation d'image par charge,
   dans lequel la couche interfaciale est disposée entre la couche de blocage de charge et la couche de formation d'image par charge, et en outre
   dans lequel la couche interfaciale est réticulée et formée à partir de la solution de revêtement à base aqueuse de la revendication 1.

9. Élément de formation d'image de la revendication 8, dans lequel la couche interfaciale a une épaisseur allant de 0,01 à 5 micromètres.
REFERENCES CITED IN THE DESCRIPTION

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