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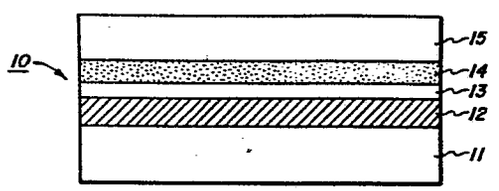
(54) Photosensitive imaging member.

(57) A photosensitive imaging member comprising a conductive substrate (11, 12) having thereon a photoresponsive layer (14, 15) where said photoresponsive layer can be a single or a composite photoresponsive layer, the improvement consisting of positioning between said conductive substrate and the photoresponsive layer, a layer (13) of an acetal of poly(vinyl alcohol).



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PHOTOSENSITIVE IMAGING MEMBER

This invention relates to a photosensitive imaging member comprising a conductive substrate having thereon a photoresponsive layer.

In the art of xerography, a xerographic plate containing a photoconductive insulating layer is imaged by first uniformly electrostatically charging its surface. The plate is then exposed to a pattern of activating electromagnetic radiation, such as light, which selectively dissipates charge in the illuminated areas of the photoconductive insulator resulting in a latent electrostatic image corresponding to the pattern of light-struck and nonlight-struck areas. The latent electrostatic image may then be developed to form a visible image by depositing finely divided electroscopic marking particles on the surface of the photoconductive insulating layer.

In recent years, interest has been shown in flexible electrophotographic plates for use in high speed office copying machines. Some of these plates are multilayered devices comprising, a conductive substrate, an adhesive blocking interface layer and a photoresponsive layer thereon. The photoresponsive region of the plate may be a single photoconductive material, e.g. selenium or this region may be composed of separate layers of a charge generation layer and a charge transport layer. The charge generation layer can be any photoresponsive material. This material can be conveniently dispersed in a polymeric matrix material. The charge transport layer may comprise an organic charge transport molecule dissolved or dispersed in a polymeric matrix material. During the imaging process, photons of light generate charge in imagewise fashion in the charge generation layer. These charges are injected into and transported across the charge transport layer to discharge in imagewise fashion the uniformly charged surface of the transport layer. The charge transport layer is substantially nonabsorbing in the spectral region of intended use, i.e. visible light, but is "active" in that it allows (1) injection of photogenerated charge from the charge generation layer and (2) efficient transport of these charges to the surface of the transport layer to discharge the surface charge thereon.

It is essential that intimate adhering contact be maintained between the conductive substrate and the charge generation layer. If

partial delamination occurs, then effective charge injection will not occur.

Difficulty has been experienced with different-variant forms of this kind of layered photoreceptor in maintaining integrity between the conductive layer and the charge generation layer or the charge transport layer. The art is constantly searching for means to effectively bond the charge generation layer or the transport layer to the conductive substrate.

Another problem experienced with attempts to employ proprietary adhesives, e.g. DuPont's 49000 polyester adhesive, is that components of the layers to be bonded migrate into and through the adhesive layer and even into the next adjacent layers. This causes charge trapping which ultimately results in an intolerable increase in residual potential. By solving these problems, greater assurance of high quality copy can be obtained.

The present invention is intended to overcome these problems, and provides a photosensitive imaging member which is characterised in that there is positioned between the conductive substrate and the photoresponsive layer, a layer of an acetal of poly(vinyl alcohol).

In one embodiment, the imaging member is a flexible member having a conductive substrate, an adhesive interface layer of an acetal of polyvinyl alcohol, a charge generation layer and, contiguous therewith, a charge transport layer. Among the outstanding advantages of this interfacial composition is that it exhibits outstanding tensile strength, modulus of elasticity, adhesive properties and electrical characteristics which far exceed the properties of prior art interfacial layers.

A photosensitive imaging member in accordance with the invention will now be described, by way of example, with reference to the accompanying drawing.

In the drawing, reference character 10 illustrates by a cross-sectional view an improved photoreceptor device of the instant invention. Reference character 11 designates a support member which can be an insulating material, for example, polyethylene terephthalate, which is overcoated with a conductive material 12, such as aluminum. This combination of 11 and 12 is obviously merely for purposes of illustration.

Aluminized polyethylene terephthalate is an effective material which is used in place of a fully metallic substrate. Layer 11 can be any one of a number of insulating or dielectric support materials and 12 can be any number of conductive materials. The substrate can be polyethylene, polypropylene, polycarbonate, ceramic, etc. The advantage of using a material such as polyethylene terephthalate is that it is flexible and extremely strong.

Thus, the support may comprise other materials such as metallized paper, plastic sheets covered with a thin coating of aluminum or copper iodide or glass coated with a thin conductive layer of chromium or tin oxide. It is preferred to use a dielectric belt coated with aluminum with its inherent coating of aluminum oxide. The conductive layer 12 is overcoated with the interfacial layer 13 which comprises an acetal of polyvinyl alcohol.

Typical acetals of polyvinyl alcohol include the following: poly(vinyl formal), poly(vinyl acetal) and poly(vinyl butyral). The preferred acetal is poly(vinyl butyral). The molecular weight range of the poly(vinyl butyral) is preferably from about 30,000-270,000. The molecular weight range of the poly(vinyl formal) and poly(vinyl acetal) is preferably from about 10,000 to 40,000. The interface layer can be deposited in a thickness range of about 100 Angstroms to 5000 Angstroms. It is preferred that this thickness be about 500 Angstroms. This material is conveniently coated from alcohol solutions such as isopropanol or mixtures of ethanol and isopropanol, etc.

Coated on top of interfacial layer 13 is the photoresponsive material of choice. In the Figure shown herein, the photoreceptor is a combination of layer 14 and layer 15. In this type of photoreceptor, the arrangement provides for a layer 14 which is known as a charge generation layer and layer 15 which is known as a charge transport layer. It is to be understood, however, that the present invention is not limited to this type of photoreceptor since it can be a single layer of photoreceptor such as selenium or a selenium alloy. As illustrated, layer 14 can comprise a particulate charge generation material such as amorphous or trigonal selenium or phthalocyanine dispersed in a binder material such as poly-N-vinyl carbazole. And layer 15 can be formed of an organic charge transfer compound dissolved in an organic matrix material. A photoreceptor of this

type will be found described in U.S. Patent 4,115,116.

The interfacial layer may be made by any convenient technique. For example, the selected acetal may be dissolved in a solvent and the solution coated onto the supporting substrate. The solvent is then allowed to evaporate leaving a dried coating on the supporting substrate. Residuals of the solvent are then driven off by drying at an efficient temperature. Typical coating techniques which are suitable for forming the interfacial layer include spray coating, draw coating, dip coating or flow coating.

A preferred application of the instant invention includes the use of the instant interface with an aluminized Mylar substrate. The thickness of the Mylar is about 3 mil and the thickness of the aluminum overcoat is 200 Angstroms. A coating of about 500 Angstroms of polyvinyl butyral B-72A, obtainable from Monsanto Company, is applied to the surface from a 0.5% solution in isopropanol. This layer was applied using a draw bar technique and residual isopropanol was removed by heating the system at a temperature between 90° C and 110° C for 5 minutes. On top of this layer of poly(vinyl butyral) is deposited a 1 micron layer of vitreous selenium by a conventional vacuum deposition technique. A charge transport layer is deposited over the vitreous selenium layer by applying a solution of N,N'-diphenyl-N,N'-bis(3-methylphenyl)-[1,1'-biphenyl]-4,4'-diamine in a bis-phenol-A polycarbonate (Lexan® 145) obtained from General Electric Company and having a molecular weight of from about 25,000 to about 40,000 using methylene chloride as a solvent. This layer is applied to the vitreous selenium layer using a Bird film applicator. The coating is then vacuum dried at 40° C for about 18 hours to form a 22 micron thick dry layer of charge transport material. The above member is then heated to about 125° C for about 16 hours which is sufficient to convert the vitreous selenium to the crystalline trigonal form.

This device was examined and subjected to conventional Carlson xerography imaging cycles totaling about 20,000 cycles. The residual remained at 40 volts and showed no signs of cycle up which would have indicated a progressive increase in the residual voltage on discharge of the photoreceptor. The overall mechanical integrity of the structure was excellent revealing no evidence of delamination between the conductive layer and the polyvinyl butyral or between the generator layer and the polyvinyl butyral.

CLAIMS:

1. A photosensitive imaging member comprising a conductive substrate (11, 12) having thereon a photoresponsive layer (14, 15), characterised in that there is positioned between the conductive substrate and the photoresponsive layer, a layer (13) of an acetal of poly(vinyl alcohol).

2. The member of claim 1 wherein the photoresponsive layer is a composite photoresponsive layer comprising of a charge generation layer (14) and a contiguous charge transport layer (15).

3. The member of claim 2 wherein said acetal is between said substrate and said charge generation layer.

4. The member of claim 2 wherein said acetal is between said substrate and said charge transport layer.

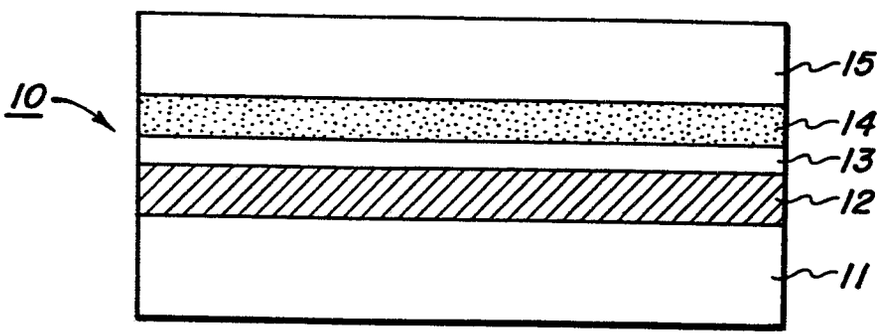
5. The member of claim 1 wherein the photoresponsive layer is of selenium or a selenium alloy.

6. The member of any one of claims 1 to 5 wherein said acetal is poly(vinyl butyral).

7. The member of claim 6 wherein the poly(vinyl butyral) has a molecular weight of 30,000 to 270,000.

8. The member of any one of claims 1 to 6 wherein said acetal is poly(vinyl formal).

9. The member of claim 8 wherein the poly(vinyl formal) has a molecular weight of 10,000 to 40,000.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