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(54) **IMAGE-RECEIVING FILM FOR ELECTROGRAPHY**

BILDEMPFANGSFILM FÜR ELEKTROGRAPHIE

FILM POUR RECEPTION D'IMAGE PAR PROCEDE ELECTROGRAPHIQUE

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- **DATABASE WPI Section Ch, Week 9403 Derwent Publications Ltd., London, GB; Class G08, AN 94-022509 & JP,A,05 330 261 (VICTOR) , 15 December 1993**
- **PATENT ABSTRACTS OF JAPAN vol. 18 no. 154 (M-1577) ,15 March 1994 & JP,A,05 330263 (VICTOR) 14 December 1993,**
- **DATABASE WPI Section Ch, Week 8812 Derwent Publications Ltd., London, GB; Class G08, AN 88-080949 & JP,A,63 033 749 (DYNIC) , 13 February 1988**

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DescriptionDETAILED DESCRIPTION OF THE INVENTIONField of Utilization in Industry

[0001] The present invention relates to an image-receiving film for electrography. More particularly, it relates to a film useful for receiving an image formed by electrography.

[0002] The term "electrography" used herein is intended to mean systems including electrophotography, electroradiography and magnetography, as widely recognized in the field of imaging and described in a number of patent documents and the like. The image-receiving film of the present invention can be usefully utilized for the preparation of an OHP film particularly by color electrophotography among the electrographic systems.

Prior Art

[0003] In recent years, various electronic equipment manufacturers have put electrophotographic full-color copying machines on the market. In fact, the advance of full-color electrophotographic techniques in recent years is significant, and even copying machines, which can reproduce images having a quality close to printed matters or photographic prints, have now appeared. In the OHP films, however, there are problems to be solved. A particularly serious problem is as follows. In order to avoid the occurrence of the so-called "offset phenomenon," that is, the transfer of a toner on a fixation roller at the time of fixation of an image transferred onto an OHP film, a silicone oil is coated as a release agent on the surface of the fixation roller, which unfavorably causes the surface of the OHP film to become oily. The oiliness on the OHP film is attributable to such a phenomenon that part of the silicone oil coated on the surface of the fixation roller is transferred from the surface onto the film to cause a large amount of the oil to exist on the film. In fact, a toner image film with a silicone oil being present on the surface thereof is sticky to the touch during handling, which is uncomfortable.

[0004] Further, when the film with a large amount of silicone oil being present, as such, is inserted into a sleeve or a cover utilized for protection and storage of the OHP film, for example, Flip-Frame™ (a registered trade mark) manufactured by 3M, U.S.A., particularly when the amount of the oil transferred to the film is large, the migration and accumulation of the oil (the so-called "oil pooling") occurs in a region where the film is in contact with the sleeve. The oil pooling is projected as a large eyesore or provides a heterogeneous projected toner image at the time of projection of the OHP film. For this reason, the development of a technique for reducing the oiliness and removing the oil pooling has been desired in the field of OHP films.

[0005] Japanese Unexamined Utility Model Publication (Rokai) No. 1-59242 proposes a transparent film for electrophotography, characterized in that in order to prevent a plurality of sheets from being carried together in an overlapped state to a copying machine, a resin layer containing silica particles having a diameter in the range of from 0.007 to 0.01 gm is provided by coating on a transparent film. The silica particles added to the resin layer, however, has a diameter of 0.01 gm at the most and hence cannot exhibit a satisfactory function of removing the silicone oil.

[0006] In order to improve the reliability of sheet feeding to a copying machine, Japanese Unexamined Patent Publication (Kokai) No. 5-119505 proposes a transparent toner imagereceiving element for electrostatic photography, comprising a substrate sheet and, provided thereon, a toner image-receiving layer comprising an amorphous silica having a volume average particle diameter of 2.5 μm and a width index of 1.54 (available from, for example, The Davison Chemical Division of W.R. Grace and Co. under the trade name SYLOID244; surface area 300 m²/g). This toner image-receiving layer does not exhibit a satisfactory function of removing the silicone oil because the surface area of the silica particles contained therein is insufficient.

[0007] In order to reduce the oiliness of the OHP film attributable to the use of a silicone oil, Japanese Unexamined Patent Publication (Kokai) No. 5-173351 proposes an CHP film comprising a recording layer (an image-forming layer) having a capability of absorbing a silicone oil. The recording layer is composed mainly of a polymethacrylic ester/styrene copolymer (hydroxyl number: 40 or more) and a polymer of a quaternary ammonium salt. However, the capability of this film to absorb the silicone oil still remains low even when the hydroxyl number of the polymethacrylic ester/styrene copolymer used in the recording layer is 80. Further, in such a film, although the adsorption of the silicone oil at the time of contact with the fixation roller is increased, the oil retention is so low that there is a fear of the oil pooling phenomena becoming severe. Furthermore, in the above film, the water absorption of the recording layer is so high that there is a fear of the recording layer absorbing moisture in air, thereby causing the silicone oil absorption and the image formability to be deteriorated with time. Furthermore, in the film, since the composition of the recording layer is complicate, the preparation thereof requires much time, which unavoidably incurs an increase in cost.

[0008] In order to prevent the occurrence of oil pooling at the time of contact of the OHP film with Flip-Frame™, U. S. Patent No. 5,208,093 proposes to incorporate, into an image-receiving layer comprising a polymer film having a

thickness of 0.5 to 10 μm , particles at least half of which have a particle diameter enough to protrude from the image-receiving layer (for example, silica particles having a particle diameter of 10 μm). For example, as shown in Fig. 2, this novel film comprises a substrate 11 comprising a transparent polyethylene terephthalate film and, provided on said substrate, an image-receiving layer 12 comprising a polyester resin containing silica particles 15. The silicone oil from the fixation roller is absorbed into the image-receiving layer 12 on its surface to form an oil layer 17. When the film as shown in the drawing is housed in Flip-Frame™ 18, the occurrence of oil pooling can be effectively inhibited because the particle diameter of the silica particles 15 is larger than the thickness of the image-receiving layer 12. Since, however, the thin oil layer provided on the image-receiving layer is indispensable to this film, the problem of the oiliness to the touch cannot be solved. That the particles used herein, such as silica particles, do not have a capability of adsorbing a silicone oil can be understood also from the fact that the surface area of the particles is 300 m^2/g .

[0009] The Japanese patent JP-A-63033749 discloses a film comprising a tonerfixing layer (1-10 microns) consisting of resin (A) 25-90 % wt, silica sol. of average particle size 3-100 micron and slipping agent 0.05-5 wt.%, placed on at least one side of such heat-resistant transparent plastic film as PET, polycarbonate, cellulose triacetate.

Problems to be Solved by the Invention

[0010] Accordingly, an object of the present invention is to provide an image-receiving film for electrography which enables the occurrence of an oil pooling phenomenon to be minimized (the inhibition of an oil pooling phenomenon), the silicone oil once held on the image-receiving layer to remain held without rapid falling (an improvement in oil retention) and the transfer of the silicone oil, when touched by hand, to be reduced (a reduction in oiliness or oily feeling to the touch).

Means for Solving the Problems

[0011] According to the present invention, the above-described object of the present invention can be attained by an image-receiving film for electrography, comprising a transparent substrate and an image-receiving layer provided on at least one surface of said substrate, characterized in that said image-receiving layer comprises a transparent image-forming resin and has, added thereto, first particles selected from porous silica having a surface area of not less than 350 m^2/g and/or polysiloxane particles, and second particles consisting of silica particles having a surface area of not more than 300 m^2/g .

[0012] According to the present invention, in an image-receiving layer, which receives an image through the fixation of toner particles, porous silica and/or polysiloxane particles having an excellent silicone oil absorption are homogeneously dispersed and fixed. In this case, silicone oil absorptive particles (hereinafter referred to also as "absorptive particles") may be fixed to the image-receiving layer by any method. Examples of the fixation method include a method which comprises previously dispersing absorptive particles in a composition for forming an image-receiving layer, coating the dispersion by the conventional coating method and fixing the coating and a method which comprises coating absorptive particles on an image-receiving layer before or after printing or the formation of an image and fixing the coating. One specific example of the method for fixing absorptive particles is to spray-coat a dispersion containing absorptive particles on, for example, a film with an image or a letter printed thereon. In this method, absorptive particles can be simply and homogeneously fixed. In this case, the absorptive particles should be used in the form of a homogeneously dispersion in a suitable solvent. The solvent used for dispersing the adsorptive particles is not particularly limited and may be any solvent so far as it can homogeneously disperse these particles and is not detrimental to the toner image on the image-receiving layer. Useful examples of the solvent include hexane and alcohols.

[0013] The construction and the mode of operation of the image-receiving film for electrography according to the present invention will now be described in detail.

[0014] Fig. 1 is a schematic cross-sectional view of a preferred embodiment of the image-receiving film according to the present invention. In this image-receiving film, one surface of a transparent substrate 1 is covered with an image-receiving layer 2. The image-receiving layer 2 contains porous silica and/or polysiloxane particles 3 which can function as a silicone oil absorber in the present invention. In this embodiment, if necessary, the image-receiving layer 2 may be provided also on the opposite side of the substrate 1 although this is not shown in the drawing. Further, it is also possible to provide an additional layer, for example, an overcoat layer, for example, between the substrate 1 and the image-receiving layer 2, on the surface of the image-receiving layer 2 or at other positions, so far as the additional layer is not detrimental to the effect contemplated in the present invention.

[0015] With respect to the transparent substrate, a suitable transparent film may be properly selected from plastic films commonly used as a substrate in the art in the production of an image-receiving film. The suitable substrate is preferably a heat-resistant plastic film, and examples thereof include films of polyethylene terephthalate, polyethylene naphthalate, polymethyl acrylate, polymethyl methacrylate, cellulose triacetate, polyamides, polyimides, polyvinyl chloride, polyvinylidene chloride, polystyrene, polycarbonate and polymethacrylonitrile. Among the above films, a polyeth-

ylene terephthalate film is preferred from the viewpoint of mechanical properties, workability, etc. If necessary, the above-described plastic film may be subjected to a corona treatment or may have on its back surface a layer containing an antistatic agent.

[0016] The thickness of the substrate is preferably in the range of from 10 to 200 μm . When the thickness of the substrate is smaller than 10 μm , no satisfactory heat resistance and mechanical strength can be attained, on the other hand, when the thickness of the substrate exceeds 200 μm , the light transmittance (transparency) is lowered and, at the same time, the handleability becomes poor. Therefore, it is preferred to avoid both the above cases. The thickness of the substrate is more preferably in the range of from 50 to 175 μm , most preferably in the range of from 75 to 150 μm . The regulation of the thickness of the substrate to the above-described range can offer a good balanced film construction and, at the same time, would reduce the cost per unit weight.

[0017] Also with respect to the image-receiving layer, a suitable material may be properly selected from resins (binder resins) commonly used in toner fixation or as a material for an image-receiving layer in the art in the production of an image-receiving film. A suitable material for the image-receiving layer is preferably a resin material which enables a toner, particularly a color toner, to be easily fused thereto and, at the same time, can provide an image having a high transparency. Examples of the suitable material include polyester resin, styrene/acrylic resin, epoxy resin, urethane resin and polyolefin resin. Among them, polyester resin is particularly preferred.

[0018] The thickness of the image-receiving layer is preferably in the range of from 0.1 to 100 g/m^2 in terms of the coverage. When the thickness is less than 0.1 g/m^2 , it cannot receive the toner satisfactorily. On the other hand, when the thickness exceeds 100 g/m^2 , the light transmittance becomes low and, at the same time, the film cannot be carried smoothly within copying machines. The coverage of the image-receiving layer is more preferably in the range of from 0.5 to 10 g/m^2 , most preferably in the range of from 0.1 to 5 g/m^2 . The regulation of the coverage of the image-receiving layer in the above-described range would offer a good balanced film construction and, at the same time, facilitate the production of the image-receiving layer.

[0019] The porous silica and/or polysiloxane particles dispersed as absorptive particles in the image-receiving layer may be properly selected respectively from a wide variety of particles.

[0020] Porous silica particles having various surface areas and particle diameters are commercially available, and proper porous silica particles suited for the purpose of the present invention may be selected from these commercially available products. Examples of such commercially available porous silica particles include G218 and G2018 manufactured by Micron.

[0021] In the porous silica particles, the capability of absorbing a silicone oil becomes better with an increase in surface area of the porous silica particles. The surface area is preferably not less than 350 m^2/g , more preferably 400 to 1500 m^2/g , most preferably 450 to 1000 m^2/g . When the surface area of the particles exceeds a certain level, no significant increase in the capability of absorbing the oil can be attained. Further, an excessive increase in surface area gives rise to problems including that handling and mixing and dispersing become difficult, so that it should be avoided.

[0022] The average particle diameter of the porous silica particles is preferably in the range of from 0.05 to 100 μm , more preferably in the range of from 0.08 to 75 μm , most preferably 0.1 to 50 μm . When the average particle diameter is less than 0.05 μm , the porous silica particles cannot effectively exhibit the capability of absorbing a silicone oil in the image-receiving layer. On the other hand, when the average particle diameter exceeds 100 μm , the light transmittance of the film is reduced and accordingly, when the film is used as the OHP film, there is the possibility that a lightness and sharpness of the projected image is lowered.

[0023] When the porous silica particles are used in the image-receiving layer, the amount thereof is preferably in the range of from 0.1 to 100 parts by weight based on 100 parts by weight of the image-forming resin for constituting the layer. When the amount of the porous silica particles added is less than 0.1 part by weight, the intended effect cannot be attained. On the other hand, when it exceeds 100 parts by weight, the haze value is remarkably reduced and, further, mixing and dispersing becomes difficult, so that there occur problems such as a lowering in surface smoothness. The amount of the silica particles added is more preferably in the range of from 1 to 80 parts by weight, most preferably in the range of from 5 to 40 parts by weight. This preferred amount range is applicable to also in the cases where the silica particles are used in combination with the following polysiloxane particles. Also when these two types of particles are used in the form of a mixture, it is preferred to regulate as a whole the amount of the silica particles in the above range while properly regulating the mixing ratio of both the types of particles.

[0024] The polysiloxane particles used alone or in combination with the porous silica particles are particles of a polymer having a siloxane bond. The polysiloxane comprises a molecular structure having a skeleton of $-(\text{Si}-\text{O}-\text{Si})-$ and has a side chain of an alkyl group, an aryl group or its derivative bonded to the silicon atom (Si) of the skeleton. The polysiloxane has excellent heat resistance, cold resistance, surface tension (low) and flexibility of the main chain by virtue of its characteristic molecular structure.

[0025] Examples of the polysiloxane which may be advantageously used in the present invention include dimethylpolysiloxane, methylhydroxypolysiloxane, mercaptopolysiloxane and aminopolysiloxane. These polysiloxanes ranging

from low molecular weight to considerably high molecular weight polysiloxanes can be easily synthesized usually by subjecting dimethylsiloxane or the like to ring-opening polymerization or alternatively using a polysiloxane having a vinyl group as a starting compound.

[0026] The average particle diameter of the polysiloxane particles is preferably in the range of from 0.05 to 100 μm , more preferably in the range of from 0.08 to 75 μm , most preferably in the range of from 0.1 to 50 μm . When the average particle diameter is less than 0.05 μm , the polysiloxane particles cannot effectively exhibit the capability of absorbing a silicone oil in the image-receiving layer. On the other hand, when the average particle diameter exceeds 100 μm , the light transmittance of the film is lowered.

[0027] When the polysiloxane particles are used in the image-receiving layer, the amount thereof is preferably in the range of from 0.1 to 100 parts by weight based on 100 parts by weight of the image-forming resin for constituting the layer. When the amount of the polysiloxane particles added is more preferably in the range of from 5 to 75 parts by weight, most preferably in the range of from 10 to 50 parts by weight. This preferred amount range is applicable to also in the cases where the polysiloxane particles are used in combination with the above-described porous silica particles.

[0028] In the present invention, the polysiloxane particles may be fixed on the image-receiving layer by spray coating or other coating methods. The spray coating can remarkably lower the necessary amount of the polysiloxane and advantageously eliminate the step of mixing and dispersing. In this case, the amount of the polysiloxane fixed is preferably in the range of from 0.001 to 5 g/m^2 . When it is less than 0.001 g/m^2 , the silicone oil cannot be removed satisfactorily. On the other hand, when it exceeds 5 g/m^2 , the light transmittance of the film is unfavorably inhibited. The amount of the polysiloxane fixed is more preferably in the range of from 0.005 to 1 g/m^2 , most preferably in the range of from 0.01 to 0.1 g/m^2 .

[0029] The electrographic image-receiving film according to the present invention, as previously described, comprises a transparent substrate and an image-receiving layer provided on at least one surface of said substrate, and is characterized in that said image-receiving layer comprises a transparent image-forming resin and has, added thereto, first particles selected from porous silica having a surface area of not less than 350 m^2/g or polysiloxane particles, and second particles consisting of silica particles having a surface area of not more than 300 m^2/g .

[0030] Further, the second particles are added to the image-receiving layer in order to impart suitable unevenness or roughness to a surface thereof and also improve feeding of the electrographic image-receiving films in the copying machine. Note, silica particles are preferably used as the second particles in view of hardness, thermal stability and costs thereof. The silica particles may be in the form of a primary particle or a secondary particle comprising an aggregate of a plurality of primary particles. The average particle diameter of the silica particles is preferably in the range of from 1 to 100 μm . When it is less than 1 μm , the effect of reducing the oil pooling phenomenon is poor and, at the same time, an improvement in feedability of the film is small. On the other hand, when it exceeds 100 μm , the light transmittance is lowered and the haze is increased. The average particle diameter is still preferably in the range of from 5 to 50 μm , most preferably in the range of from 8 to 25 μm .

[0031] The average particle diameter of the second silica particles is preferably larger than that of the above described first particles. When the average particle diameter of the second silica particles is relatively large, the resultant structure is such that first particles are distributed among second particles, so that a silicone oil is effectively retained in gaps among the adjacent second particles. Further, the first particles can effectively adsorb the silicone oil, and, as a result of synergistic action, can reduce oily feeling and also can inhibit an oil pooling phenomenon as lower as possible. The amount of the second silica particles is suitably in the range of from 0.1 to 100 parts by weight based on 100 parts by weight of the porous silica. When it is less than 0.1 part by weight, the effect of improving the feedability of the film becomes poor. On the other hand, when it exceeds 100 parts by weight, the haze value remarkably lowers or mixing and dispersing become difficult. The amount of the additional particles is more preferably in the range of from 1 to 50 parts by weight, most preferably in the range of from 2 to 20 parts by weight, based on 100 parts by weight of the porous silica. This is because a better balance between the feedability of the film and the light transmittance can be offered.

[0032] In addition, in the present invention, the addition of an antistatic agent to the image-receiving layer can enhance the antistatic effect of the film and facilitate the deposition of toner particles onto the image-receiving layer. Examples of antistatic agents, which can be advantageously used, include quaternary ammonium salts and various clay particles.

[0033] The addition of the antistatic agent reduces the surface resistivity of the image-receiving film. Therefore, the amount of the antistatic agent added is preferably determined by taking the surface resistivity of the film into consideration. Although the surface resistivity varies depending upon copying machines used, it is suitably in the range of from 1×10^6 to $1 \times 10^{14} \Omega$. When it is less than $1 \times 10^8 \Omega$, the electrification is so unsatisfactory that toner particles unfavorably scatter without deposition on the image-receiving layer. On the other hand, when it exceeds $1 \times 10^{14} \Omega$, the film cannot be smoothly carried within copying machines and, at the same time, the toner particles cannot be transferred. The surface resistivity is more preferably in the range of from 1×10^9 to $1 \times 10^{13} \Omega$.

[0034] The image-receiving film of the present invention may be produced by various techniques depending upon

film layer construction and other factors. One example of the techniques will now be described. At the outset, a pre-determined film forming composition is coated on a film as a substrate and dried to form an image-receiving layer. In this case, the formation of the image-receiving layer may be carried out by coating or lamination methods commonly used in the art, such as Mayer bar coating, extrusion coating, die coating, Narr coating, gravure coating and kiss coating.

Mode of Operation

[0035] In the image-receiving layer of the present invention, the porous silica and/or polysiloxane particles dispersed in the image-receiving layer serves as a silicone oil absorbent. In particular, since particles capable of absorbing a silicone oil are homogeneously dispersed in a predetermined proportion, the oiliness on the surface of the film can be reduced and, at the same time, the occurrence of an oil pooling phenomenon can be prevented.

Examples

[0036] The present invention will now be described in more detail with reference to the following examples. In the following examples, "parts" are by weight unless otherwise specified.

Example 1

[0037] A solution mainly composed of the following transparent polyester resin was coated on a 125 μm -thick transparent polyester film (a substrate) at a coverage on a dry basis of g/m^2 to form an image-receiving layer.

Composition of coating solution	
Polyester resin (PS-2 manufactured by KAO Corp.) First particles of porous silica (G2018 manufactured by Micron Co.) Surface area: 600 m^2/g (as measured by BET method; the same shall apply hereinafter) Average particle diameter: 2 μm [as measured by Spicca 2 (an image processing device manufactured by Nippon Avionics Co., Ltd.; the same shall apply hereinafter)]	10.00 parts
Polyester resin (VITEL 2200 manufactured by Shell Kagaku K.K.)	0.20 part
Antistatic agent (quaternary ammonium salt) Second particles of silica (SYLOID404 manufactured by Davison Co.) Average particle diameter = 5.2 μm Surface area = 300 m^2/g	1.20 parts
Toluene	76.06 parts
Methyl ethyl ketone	11.49 parts

[0038] An image was formed using the resultant image-receiving film by means of a color copying machine. The film with an image being formed thereon was used as an OHP film to evaluate the properties. Laser Copia (a registered trade mark) CLC200, a color laser copying machine manufactured by Canon Sales Co., Inc., was used as the color copying machine.

Oil pooling test

[0039] The film under test was inserted into Flip-Frame™, and observation was made by visual inspection for pooling caused by a silicone oil. The results were evaluated based on the following three grades.

Excellent	No pooling observed
Good	Substantially no pooling observed
Failure	Pooling clearly observed

Touch test (evaluation on oiliness)

[0040] The film under test was touched with a finger, and the results were evaluated as follows.

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Excellent	No oiliness observed
Good	Substantially no oiliness observed
Failure	Oiliness clearly observed

Haze test

[0041] In order to evaluate the occurrence of haze in the film under test, the haze value was measured with a haze meter manufactured by BYK Gardner (available under the designation XL-211), and the results were evaluated as follows.

Excellent	Less than 8%
Good	8% to less than 12%
Failure	Not less than 12%

Image quality test

[0042] The film under test was inserted into Flip-Frame™, and an image was projected by means of OHP "M2180" manufactured by 3M, U.S.A. The projected image (test pattern) was observed by visual inspection, and the reproduction of the image was evaluated as follows.

Excellent	Complete reproduction
Good	Satisfactory reproduction
Failure	Unsatisfactory reproduction

[0043] In the test, oil pooling was not observed at all. In this connection, it is noteworthy that neither the background nor image had oil pooling. Further, no oiliness was felt when the surface of the film was touched with a finger. The haze value was very low, and the image reproduction was also excellent. The results obtained in this example together with the results obtained in the other examples for reference are given in the following Table 1.

Example 2

[0044] The procedure of Example 1 was repeated, except that the coverage of the image-receiving layer, the surface area of the first particles of porous silica, etc. were changed as follows.

Coverage of image-receiving layer (on a dry basis)	20 g/m ²
Surface area of porous silica particles	350 m ² /g
Average particle diameter of porous silica particles	5 μm
Amount of porous silica particles added	7.5 parts

[0045] The results are given in the following Table 1.

Example 3

[0046] The procedure of Example 1 was repeated, except that the coverage of the image-receiving layer, the surface area of the first particles of porous silica, etc. were changed as follows.

Coverage of image-receiving layer (on a dry basis)	15 g/m ²
Surface area of porous silica particles	450 m ² /g
Average particle diameter of porous silica particles	5 μm
Amount of porous silica particles added	5.0 parts

[0047] The results are given in the following Table 1.

Example 4

[0048] The procedure of Example 1 was repeated, except that the coverage of the image-receiving layer, the surface area of the first particles of porous silica, etc. were changed as follows.

Coverage of image-receiving layer (on a dry basis)	5 g/m ²
Surface area of porous silica particles	500 m ² /g
Average particle diameter of porous silica particles	4 μm
Amount of porous silica particles added	3.0 parts

[0049] The results are given in the following Table 1.

Example 5

[0050] The procedure of Example 1 was repeated, except that the coverage of the image-receiving layer, the surface area of the first particles of porous silica, etc. were changed as follows.

Coverage of image-receiving layer (on a dry basis)	1.5 g/m ²
Surface area of porous silica particles	800 m ² /g
Average particle diameter of porous silica particles	1 μm
Amount of porous, silica particles added	0.5 part

[0051] The results are given in the following Table 1.

Example 6

[0052] The procedure of Example 1 was repeated, except that the coverage of the image-receiving layer, the surface area of the first particles of porous silica, etc. were changed as follows.

Coverage of image-receiving layer (on a dry basis)	1 g/m ²
Surface area of porous silica particles	1000 m ² /g
Average particle diameter of porous silica particles	1.5 μm
Amount of porous silica particles added	0.3 part

[0053] The results are given in the following Table 1.

Example 7

[0054] The procedure of Example 1 was repeated, except that the coverage of the image-receiving layer, the surface area of the first particles of porous silica, etc. were changed as follows.

Coverage of image-receiving layer (on a dry basis)	0.8 g/m ²
Surface area of porous silica particles	1500 m ² /g
Average particle diameter of porous silica particles	0.5 μm
Amount of porous silica particles added	0.1 part

[0055] The results are given in the following Table 1.

Example 8

[0056] The procedure of Example 1 was repeated, except that the coverage of the image-receiving layer, the surface area of the first particles of porous silica, etc. were changed as follows.

Coverage of image-receiving layer (on a dry basis)	0.5 g/m ²
Surface area of porous silica particles	2000 m ² /g

(continued)

Average particle diameter of porous silica particles	0.1 μm
Amount of porous silica particles added	0.05 part

[0057] The results are given in the following Table 1.

Example 9

[0058] The following components were mixed together to prepare a dispersion of polysiloxane particles.

Siloxane oligomer (SA-200 manufactured by Shin-Nakamura Chemical Co., Ltd.)	12.10 carts
Ammonium dodecyl sulfate	1.20 parts
Ion-exchanged water	86.70 parts

[0059] The resultant solution was thoroughly stirred with a homogenizer, 0.13 part of benzoyl peroxide (75%) was added thereto, and a reaction was allowed to proceed at 65°C for 4 hr in a nitrogen gas atmosphere while stirring at 100 rpm, thereby completing the polymerization reaction. A polymer was separated from 10 parts of the resultant polymer solution and redispersed in 10 parts by weight of toluene/methyl ethyl ketone. Thus, a dispersion of polysiloxane particles having an average particle diameter of 30 μm was provided.

[0060] A solution composed mainly of the following transparent polyester resin and containing the dispersion of polysiloxane particles prepared above was coated on a 5 ml-thick transparent polyethylene terephthalate film (a substrate) at a coverage of 20 g/m² on a dry basis to form an image-receiving layer.

Coverage of image-receiving layer (on a dry basis):	20 g/m ²
Average particle diameter of polysiloxane particles:	30 μm
Amount of polysiloxane particles added:	5.0 parts
First porous silica (G2018 manufactured by Micron Co.)	0.6 part
Second silica particles (SYLOID404)	0.06 part

[0061] The results are given in Table 1.

Table 1

Characteristic test for image-receiving films				
Ex. No.	Oil pooling test	Touch test	Haze test	Image quality test
1	Excellent	Excellent	Excellent	Excellent
2	Good	Good	Good	Good
3	Excellent	Excellent	Excellent	Excellent
4	Excellent	Excellent	Excellent	Excellent
5	Excellent	Excellent	Excellent	Excellent
6	Excellent	Excellent	Excellent	Excellent
7	Excellent	Excellent	Excellent	Excellent
8	Good	Good	Good	Excellent
9	Excellent	Excellent	Good	Good

Comparative Example 1

[0062] The procedure of Example 1 was repeated, except that, for comparison, the use of porous silica particles was omitted. The results are given in Table 2.

Comparative Example 2

[0063] The procedure of Example 1 was repeated, except that, for comparison, the following porous silica particles were used. The results are given in the following Table 2.

Surface area	300 m ² /g
Average particle diameter	30 μm
Amount	300 parts

Comparative Example 3

[0064] The procedure of Example 9 was repeated, except that, for comparison, the following polysiloxane particles were used. The results are given in Table 2.

Average particle diameter	30 μm
Amount	200 parts

Table 2

Characteristic test for image-receiving films Items for test				
Ex. No.	Oil Pooling test	Touch test	Haze test	Image quality test
1	Failure	Failure	Excellent	Excellent
2	Excellent	Excellent	Failure	Failure
3	Excellent	Excellent	Failure	Failure

Effect of the Invention

[0065] According to the present invention, in image-receiving films, for example, for OHP, the occurrence of an oil pooling phenomenon can be reduced, and a silicone oil, which has been once held on an image-receiving layer, can be kept held on the image-receiving layer without rapid falling. Further, it is also possible to reduce the transfer of an silicone oil upon touch on the film with a finger. Moreover, according to the present invention, it is also possible to enhance the feedability of the film within a copying machine.

Brief Description of the Drawings

Fig. 1

[0066] Fig. 1 is a schematic cross-sectional view of a preferred embodiment of the image-receiving film for electrography according to the present invention.

Fig. 2

[0067] Fig. 2 is a schematic cross-sectional view of an embodiment of the conventional image-receiving film for electrography.

Description of Reference Numerals

[0068]

- 1 substrate,
- 2 image-receiving layer, and
- 3 silicone oil absorptive particles

Claims

1. An image-receiving film for electrography, comprising a transparent substrate and an image-receiving layer provided on at least one surface of said substrate, characterized in that said image-receiving layer comprises a transparent image-forming resin and has, added thereto, first particles selected from porous silica having a surface

area of not less than 350 m²/g and/or polysiloxane particles, and second particles consisting of silica particles having a surface area of not more than 300 m²/g.

2. An image-receiving film for electrography according to claim 1, characterized in that the average particle diameter of said first particles is smaller than that of said second silica particles.

Patentansprüche

1. Bildempfangender Film für die Elektrographie, umfassend ein transparentes Substrat und eine bildempfangende Schicht, die auf wenigstens einer Fläche des Substrats bereitgestellt ist, dadurch gekennzeichnet, daß die bildempfangende Schicht ein transparentes, bildformendes Harz umfaßt und auf demselben beigefügte erste Teilchen, die aus porösem Siliciumdioxid mit einer spezifischen Oberfläche von nicht weniger als 350 m²/g und/oder Polysiloxan-Teilchen ausgewählt sind, und zweite Teilchen, die aus Siliciumdioxid-Teilchen mit einer spezifischen Oberfläche von nicht mehr als 300 m²/g bestehen, aufweist.
2. Bildempfangender Film für die Elektrographie gemäß Anspruch 1, dadurch gekennzeichnet, daß der durchschnittliche Teilchendurchmesser der ersten Teilchen kleiner ist als derjenige der zweiten Siliciumdioxid-Teilchen.

Revendications

1. Film pour réception d'image par procédé électrographique, comprenant un substrat transparent et une couche de réception d'image déposée sur au moins une surface dudit substrat, caractérisé en ce que ladite couche de réception d'image comprend une résine transparente de formation d'image et a, ajoutées à celle-ci, des premières particules choisies en silice poreuse ayant une aire de surface non inférieure à 350 m²/g et/ou des particules de polysiloxane, et des secondes particules constituées de particules de silice ayant une aire de surface de pas plus de 300 m²/g.
2. Film pour réception d'image par procédé électrographique selon la revendication 1, caractérisé en ce que le diamètre moyen de particule desdites premières particules est inférieur à celui desdites secondes particules de silice.

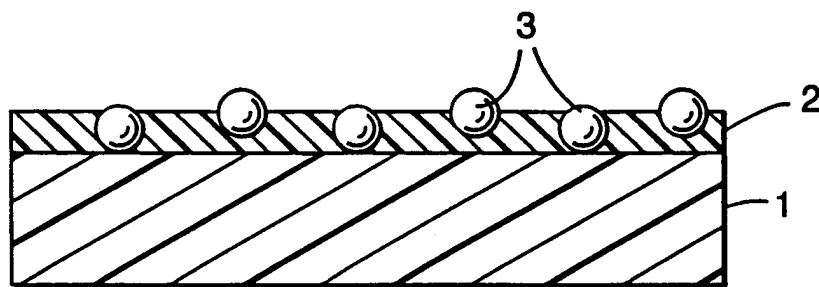


Fig.1

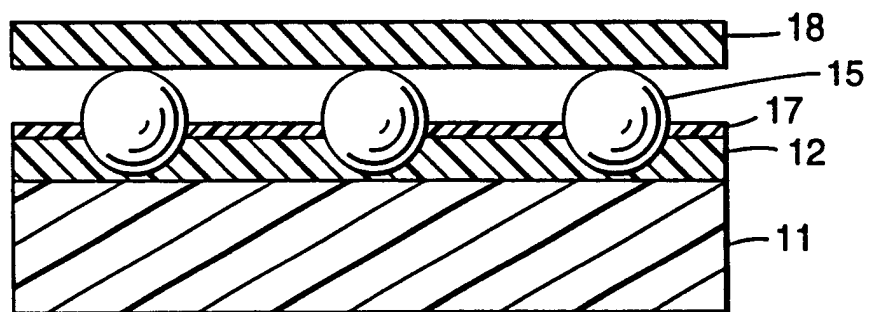


Fig.2