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(54) **METHOD FOR PROCESSING PLASTIC MATERIAL, AND THE PROCESSED PLASTIC MATERIAL**

VERFAHREN ZUM VERARBEITEN EINES KUNSTSTOFFS UND VERARBEITETER KUNSTSTOFF

PROCÉDÉ POUR LE TRAITEMENT DE MATIÈRE PLASTIQUE, ET MATIÈRE PLASTIQUE TRAITÉE

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Description

FIELD OF THE INVENTION

[0001] The invention relates to a method for processing plastic material as defined in the preamble of claim 1 and to the processed plastic material as defined in the preamble of claim 8.

BACKGROUND OF THE INVENTION

[0002] Known from the prior art are many different plastic-based materials.

[0003] Also known from the prior art are electrically charged note sheets and the like formed from plastic-based material that can be attached on different bases by means of the electrical charge. In addition, known from the prior art are different sticker- and adhesive-surfaced note sheets formed from plastic- and paper-based materials, the problem of which is that the sticker or adhesive surface easily leaves a mark on the base on which it has been attached.

[0004] The problem in the plastic-based materials known from the prior art is that they are difficult to be printed. Plastic-based material cannot be conventionally printed by the generally known printing methods because the printing ink cannot be adhered and absorbed in the plastic-based material, whereby the printing ink will not dry and the impression becomes messy and staining. In addition, spreading the printing ink on the surface of a plastic material often provides a waving effect in the material, whereby the material becomes cockled.

[0005] From EP 2289695 is known an electrostatic adsorbable sheet. From WO 01/030588 is known adherent plastic notes. From EP 0328353 is known a method for providing a substrate with a writing surface. From EP 0789281 is known a liquid toner printable thermoplastic film.

OBJECTIVE OF THE INVENTION

[0006] An objective of the invention is to eliminate the drawbacks referred to above and to disclose a new type of a method for processing plastic material. Another objective of the invention is to disclose a new type of plastic material that is suitable to be printed by the known printing methods.

SUMMARY OF THE INVENTION

[0007] The method and the plastic material according to the invention are characterized by what has been presented in the claims.

[0008] The invention is based on a method for processing plastic material in order to print the plastic material. According to the invention, at least one surface of the plastic material is coated with at least one coating mixture that contains a pigment and a binder and an alcohol to

provide a coating layer and to increase pore volume to the surface of the plastic material, and the plastic material is selected so as to be able to receive an electrical charge, and the plastic material is charged electrically before coating or after coating, and the plastic material is provided onto a carrier material. Preferably, at least one surface of the plastic material is coated with at least one coating layer.

[0009] In addition, the invention is based on the corresponding processed plastic material. According to the invention, the plastic material selected so as to be able to receive an electrical charge is processed by coating at least one of its surfaces with at least one coating mixture that contains a pigment and a binder and an alcohol to form a coating layer and to increase pore volume on the surface of the plastic material. The plastic material is has been charged electrically before coating or after coating. The plastic material is provided onto a carrier material.

[0010] The invention is specifically based on the coating of plastic material, such as a plastic web, sheet or the like, so as to provide a good base for printing in order to print the plastic material by any printing technique. The invention is based on the basic idea of providing increased pore volume to the surface of the dense plastic material and absorbing the printing ink better and faster in the surface of the plastic material. In addition, the invention is based on the processing of electrically charged or electrically chargeable plastic material so that the plastic material will be easily printable by a desired printing technique.

[0011] Electrically charged plastic material in this context refers to electrically charged material that is self-adhesive by virtue of the electrical charge. Electrically chargeable plastic material in this context refers to electrically chargeable material that is self-adhesive after generation of the electrical charge.

[0012] The purpose of the coating layer that is formed from a coating mixture is, in the context of this invention, to act as a printing ink adhesion basis in which the printing ink is absorbed and adhered irrespective of the printing method. The coating layer must be functional in home printing as well as in industrial printing. Each coating layer may be formed from the same coating mixture. Alternatively, at least one coating layer is formed from a different coating mixture than the rest of the coating layers. In one embodiment, the surface of the plastic material is provided with a first and a second coating layer, and the second coating layer is formed from a different coating mixture than the first coating layer.

[0013] In one embodiment of the invention, the coating mixture contains 5 to 80 w-% of the binder, in one embodiment 10 to 30 w-% of the binder.

[0014] In one embodiment of the invention, the coating mixture contains 30 to 70 w-%, in one embodiment 40 to 60 w-%, of alcohol.

[0015] In one embodiment of the invention, the binder is selected from the group of latex, starch, protein, e.g.

casein, adhesive, resin and their combinations.

[0016] In one embodiment of the invention, the coating mixture contains an additive and/or a filler. The filler may have been selected from the coating mixture fillers known per se.

[0017] In one embodiment of the invention, the coating mixture contains an additive, such as a rheology modifier, e.g. CMC, to modify the rheology, e.g. to raise the viscosity. In one embodiment, the coating mixture contains less than 1.5 w-%, in one embodiment approximately 1 w-%, of the additive for raising the viscosity.

[0018] In one embodiment, the additives may include other suitable and desired additives, e.g. colorants, auxiliary pigments, strength improving agents, plasticizers, lubricants, wet strength improving agents, dispersing agents, defoamers and/or optical brighteners or other agents required by the purpose of use.

[0019] In one embodiment of the invention, the pigment is selected from the group of mineral-based pigments, calcium carbonates, such as PCC and GCC, kaolin, talc, gypsum, titanium dioxide, organic pigments, e.g. plastic pigments, cellulose-based pigments and their different combinations. In one embodiment, the employed pigment is a combination of several pigments to obtain the best properties, e.g. lightness, porosity, printing ink absorption, runnability, opacity, gloss, bulk etc. for the coating layer.

[0020] In one embodiment, the size of the pigment particles in the coating mixture is less than 10, μm , preferably 0.2 to 5 μm , in the coating of the plastic material.

[0021] In one embodiment, the amount of coating in the coating layer on the surface of the plastic material ranges from 1 to 40 g/m^2 , in one embodiment from 5 to 10 g/m^2 , in one embodiment from 10 to 20 g/m^2 , in one embodiment is at least 20 g/m^2 and in one embodiment from 20 to 30 g/m^2 . Preferably, the thickness of the coating layer depends on the employed printing method and the employed amount of ink. Preferably, the coating layer acts as an absorber for the solvent in the printing ink. Preferably, the thickness of the coating layer is defined so as to prevent a heat shock effect during printing on the surface of the plastic material, e.g. in laser printing.

[0022] In one embodiment of the invention, the plastic material is precoated with a preliminary mixture before coating the plastic material with the coating mixture. Coating with the preliminary mixture and the coating mixture may be effected substantially in the same process or sequentially in a two-step process or in completely different processes. In one embodiment, the preliminary mixture contains a pigment and a binder. In one embodiment, the preliminary mixture contains latex but not substantially a pigment. In one embodiment, the preliminary mixture has substantially the same composition as the coating mixture but may have a coarser particle size distribution. In one embodiment, the preliminary mixture includes an additive. By precoating, it is possible to improve the adhesion and spreading of the coating mixture on the surface of the plastic material. In one embodiment, the

amount of precoating is approximately 1 to 5 g/m^2 . In one embodiment, the size of the pigment particles in the preliminary mixture is less than 10 μm , preferably 1 to 5 μm .

[0023] In one embodiment, the plastic material is selected from any suitable plastics and their different combinations. In one embodiment, the plastic material is selected so as to be able to receive an electrical charge. In one embodiment, the plastic material is polypropylene or a derivative thereof. The plastic material may be present in the form of a web, film, sheet or the like.

[0024] In one embodiment of the invention, the plastic material is electrically chargeable. In one embodiment, the plastic material is charged electrically. In one embodiment, the plastic material is charged electrically before coating. This way, the surface of the plastic material is provided with surface energy, which improves spreading of the coating mixture on the surface of the plastic material and its adhesion on the surface of the plastic material. In one embodiment, the plastic material is charged electrically after coating. In one embodiment, the electrical charging is effected by means of a corona treatment.

[0025] In one embodiment, the amount of the electrical charge provided to the plastic material depends on the thickness and thereby the weight of the coating layer. In one embodiment, the electrical charge must be raised as the weight of the material increases.

[0026] In one embodiment of the invention, the plastic material is provided onto a carrier material. The carrier material facilitates the processing of the plastic material. Preferably, the plastic material can be separated from the carrier material when it is being brought into use and is to be attached to a desired position and to a desired base. As the plastic material is separated from the carrier material, the electrical charge of the plastic material is activated and the plastic material can be attached to the desired base.

[0027] In one embodiment of the invention, an insulation layer is provided between the plastic material and the coating layer. By the insulation layer, the plastic material can be protected e.g. in the printing from the effect of heat and heat shocks.

[0028] The plastic material may be formed by any method and/or device known per se. The plastic material may be of any color, and it may be monochromatic or patterned. The surface of the plastic material may be modified, e.g. grooved.

[0029] In one embodiment, the plastic material is coated by blade coating, spray coating, rod coating, film transfer coating, curtain coating, offset machine, rotogravure machine or flexographic press or their different combinations. In one embodiment, the plastic material is coated by blade coating. In one embodiment, the plastic material is coated by spray coating. In one embodiment, the precoating and actual coating of the plastic material can be effected by the same coating method or alternatively by different coating methods.

[0030] In one embodiment, the coated plastic material is dried after coating or between the different coating

steps.

[0031] In one embodiment of the invention, the coated plastic material is used in printing selected from the group of: offset printing, digital printing, laser printing, inkjet printing and their combinations.

[0032] The plastic material can be colored and/or patterned in connection with the manufacture, coating and/or printing of the plastic material. The plastic material according to the invention can be manufactured with a mat or glossy surface.

[0033] The material according to the invention can be used as note sheets, memos, posters, decorative material, interior decoration material, window decorations or in equivalent purposes of use. The material according to the invention can be used in households, offices, commerce or other desired applications.

[0034] The plastic material according to the invention is not dependent on the printing method, but the coated plastic material can be printed by any printing technique.

[0035] The coating layer according to the invention absorbs the printing ink, whereby the surface of the plastic material becomes tack-free practically immediately after printing.

[0036] The plastic material according to the invention provides new possibilities for use. The plastic material according to the invention can be used as such or e.g. as combined material with another material.

[0037] Another advantage of the invention is that the coated plastic material is inexpensive to manufacture, and the desired material can also be manufactured in small batches.

DETAILED DESCRIPTION OF THE INVENTION

[0038] In the following section, the invention will be described with detailed examples of its embodiments.

Example 1

[0039] Coating mixtures according to the invention were formed in the tests and spread on the surface of an electrically charged polypropylene material. The electrically charged polypropylene material was used to form electrically charged, self-adhesive note sheets.

[0040] The coating compositions contained as a pigment 50 w-% of calcium carbonate, GCC (HC-60), and as a binder 10 w-% of latex. The coating mixture consisted mainly of round and coarse calcium carbonate particles, the size of which ranged from 0.2 to 5 μm . In addition, the coating mixtures contained approximately 1 w-% of CMC and 40 w-% of water and, in some cases, 1 to 2 w-% of alcohol.

[0041] Before coating, the polypropylene material was charged electrically by a corona treatment to form a self-adhesive plastic film and precoated by a preliminary mixture that contained latex. The precoating was provided to the surface of the polypropylene by approximately 3 g/m².

[0042] The polypropylene material was coated with the coating mixtures by sheet blade coating to form a coating layer on the surface of the polypropylene material. The amount of the coating layer was approximately 20 g/m².

5 Blade coating is a coating method that is known per se and is not described in more detail in this connection. The coating mixtures were well spread on the surface of the polypropylene material.

10 **[0043]** The precoating and coating of the polypropylene material were effected in sequential steps.

[0044] The coated polypropylene materials were printed by different printing methods; inkjet, laser printing and digital printing technique.

15 Example 2

[0045] Coating mixtures according to the invention were formed in the tests and spread on the surface of an electrically charged polypropylene material.

20 **[0046]** The coating mixtures contained as a pigment 35 w-% of calcium carbonate, GCC (HC-60), and as a binder 30 w-% of resin. The coating mixture consisted mainly of round and coarse calcium carbonate particles, the size of which ranged from 0.2 to 5 μm . In addition, the coating mixtures contained approximately 30 to 40 w-% of alcohol.

[0047] The polypropylene material was coated with the coating mixtures by film transfer coating to form a coating layer on the surface of the polypropylene material. The amount of the coating layer was approximately 15 g/m². The coating mixtures were well spread on the surface of the polypropylene material.

[0048] Precoating and two surface coatings of the polypropylene material were effected in sequential steps.

35 **[0049]** The coated polypropylene materials were printed by different printing methods; inkjet, laser printing and digital printing technique.

Example 3

40 **[0050]** Coating mixtures according to the invention were formed in the tests and spread on the surface of an electrically charged polypropylene material. The polypropylene material was provided by lamination onto paper-board that acted as a carrier material.

45 **[0051]** The coating mixtures contained as a pigment 20 w-% of calcium carbonate, GCC (HC-60), and as a binder 40 w-% of resin. The coating mixture consisted mainly of round and coarse calcium carbonate particles, the size of which ranged from 0.2 to 5 μm . In addition, the coating mixtures contained approximately 1 w-% of a plasticizer, e.g. calcium stearate, and 40 w-% of alcohol.

55 **[0052]** The polypropylene material was coated with the coating mixtures by sheet blade coating to form a coating layer on the surface of the polypropylene material. The amount of the coating layer was approximately 10 g/m². The coating mixtures were well spread on the surface of

the polypropylene material.

[0053] Precoating and coating of the polypropylene material were performed sequentially.

[0054] The coated polypropylene materials were printed by different printing methods; inkjet, laser printing and digital printing technique.

[0055] It was discovered that large pore volume and large pores wherein the printing ink was well absorbed were provided in all tests to the surface of the plastic material by the tested coating mixtures. In addition, the printing ink was well adhered to the coating layer, and the surface of the coated material was practically immediately tack-free.

[0056] It was discovered that the invention provides for the easy printing of plastic material without staining. In addition, in additional tests it was discovered that a plastic material that is suitable to be printed was provided using many different coating mixture ratios.

[0057] The method for processing plastic material and the processed plastic material according to the invention are suitable in different embodiments to be used in different printing purposes.

[0058] The invention is not limited merely to the examples referred to above; instead, many variations are possible within the scope of the inventive idea defined by the claims.

Claims

1. A method for processing plastic material in order to print the plastic material, **characterized in that** at least one surface of the plastic material is coated with a coating mixture that contains a pigment and a binder and an alcohol to provide a coating layer and to increase pore volume to the surface of the plastic material, and the plastic material is selected so as to be able to receive an electrical charge, and the plastic material is charged electrically before coating or after coating, and the plastic material is provided onto a carrier material.
2. The method according to claim 1, **characterized in that** the coating mixture is provided with 5 to 80 w-% of the binder.
3. The method according to claim 1 or 2, **characterized in that** the binder is selected from the group of latex, starch, protein, adhesive, resin and their combinations.
4. The method according to any one of claims 1 to 3, **characterized in that** an additive is added to the coating mixture to modify the rheology.
5. The method according to any one of claims 1 to 4, **characterized in that** the pigment is selected from the group of mineral-based pigments, calcium car-

bonates, kaolin, talc, gypsum, titanium dioxide, organic pigments, cellulose-based pigments and their combinations.

6. The method according to any one of claims 1 to 5, **characterized in that** the plastic material is precoated with a preliminary mixture before coating of the plastic material with the coating mixture.
7. The method according to any one of claims 1 to 6, **characterized in that** an insulation layer is provided between the plastic material and the coating layer.
8. Plastic material, **characterized in that** the plastic material selected so as to be able to receive an electrical charge is processed by coating at least one of its surfaces with a coating mixture that contains a pigment and a binder and an alcohol to form a coating layer and to increase pore volume on the surface of the plastic material, wherein the plastic material has been charged electrically before coating or after coating, and the plastic material is provided onto a carrier material.
9. The plastic material according to claim 8, **characterized in that** the coating mixture contains 5 to 80 w-% of the binder.
10. The plastic material according to claim 8 or 9, **characterized in that** the binder is selected from the group of latex, starch, protein, adhesive, resin and their combinations.
11. The plastic material according to any one of claims 8 to 10, **characterized in that** the pigment is selected from the group of mineral-based pigments, calcium carbonates, kaolin, talc, gypsum, titanium dioxide, organic pigments, cellulose-based pigments and their combinations.
12. The plastic material according to any one of claims 8 to 11, **characterized in that** a precoating layer is provided on the surface of the plastic material, under the coating layer.
13. The plastic material according to any one of claims 8 to 12, **characterized in that** an insulation layer is provided between the plastic material and the coating layer.
14. The plastic material according to any one of claims 8 to 13, **characterized in that** the coated plastic material is used in printing selected from the group of: offset printing, digital printing, laser printing, inkjet printing and their combinations.

Patentansprüche

1. Verfahren zum Verarbeiten von Kunststoffmaterial zum Bedrucken des Kunststoffmaterials, **dadurch gekennzeichnet, dass** zumindest eine Oberfläche des Kunststoffmaterials mit einem Beschichtungsgemisch beschichtet wird, das ein Pigment und ein Bindemittel und einen Alkohol enthält, um eine Beschichtungsschicht bereitzustellen und ein Porenvolumen an der Oberfläche des Kunststoffmaterials zu erhöhen, und dass das Kunststoffmaterial so ausgewählt ist, dass es imstande ist, eine elektrische Ladung aufzunehmen, und dass das Kunststoffmaterial vor dem Beschichten oder nach dem Beschichten elektrisch geladen wird und dass das Kunststoffmaterial auf einem Trägermaterial bereitgestellt ist. 5
2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** das Beschichtungsgemisch mit 5 bis 80% Gew/V Bindemittel bereitgestellt ist. 10
3. Verfahren nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** das Bindemittel ausgewählt ist aus der Gruppe von Latex, Stärke, Protein, Klebstoff, Harz und ihren Kombinationen. 15
4. Verfahren nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** ein Zusatzstoff dem Beschichtungsgemisch zum Verändern der Rheologie zugegeben wird. 20
5. Verfahren nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** das Pigment ausgewählt ist aus der Gruppe von Pigmenten auf Mineralbasis, Kalziumkarbonaten, Kaolin, Talk, Gips, Titandioxid, organischen Pigmenten, Pigmenten auf Zellulosebasis und ihren Kombinationen. 25
6. Verfahren nach einem der Ansprüche 1 bis 5, **dadurch gekennzeichnet, dass** das Kunststoffmaterial mit einem Vorgemisch vor dem Beschichten des Kunststoffmaterials mit dem Beschichtungsgemisch vorbeschichtet wird. 30
7. Verfahren nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** eine Isolierschicht zwischen dem Kunststoffmaterial und der Beschichtungsschicht bereitgestellt ist. 35
8. Kunststoffmaterial, **dadurch gekennzeichnet, dass** das Kunststoffmaterial, das so ausgewählt ist, dass es imstande ist, eine elektrische Ladung aufzunehmen, durch Beschichten zumindest einer seiner Oberflächen mit einem Beschichtungsgemisch bearbeitet wird, das ein Pigment und ein Bindemittel und einen Alkohol enthält, um eine Beschichtungsschicht zu bilden und ein Porenvolumen an der Oberfläche des Kunststoffmaterials zu erhöhen, wobei das Kunststoffmaterial vor dem Beschichten oder nach dem Beschichten elektrisch geladen wird und das Kunststoffmaterial auf einem Trägermaterial bereitgestellt ist. 40
9. Kunststoffmaterial nach Anspruch 8, **dadurch gekennzeichnet, dass** das Beschichtungsgemisch 5 bis 80% Gew/V Bindemittel enthält. 45
10. Kunststoffmaterial nach Anspruch 8 oder 9, **dadurch gekennzeichnet, dass** das Bindemittel ausgewählt ist aus der Gruppe von Latex, Stärke, Protein, Klebstoff, Harz und ihren Kombinationen. 50
11. Kunststoffmaterial nach einem der Ansprüche 8 bis 10, **dadurch gekennzeichnet, dass** das Pigment ausgewählt ist aus der Gruppe von Pigmenten auf Mineralbasis, Kalziumkarbonaten, Kaolin, Talk, Gips, Titandioxid, organischen Pigmenten, Pigmenten auf Zellulosebasis und ihren Kombinationen. 55
12. Kunststoffmaterial nach einem der Ansprüche 8 bis 11, **dadurch gekennzeichnet, dass** eine Vorbeschichtungsschicht auf der Oberfläche des Kunststoffmaterials unter der Beschichtungsschicht bereitgestellt ist.
13. Kunststoffmaterial nach einem der Ansprüche 8 bis 12, **dadurch gekennzeichnet, dass** eine Isolierschicht zwischen dem Kunststoffmaterial und der Beschichtungsschicht bereitgestellt ist.
14. Kunststoffmaterial nach einem der Ansprüche 8 bis 13, **dadurch gekennzeichnet, dass** das beschichtete Kunststoffmaterial für einen Druck, ausgewählt aus Offset-Druck, Digitaldruck, Laserdruck, Tintenstrahldruck und ihren Kombinationen verwendet wird.

Revendications

1. Procédé de traitement d'un matériau plastique permettant d'imprimer celui-ci, **caractérisé en ce qu'une surface au moins du matériau plastique est revêtue d'un mélange de revêtement qui contient un pigment et un liant et un alcool pour former une couche de revêtement et augmenter le volume poreux à la surface du matériau plastique, et en ce que le matériau plastique est sélectionné pour pouvoir recevoir une charge électrique, qu'il est chargé électriquement avant ou après le revêtement, et qu'il est formé sur un matériau support.**
2. Procédé suivant la revendication 1, **caractérisé en ce que le mélange de revêtement contient de 5 à 80 % en poids du liant.**

3. Procédé suivant la revendication 1 ou 2, **caractérisé en ce que** le liant est choisi dans le groupe constitué par le latex, l'amidon, la protéine, l'adhésif, la résine et leurs combinaisons. 5
4. Procédé suivant une quelconque des revendications 1 à 3, **caractérisé en ce qu'**un additif est ajouté au mélange de revêtement pour modifier la rhéologie. 10
5. Procédé suivant une quelconque des revendications 1 à 4, **caractérisé en ce que** le pigment est choisi dans le groupe constitué par les pigments minéraux, les carbonates de calcium, le kaolin, le talc, le gypse, le dioxyde de titane, les pigments organiques, les pigments cellulosiques et leurs combinaisons. 15
6. Procédé suivant une quelconque des revendications 1 à 5, **caractérisé en ce que** le matériau plastique est revêtu d'un mélange préliminaire préalablement au revêtement avec le mélange de revêtement. 20
7. Procédé suivant une quelconque des revendications 1 à 6, **caractérisé en ce qu'**une couche d'isolation est formée entre le matériau plastique et la couche de revêtement. 25
8. Matériau plastique, **caractérisé en ce que** le matériau plastique sélectionné pour pouvoir recevoir une charge électrique, est traité par revêtement d'une de ses surfaces au moins d'un mélange de revêtement qui contient un pigment et un liant et un alcool pour former une couche de revêtement et augmenter le volume poreux à la surface du matériau plastique, **en ce que** le matériau plastique a été chargé électriquement avant ou après le revêtement et qu'il est formé sur un matériau support. 30 35
9. Matériau plastique suivant la revendication 8, **caractérisé en ce que** le mélange de revêtement contient 5 à 80% en poids du liant. 40
10. Matériau plastique suivant la revendication 8 ou 9, **caractérisé en ce que** le liant est choisi dans le groupe constitué par le latex, l'amidon, la protéine, l'adhésif, la résine et leurs combinaisons. 45
11. Matériau plastique suivant une quelconque des revendications 8 à 10, **caractérisé en ce que** le pigment est choisi dans le groupe constitué par les pigments minéraux, les carbonates de calcium, le kaolin, le talc, le gypse, le dioxyde de titane, les pigments organiques, les pigments cellulosiques et leurs combinaisons. 50
12. Matériau plastique suivant une quelconque des revendications 8 à 11, **caractérisé en ce qu'**une couche de revêtement préliminaire est formée à la surface du matériau plastique, sous la couche de revêtement. 55
13. Matériau plastique suivant une quelconque des revendications 8 à 12, **caractérisé en ce qu'**une couche d'isolation est formée entre le matériau plastique et la couche de revêtement.
14. Matériau plastique suivant une quelconque des revendications 8 à 13, **caractérisé en ce que** le matériau plastique revêtu est utilisé pour l'impression choisie dans le groupe constitué par l'impression offset, l'impression numérique, l'impression laser, l'impression par jet d'encre et leurs combinaisons.

REFERENCES CITED IN THE DESCRIPTION

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