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(54) Film product for use in printing

(57) The invention provides a substrate for reception of an electrophotographic image and use as a film positive or negative in a printing process. The substrate of the invention does not display the disadvantage of reduced contrast in the positive or negative which has been caused in the past by areas of the electrophotographic image not being sufficiently solid as a result of mutual-repulsion of toner particles. The substrate of the invention has a coating layer which has in its bulk a toner-coalescing agent which, under the influence of the heat of the fusing step of the electrophotographic process, brings about an improved degree of coalescence of the toner applied.

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Description

[0001] This invention relates to film products for use in receiving images and subsequent use in printing processes.

Background to the invention

[0002] Electrophotographic machines such as laser printers and photocopiers in which toner is applied imagewise to a substrate by electrostatic attraction are ubiquitous. By and large they are superb for making ordinary images. With some limitations they are adequate for overhead transparencies and, in principle but not in practice, they should make an excellent potential source of film positives and negatives for the printing industry: e.g. in offset, screen and flexo printing.

[0003] Unfortunately, the charged nature of the toner particles used in electrophotographic machines leads to a mutual repulsion and the image is not a solid area: there is often a gap between each toner particle. This gap is usually not noticeable for ordinary images: it reduces somewhat the contrast of overhead projections but, more seriously, this gap lets through sufficient light to reduce the contrast of the positive or negative. Hence the use of electrophotographic machines for film positives and negatives is limited.

[0004] Electrophotographic systems usually incorporate a heat processing step to fuse the toner particles to each other and to the substrate. Often this is a heated roller system, though it can also be an intense burst of heat from a lamp. The fusing system is a compromise. It needs to take place at sufficiently low temperatures to be energy efficient, to allow substrate to pass through quickly and to minimize the distortion of the substrate. To provide better fusing of the toner it is best to increase the temperature and pressure within the fusing system of the electrophotographic machine. This can however melt the toner and force it to flow together better. Although there are many differences in machine design, the vast majority have opted for a lower temperature that gives adequate print image results but insufficient coalescence of the toner for producing film positives and negatives. Current commercially available laser imageable films include "Delta Laserfilm" and "Folaproof Laser Film".

[0005] Another approach is to increase the amount of toner deposited. But this can often have detrimental effects on image quality and consumables cost so it is not usually a favoured option.

[0006] Yet another approach, when using the system for film positives or negatives, is to mask the problem through the use of a translucent film. The scattering of the light reduces the effective amount of light passed by the gaps between the toner particles and increases the image contrast. However, this approach reduces resolution and provides only a modest increase in contrast.

[0007] A further approach to the problem is to post-treat the image with solvent, sometimes in combination with heat and/or pressure. This can achieve excellent results: the toner particles fuse together and give a solid black image which can easily be used as a printing positive or negative. However, this is an extra processing step, it involves extra cost, it requires extra time to ensure that the solvent is fully evaporated and the use of solvents can give rise to odour or health and safety issues.

[0008] US-A-4461823 (DuPont) describes a "prolonged tack toner" in a process to develop a substrate containing a latent image. The "prolonged tack toner" is prepared from a thermoplastic resin (e.g. polymethyl methacrylate/ methacrylic acid) and a solid plasticiser (e.g. triphenyl phosphate). The mixture becomes tacky upon heating and retains this tackiness for a considerable time after cooling. The "prolonged tack toner" image can then be transferred to another substrate to give an image with an increased optical density. EP-A-0501396 (DuPont) similarly uses a solid plasticiser and monomer/photoinitiator mixture as a "prolonged tack toner".

[0009] GB-A-2085806 discloses a receiving substrate for use in a reflex thermoremanent magnetic imaging method. The receiving substrates specifically disclosed are bond-like papers which are treated during manufacture with a binder and plasticiser combination. The substrate is used in pressure transfer thereto of a toner-developed latent magnetic image produced by reflex thermoremanent magnetic imaging of a magnetic imaging member. The binder and plasticiser treatment is shown to provide improved adhesive properties with respect to toner transfer during pressure transfer.

[0010] WO-A-95/18992 describes a receptor layer comprising a blend of an acrylic resin, a vinyl resin, a solution or dispersion grade rubber and a plasticiser. An image is applied to the receptor layer by thermally bonding electrostatic toners which were previously printed onto a transfer medium. The receptor layer is stated to be particularly suitable for printing graphics on plasticised polyvinyl chloride coated fabric for use on soft-sided vehicles where previous receptor layers did not withstand the flexing, rolling, flapping and cold-flexing to which the fabric is subjected in use.

[0011] US-A-5665504 describes the creation of simulated, photographic-quality prints using non-photographic imaging such as xerography and ink jet printing. This is achieved by means of a coated backing sheet having successive first and second coating layers, the first layer comprising an adhesive polymer for adhering the backing sheet to imaged transparent substrates, whilst the second layer prevents premature activation of the first layer and contains a plasticiser having at melting point of less than 75°C. In use, an ink-jet or xerographic image is formed on a transparency which is then laminated to the backing sheet by application of heat and pressure, in order to create the simulated, photo-

graphic-quality prints.

[0012] US-A-5045426 discloses a coated cellulosic (and therefore opaque) web which is usable for producing security documents, such as cheques, which are to be printed using non-contact printing devices such as laser printers. The web is coated with a polymeric toner adhesion-enhancing composition which may contain a plasticiser for the purpose of enhancing the flexibility of the coating.

[0013] US-A-4526847 describes a transparency for the formation of an adherent electrostatic image thereon. The transparency comprises a polyester base film with a nitrocellulose coating layer which contains a plasticiser, preferably castor oil, which contributes to the adherence of the coating layer to the base film and to the flexibility of the coating layer.

[0014] US-A-4259425 describes an electrographic recording material comprising a conductive sheet coated with an electrically insulating layer comprising up to 500 parts by weight of a finely divided pigment per 100 parts by weight of polymeric binder comprising a particular polyvinyl acetal, polystyrene or poly(α-methylstyrene) and a plasticising liquid polystyrene. The coated material provides improved print retention when printed on electrographically.

The invention

[0015] According to the present invention, there is provided a substrate for use in producing film positives by means of an electrographic printing process, the substrate comprising: a base layer, an optional adhesive layer and a film-coating layer, the film-coating layer having within its bulk a toner-coalescing agent which, under the influence of the heat of the fusing step of the electrographic printing process, has an effect of improving the degree of coalescence of the toner applied to the surface of the film-coating layer.

[0016] In this invention the benefits of the solvent approach without substantial drawbacks can be achieved. In effect, the solvent is built into the toner-receptive coating of the film. The invention also avoids the inclusion of a liquid solvent within this coating - it would be unpleasant to handle, would leave deposits on the rollers of the laser printer and would be subject to easy image wipe-off and smearing.

[0017] The invention uses a heat-activated toner-coalescing system. The bulk of the system can be a polymer or polymer blend that could be used as an ordinary electrographic system. For example, it can have adequate toner adhesion and does not contaminate the printer mechanism. The bulk system would however suffer from the defects listed above. Within the bulk system a chemical blend is provided which, at ambient temperatures, imparts no special properties to the bulk. However, using the heat provided during the fusing stage (and, optionally, in a further heat processing step), the chemical blend is able to migrate to the surface of the system and has sufficient chemical compatibility with the toner (when hot within the fuser system) to cause it to coalesce much more efficiently. In addition, it is ensured that, on removal of the heat, the system reverts to its bulk properties, leaving minimal residues on the machine and the minimum of undesirable residue on the surface. It is specially important that the final image does not feel 'sticky' to the touch, and has no unpleasant chemical feel or smell. It is a particular feature of this invention that the heat activation step is reversible and achieves these "user friendly" aims.

[0018] In an electrographic machine, the fusing system is specifically designed to cope with semi-solids - the toner particles themselves are partially melted. However, it has only a certain latitude so it is important in the implementation of this invention that the chemical system does not cause the layer and the toner to adhere to the fusing rollers. This requires a suitable choice of the polymers and additives to the coating.

[0019] As an aid to reducing the tendency of the system to adhere to the fusing rollers, it is possible to include inert solid particles within or on the surface of the film. It has been found that these particles can confer extra benefits:

(a) they can minimize the effects of any residual chemical on the surface by improving the 'feel' of the final imaged substrate;
(b) they can act as a reservoir that releases the chemical blend when heating and re-absorbs it on cooling; and
(c) they can provide controlled scattering to further increase image contrast.

[0020] Should users so require, the carrier substrate can be translucent to give the additional benefits of the scattering systems.

[0021] The advantages which can be achieved by the use of a toner coalescing agent are:

(a) improved, 'stronger' images for ordinary use;
(b) improved, higher contrast overhead transparencies; and
(c) improved usability as film positives or negatives for the printing industry.

[0022] Tests confirming the mechanism of action of this invention have included:

(a) demonstrations that the effect depends on the thickness of the coating layer, the thicker the coating (up to a

limit), the stronger the image enhancement, showing that the effect is not due merely to residual surface toner-coalescing agent;
(b) demonstrations that the toner-coalescing agent requires heat for its action e.g. a drop of a typical agent (Citroflex A-4, a citrate plasticiser) on a non-enhanced toner image had no effect after several hours at room temperature, but coalesced the image rapidly when heated;
(c) demonstrations using different grades of "Syloid" filler with different oil absorption coefficients (0.8g/g and 2g/g respectively) showed an enhanced effect using the filler with the higher absorption coefficient; and
(d) acceptability tests showing that the feel of a test sample that had deliberately been coated with a thin layer of "Citroflex A-4", was disliked, yet the feel of a film that had been enhanced using "Citroflex A-4" within the coating layer was not disliked.

[0023] The base layer preferably comprises polyethylene terephthalate or polycarbonate. Advantageous also are base layers which comprise a pre-stabilised polyester, for example a polyester film which has been shrunk under the influences of tension and elevated temperature. Such a pre-stabilised film may have a dimensional stability of no more than 2 or 3% at a temperature of 150°C.

[0024] Preferably, the base layer has a film thickness of 50 to 100 μm, onto which is coated the optional adhesive layer which can comprise a linear polyester resin coated from an organic solvent, the linear polyester resin preferably being coated at from 2 to 15 wt.% of the solvent.

[0025] The film-coating layer preferably has a film thickness of 10 to 20 microns which may be coated from a solvent-based or from a water-based formulation comprising a film-forming component, a toner-coalescing agent and an optional anti-blocking layer.

[0026] A preferred embodiment of the substrate comprises either (a) an antistatic back coat, with a film thickness of less than 3 μm, on the outer side of the base layer, to aid film sheet feeding through the electrostatic printer, to sharpen-up images, to prevent the final film-coatings from sticking to one another and to minimise static build-up, or (b) an antistatic component built into the base layer. The antistatic component may comprise a polystyrene sulphonate or a quaternary ammonium polymeric alkyl or aryl sulphonate compound.

[0027] When the film-coating layer is coated from a solvent-based formulation the film-forming component preferably comprises one or more of the following polymers: nitrocellulose, polyvinyl chloride, styrene/acrylate copolymers, polyurethanes and polyacrylonitriles. When the film-coating layer is coated from a water-based formulation the film-forming component preferably comprises one or more of the following polymers: polvinyl alcohol and its derivatives, gelatin and its derivatives, cellulose derivatives, modified starches and polyacrylamides. The film-forming component is preferably present in a total amount of 50 to 90 wt.% of the film-coating layer.

[0028] The toner-coalescing agent is present so as to coalesce the toner, and comprises preferably a solid plasticiser of high melting point or a liquid plasticiser of high boiling point, which will coalesce the toner at temperatures greater than ambient. Preferably, the toner-coalescing agent has no significant effect on the degree of toner coalescence at temperatures up to 100°C and has a significant toner-coalescing effect at a temperature of 120°C. In other words, the temperature at which the toner-coalescing agent becomes effective preferably lies in the range of from 100°C to 120°C, although the effectiveness may increase over a range of temperatures falling between these limits.

[0029] The toner-coalescing agent preferably comprises one or more of the following chemical compounds: dibasic polymeric polyester plasticisers, citrate plasticisers, p-toluenesulphonamide plasticisers, benzoate plasticisers, alkyl and aryl phosphates or phthalates e.g. dioctylphthalate, chlorinated polyolefins, or other compounds capable of coalescing the toner. The toner-coalescing agent is preferably present in a total amount of 10 to 50 wt.% of the film-coating layer, more preferably 20 to 45 wt.%, most preferably 25 to 40 wt.%. Optionally, when the film-coating layer is a water-based formulation, it further comprises a toner-coalescing agent containment agent which functions: to contain the toner-coalescing agent within the film-coating layer, as a film strengthening agent and as adhesion promoter to the optional adhesive layer. The toner-coalescing agent containment agent preferably comprises a polyvinyl acetate polymer in a total amount of 10 to 60 wt.% of the film-coating layer.

[0030] The anti-blocking layer preferably comprises one or more of the following solid particle fillers: silicas, organically or inorganically treated silicas, talc, urea formaldehyde condensates and aluminas, or other materials which can absorb the toner-coalescing agent. The anti-blocking layer preferably comprises a solid particle filler in a total amount of 3 to 25 wt.% of the film-coating layer.

[0031] The substrate is preferably transparent to light over the wavelength range of from 300 nm to 700 nm, preferably 350 nm to 500 nm.

[0032] The invention also provides a method of producing a film positive or negative, comprising

providing a substrate as referred to above, and
imaging the film-coating layer of the substrate with toner applied in an electrographic printing process,
wherein the electrographic printing process includes a fusing step, in which heat is applied to the toner-imaged

substrate and has a toner-coalescing effect on the toner forming the image.

Examples

[0033] The present invention is illustrated by the following examples whilst not being limited thereto. In these examples, various commercially-available materials are listed by their trade names, the letters identifying the following companies:

(a) Toray Plastics, France
(b) Huls, UK
(c) Croxton and Garry, UK
(d) Croda, UK
(e) W R Grace, UK
(f) Autotype International, UK
(g) Eastman Chemicals, USA
(h) Nippon Gohsei, Japan
(i) Resadhesion, Hants., UK
(j) Folex Film Systems, Switzerland
(k) Velsicol Chemical Corp., USA
(l) Dick Peters BV, Netherlands
(m) ICI, UK
(n) Sericol, UK

[0034] Example 1 involves a solvent-based formula whereas Examples 2, 4 and 5 involve a water-based formula. All amounts given are on a percent by weight basis, unless stated otherwise.

Example 1

Solvent based formula

[0035] On to a 100 μm antistatic polyester base - "Terphane 45:32" (a), an adhesive layer of the following formulation was coated.

Butanone	93
"Dynapol L411" (b) - linear polyester	7

[0036] The solution was coated onto the polyester with a 0.010" Meyer bar and dried at 40°C.
[0037] To the above base plus adhesive the following coating was applied using a 0.020" Meyer bar:

30 wt.% solution of 1/2 second Nitrocellulose in Butanone	77.4
"Paraplex G-30" (c) - dibasic polyester plasticiser	13.6
"Citroflex A-4" (d) - citrate plasticiser	4.5
"Syloid ED-30" (e) - organically treated silica	4.5

[0038] The coating was dried at 40° C. The film was imaged on a QMS 860 laser printer. The UV density of the image was measured on a MacBeth TR927 densitometer with the following results;

Image Density	2.60 - 2.80
Background Density	0.06

[0039] The film was used as film positive to image a screen stencil using "Capillex 25" (f) - a diazo sensitised screen capillary film. The exposure was carried out in a vacuum frame with a 5kW light source at a distance of one metre for 5 minutes. After exposure the screen stencil was developed by washing in a cold water spray. The stencil was dried and the image examined for quality. The image density achieved was equivalent to a conventional silver halide film positive.
[0040] The stencil was printed to 1,000 impressions on a Svecia screenprinting press using Mattplast MG (n) inks

with no apparent signs of image breakdown.

Comparative Example 1

Solvent based formula

[0041] The procedure of Example 1 was repeated exactly, except that "Paraplex G-30" and "Citroflex A-4" were omitted from the coating solution.

[0042] The U.V. density of the image was as follows:

Image Density	1.50 - 1.80
Background Density	0.16 - 0.20

[0043] As in Example 1, the imaged positive was used to make a Capillex 25 screen stencil. The resulting stencil resisted washout development in the clear areas. These areas correspond to the weak image generated in this comparative example. The positive was insufficiently dense to prevent UV light passing through and partially exposing the Capillex stencil. The developed stencil was of such poor quality that it was not suitable for printing from.

Example 2

Water based formula

[0044] On to a 100 μm antistatic polyester base - "Terphane 45:32" (a), an adhesive layer of the following formulation was coated.

Water/IPA (1:1)	95
30 wt.% "Aq. 29D" (g) - sulphonated linear polyester	5

[0045] The solution was coated onto the polyester with a 0.0060" Meyer bar and dried at 40°C.

[0046] To the above base plus adhesive the following coating was applied using a 0.020" Meyer bar:

10 wt.% "Gohsenol GH-20" (h) - polyvinyl alcohol aq. solution	62.0
50 wt.% "Resad 1350" (i) - stabilised polyvinyl acetate	25.0
Paraplex G-30	6.2
Citroflex A-4	3.1
Syloid ED-30	3.7

[0047] The film was formed and treated in a similar manner to Example 1 above. The density of the final image achieved was equivalent to a conventional silver halide film positive.

Comparative Example 2

Water based formula

[0048] The procedure of Example 2 was repeated exactly, except that "Paraplex G-30" and "Citroflex A-4" were omitted from the coating solution.

[0049] The U.V. density of the image was as follows:

Image Density	1.60 - 1.70
Background Density	0.10 - 0.20

Example 3

[0050] Commercially available laser imageable films - "Delta Laser Film" (f) and "Folaproof Laserfilm" (j) were imaged on a QMS 860 laserprinter in a similar manner to Example 1 above. In each case the U.V. density of the image was as follows:

Image Density	1.60 - 1.70
Background Density	0.10 - 0.20

Example 4

Water based formula

[0051] On to a 100 μm antistatic polyester base - "Terphane 45:32" (a) - an adhesive layer of the following formulation was coated.

Water/IPA (1:1)	95
30% "Aq. 29D" (g) - sulphonated linear polyester	5

[0052] The solution was coated on to the polyester with a 0.0060" Meyer bar and dried at 40°C.
[0053] To the above base plus adhesive the following coating was applied using a 0.020" Meyer bar:

10% "Gohsenol GH-20" (h)	61.3
50% "Resad 1350" (i)	24.5
"Benzoflex 2-45" (k) - diethylene glycol dibenzoate plasticiser	9.2
"Syloid C-906" (e) - organically treated silica	5.0

[0054] The film was formed and treated in a similar manner to Example 1 above.
[0055] The measured U.V. density was as follows:

Image density	2.50 - 2.90
Background Density	0.10 - 0.20

[0056] The image density achieved was equivalent to that of a conventional silver halide film positive.

Example 5

Water based formula

[0057] To the adhesive-layer coated polyester base prepared according to Example 4, the following coating was applied using a 0.040" Meyer bar:

10% "Gohsenol GH-20"(h)	56
50% "Resad 1350" (i)	22
"Benzoflex 9-88" (k) - dipropylene glycol dibenzoate plasticiser	3
"Cereclor S-63" (m) - chlorinated polyolefin plasticiser	11
"Syloid E02" (e) - organically treated silica	2
30% "Permanol HN2" - high density polyethylene dispersion	7

[0058] The film was formed and treated in a similar movement to Example 1 above.
[0059] The measured U.V. density was as follows:

Image density	2.50-2.90
Background density	0.10-0.20

[0060] The image density achieved was equivalent to that of a conventional silver halide film positive.

Example 6

[0061] The adhesive layer formulation of Example 2 was coated at a thickness of 10 μm on a sheet of Autostat CT4 (f) pre-stabilised polyester film base of 100 μm thickness. The coating formulation of Example 5 was then coated onto the adhesive layer at a thickness of 10 μm. The length of the sheet was measured using a Maxtascan 250 XY plotting microscope before and after imaging on a Xante 8300 laser printer. The following results were obtained:

original length of sheet (mm)	length after processing (mm)	% change
297.20	296.41	0.266

[0062] The change in length during processing using a standard laser printer is sufficiently small to maintain the integrity of the imaged film. This is particularly desirable when four-colour process work is to be carried out.

Example 7

[0063] The following tests were conducted to illustrate the effect of different levels of plasticiser addition.

[0064] A base mix was made in the following formulation, the quantities being in grams:

10 wt % Gohsenol GH20 (h)	470
50 wt% Resad 1350 (i)	190
Syloid ED 30 (e)	75
30 wt% Permanol HN2 (l)	15
water	250

[0065] The mixture was divided into six equal parts and the following additions of Benzoflex 9-88 (k) and Cereclor S-63 (m) were made using a 2:1 ratio mix of the two plasticisers.

part number	Benzoflex 9-88	Cereclor S-63	% addition of plasticiser
1	0.00	0.00	0
2	1.32	2.64	9.80
3	3.30	6.67	21.3
4	3.96	8.04	24.5
5	6.60	13.4	35.2
6	9.90	20.1	44.9

[0066] The coating and film-treatment steps of Example 5 were repeated for each of the six mixtures and the following UV image density values were obtained by interpolation of the results.

plasticiser level	0%	10%	15%	20%	30%	35%	40%	45%
UV density	1.65	1.76	1.86	2.07	2.33	2.47	2.59	2.72

Claims

1. A substrate for use in producing film positives by means of an electrographic printing process, the substrate comprising:

   a base layer, an optional adhesive layer and a film coating layer, the film-coating layer having within its bulk a toner-coalescing agent which, under the influence of the heat of the fusing step of the electrographic printing process, has an effect of improving the degree of coalescence of the toner applied to the surface of the film-coating layer.

2. A substrate according to claim 1, wherein the film-coating layer has a film thickness of 10 to 20 μm.

3. A substrate according to claim 1 or 2, wherein the bases layer comprises a pre-stabilised polyester.

4. A substrate according to claims 1 or 2, wherein the base layer comprises polyethylene terephthalate or polycarbonate.

5. A substrate according to any preceding claim, wherein the base layer has a film thickness of 50 to 100 μm.

6. A substrate according to any preceding claim, having (a) an antistatic back coat, on the side of the base layer opposite the film-coating layer, or (b) an antistatic component incorporated in the base layer.

7. A substrate according to claim 6, having an antistatic back coat having a thickness of less than 3 μm.

8. A substrate according to claim 6, having an antistatic component incorporated into its base layer, the antistatic component comprising a polystyrene sulphonate or a quaternary ammonium polymeric alkyl or aryl sulphonate compound.

9. A substrate according to any preceding claim, wherein the film-coating layer is a solvent-based or a water-based formulation comprised of a film-forming component, a toner-coalescing agent and/or an anti-blocking layer.

10. A substrate according to claim 9, wherein the anti-blocking layer comprises a solid particle filler in a total amount of 3 to 25 wt.% of the film-coating layer.

11. A substrate according to claim 9, wherein the film-coating layer is a solvent-based formulation and the film-forming component comprises one or more of the following polymers:

nitrocellulose;
polyvinyl chloride;
styrene/acrylate copolymers;
polyurethanes; and
polyacrylonitriles.

12. A substrate according to claim 9, wherein the film-coating layer is a water-based formulation and the film-forming component comprise one or more of the following polymers:

polyvinyl alcohol and its derivatives;
gelatin and its derivatives;
cellulose derivatives;
modified starches; and
polyacrylamides.

13. A substrate according to any preceding claim, wherein the toner-coalescing agent has no significant effect on the degree of toner coalescence at temperatures up to 100°C and has a significant toner-coalescing effect at a temperature of 120°C.

14. A substrate according to any preceding claim, wherein the toner-coalescing agent is present in an amount of 10 to 50 wt.% of the film-coating layer.

15. A substrate according to claim 14, wherein the toner-coalescing agent is present in an amount of 20 to 45 wt.% of the film-coating layer.

16. A substrate according to any preceding claim, wherein the toner-coalescing agent comprises one or more of the following chemical compounds:

dibasic polymeric polyester plasticisers;
citrate plasticisers;
p-toluenesulphonamide plasticisers;
benzoate plasticisers e.g. triethyleneglycol or tripropyleneglycol dibenzoate;
alkyl and aryl phosphates; and

chlorinated polyolefins.

17. A substrate according to claim 10, wherein the anti-blocking layer comprises one or more of the following solid particle fillers:

silicas;
organically or inorganically treated silicas;
talc;
urea formaldehyde condensates; and
aluminas;

or other materials which can absorb the toner-coalescing agent.

18. A substrate according to claim 11, wherein the film-coating layer is a water based formulation and further comprises a toner-coalescing agent containment agent which functions to contain the toner-coalescing agent within the film-coating layer, as a film strengthening agent and/or an adhesion promoter to the optional adhesive layer.

19. A substrate according to claim 18, wherein the toner-coalescing agent containment agent comprises a polyvinyl acetate polymer in a total amount of 10 to 60 wt.% of the film-coating layer.

20. A substrate according to any preceding claim, having an adhesive layer comprising a linear polyester resin coated from an organic solvent.

21. A substrate according to claim 20, wherein the linear polyester resin is coated at from 2 to 15 wt.% of the solvent.

22. A substrate according to any preceding claim, wherein the film-forming component is present in a total amount of 50 to 90 wt.% of the film-coating layer.

23. A substrate according to any preceding claim, which is transparent to light over the wavelength range of from 300 nm to 700 nm, preferably 350 nm to 550 nm.

24. A method of producing a film positive or negative, comprising:

providing a substrate according to any preceding claim, and
imaging the film-coating layer of the substrate with toner applied in an electrographic printing process, wherein the electrographic printing process includes a fusing step, in which heat is applied to the toner-imaged substrate and has a toner-coalescing effect on the toner forming the image.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 30 8865

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	WO 97 12283 A (MMM) 3 April 1997 * page 4, line 1 - page 8, line 27; claims 1-7; examples 1-4 *	1-24	G03G7/00
X	PATENT ABSTRACTS OF JAPAN vol. 9, no. 246 (P-393), 3 October 1985 & JP 60 100149 A (RICOH), 4 June 1985 * abstract *	1,11,12, 16	
X	PATENT ABSTRACTS OF JAPAN vol. 11, no. 112 (P-565), 9 April 1987 & JP 61 259261 A (DYNIC), 17 November 1986 * abstract *	1,11,12, 16	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			G03G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	12 February 1999	Vanhecke, H

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 98 30 8865

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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12-02-1999

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82