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Description

The invention relates to the use of a nonwoven as carrier material for coating, in particular direct coating, with an overcoat, especially with a layer of varnish and/or a layer of paint.

Coating systems made of carrier materials and layers of varnish or layers of paint are in principle known. Application of these systems to surfaces can achieve improved protection of the surface in respect of mechanical loads, for example impact or bending, in respect of damage due to abrasion, in respect of cracking as a consequence of temperature variations, and in respect of corrosion in contact with aggressive chemicals.

The use of coating systems moreover has the advantage, in comparison with the direct application of layers of varnish or layers of paint, that when these layers are applied to the surfaces to be protected, the said layers have already been hardened. No solvents are therefore liberated at the application site. Furthermore, handling of the coated materials is facilitated, because when layers of varnish and layers of paint are in the as yet unhardened state they are usually very susceptible to adverse effects from, for example, impacts or contamination.

Carrier materials usually used in industry are papers, because these have good absorbency and it is therefore possible to achieve high adhesive-bond strengths.

A disadvantageous aspect of the use of paper is, however, that papers that can be used are only those that are relatively thick and stiff, because those are the only papers having the required mechanical properties, for example adequate strength. However, papers that are thick and stiff are unsuitable for replicating structured surfaces, and in particular small radii. For this reason, it is often impossible to use them when the intention is to apply the coated carrier material to a substrate with

structured surface.

The document WO 2012/074380 discloses a coating system where a nonwoven or woven fabric is used as substrate for the direct application of coatings. Because the substrates have higher stability and flexibility than paper, this coating system can also be used for the coating of materials with structured surfaces. That document does not provide any more detailed information concerning the nature of the nonwoven or woven fabric to be used. Practical tests have shown that the adhesion of the varnish is unsatisfactory on the nonwovens that are usually used in the field of surface coating, these being based on polyester, polyacrylonitrile and glass fibres.

GB 1 468 506 A describes a decorative sheet material in the form of a roll consisting of a flexible, porous substrate, the decorative surface of which has a flexible, uncured coating of an acid-curable resin which can be cured by an acid-containing adhesive applied to the other surface of the flexible sheet material, so that when the sheet material is unrolled and applied on a wall or on another surface by means of the acid-containing adhesive, which at this stage is applied to the other surface of the flexible material, the coating cures. Suitable acid-curable resins comprise formaldehyde condensates of amino and amide compounds, e.g. urea, melamine, substituted melamines, guanamine, ethyleneurea and thiourea, and the alkylated derivatives of these condensates. Other suitable resins comprise acrylic copolymers containing acrylamide and methacrylamide which have been condensed with formaldehyde and with alkylated derivatives of these condensates.

WO 96/26810 A1 describes a process for the production of security paper comprising a security feature. The process comprises the production of paper which is in a moist condition and which comprises one or more security features, and also the downstream application of a polyurethane coating to one or both sides of the sized paper.

WO 2009/080772 A1 describes a process for the production of a decorated laminate with a lamellar core made of wood or wood material, a decorative layer on at least one side of the core, and an outer layer with amino plastic on the decorative layer, comprising the following steps: provision of the lamellar core, fastening of a cellulose nonwoven on at least one side of the core, printing of the decorate effect onto the available side of the cellulose nonwoven, application of at least one hardenable outer layer on the printed decorated effect, hardening of the hardenable layers. The Examples mention urea-formaldehyde resins as binders.

WO 2012/074380 A1 describes a coating system for the direct application of a coating layer to a substrate, where the system comprises a coating layer based on a material made of a cured polyester and/or of a cured polyacrylate, and where there is a woven carrier fabric integrated into the material.

EP 1 365 069 A2 describes a security paper for the production of valuable documents, for example banknotes, passports, identity cards or the like, provided at least to some extent with a coating which ensures increased suitability for circulation. The coating is provided at least on one of the surfaces of the security paper and consists of a composition comprising only a binder and no fillers. The Examples mention melamine resin size.

EP 0707 977 A1 describes a cast coated paper for inkjet recording, comprising the following in a laminate: a base paper, an undercoating layer, comprising a pigment and an adhesive, and also a cast coated layer comprising a resin, where the pigment in the undercoating layer comprises aluminium oxide with bulk density from 0.05 to 0.15 g/cm^3.

Starting from the above document, the object underlying the invention consists in providing a nonwoven which, as carrier material for coating, in particular for direct coating, is optimized with an overcoat, and especially features high

adhesion to a very wide variety of overcoats, especially layers of varnish and/or layers of paint.

The said object is achieved via use of a nonwoven having a specific surface area, as measured to DIN ISO 9277, of at least 0.15 m^2/g and a thickness of from 10 to 400 µm comprising fibres having a linear density of less than 5 dtex in an amount of at least 30 weight percent, based on the overall weight of the nonwoven, wherein the nonwoven contains the following hydrophilic components:

- fibres having a surface energy, as measured to DIN 55660, of > 35 mN/m, and

- at least one binder having a surface energy, as measured to DIN 55660, of > 35 mN/m, selected from the group of acrylates, vinyl acrylates, vinyl acetates, ethylene-vinyl acetates (EVA), acrylonitrile-butadienes (NBR), styrene-butadienes (SBR), acrylonitrile-butadiene-styrenes (ABS), vinyl chlorides, ethylene-vinyl chlorides, polyvinyl alcohols, polyurethanes, starch derivatives, cellulose derivatives and also their mixtures and/or copolymers thereof and optionally

- at least one filler having a surface energy, as measured to DIN 55660, of > 35 mN/m

as carrier material for coating with an overcoat, especially with a layer of varnish, a layer of paint and/or a self-supporting film/sheet.

Surprisingly, it has been found according to the invention that a nonwoven having the abovementioned features exhibits excellent adhesion to a very wide variety of overcoats, especially to layers of varnish and/or layers of paint. According to the invention, the term "hydrophilic" means that the surface energy of the relevant component as measured to DIN 55660 is > 35 mN/m.

A very wide variety of fibres can be used as hydrophilic fibres.

Particularly suitable fibres according to the invention are those containing cellulose, viscose, lyocell, polyester, especially polyethylene terephthalate or polybutylene terephthalate, copolyester, (co)polyamide, especially polyamide 6, polyamide 6,6, aliphatic and/or aromatic polyamides, polyphenylene sulphide, glass, basalt, polyurethane, polyimide, melamine resin, modacrylic and/or polyacrylonitrile, in so far as these have a surface energy, as measured to DIN 556600, of > 35 mN/m.

If polyesters are used, preference is given to aromatic polyesters, because these have better mechanical and thermal properties than aliphatic polyesters. The amount of the abovementioned materials comprised in the fibres is preferably from 50 to 100 wt%, more preferably from 60 to 100 wt%. It is particularly preferable that the fibres consist of the abovementioned materials. In so far as the fibres comprise mixtures of the abovementioned materials, these can by way of example take the form of blends and/or copolymers.

Fibres comprising cellulose have proved particularly suitable, especially hydrophilic natural fibres, for example wood fibres, bast fibres, in particular hemp fibres, flax fibres, kenaff fibres, ramie fibres, jute fibres, sisal fibres, coconut fibres and/or cotton fibres.

According to a preferred embodiment of the invention, the fibres comprise a mixture of synthetic fibres and natural fibres. It is preferably here that the natural fibres are present in ground form, for example in the form of fibre pulp. The proportion of synthetic fibres and natural fibres here can vary as required by the desired property profile. Good results are generally achieved by setting the quantitative ratios of natural to synthetic fibres to from 9:1 to 1:9.

The proportion of the hydrophilic fibres in the nonwoven is preferably from 20 wt% to 100 wt%, preferably from 30 wt% to 80 wt%, based on the total weight of the nonwoven. If the

hydrophilic fibres are present, they advantageously form at least part of the proportion of fibres with a linear density of less than 5 dtex provided in the nonwoven of the invention. According to the invention, the proportion of fibres with a linear density of less than 5 dtex is at least 30 weight percent, based on the overall weight of the nonwoven. According to a preferred embodiment of the invention, the proportion of fibres with a linear density of less than 5 dtex is from 50 to 100 wt%, preferably from 60 to 100 wt%, based on the overall weight of the nonwoven.

Hydrophilic binders used can be a very wide variety selected from the group of acrylates, vinyl acrylates, vinyl acetates, ethylene-vinyl acetates (EVA), acrylonitrile-butadienes (NBR), styrene-butadienes (SBR), acrylonitrile-butadiene-styrenes (ABS), vinyl chlorides, ethylene-vinyl chlorides, polyvinyl alcohols, polyurethanes, starch derivatives, cellulose derivatives and also their mixtures and/or copolymers, in so far as these have a surface energy, as measured to DIN 55660, of > 35 mN/m.

The proportion of the hydrophilic binder in the nonwoven is preferably from 0 to 90 wt%, more preferably from 5 to 50 wt%, still more preferably from 10 to 30 wt%, still more preferably from 15 to 25 wt%, based on the total weight of the nonwoven.

A very wide variety of fillers can be used as hydrophilic fillers. Fillers particularly suitable according to the invention are those selected from the group consisting of carbonates, silicates, sulphates, borates, phosphates, and also metals and their oxides, carbon blacks, glasses, polymer particles, ground fibres (synthetic and natural) and/or organic and inorganic pigments, colour pigments, (non)ionic surfactants, UV stabilizers, biocides, in so far as these have a surface energy, as measured to DIN 55660, of > 35 mN/m.

The proportion of the hydrophilic fillers in the nonwoven is preferably from 0% to 90 wt%, more preferably from 5 to 50 wt%,

more preferably from 10 to 30 wt%, more preferably from 15 to 25 wt%.

According to the invention, the nonwoven comprises hydrophilic fibres, hydrophilic binder and optionally fillers with a surface energy, as measured to DIN 55660, of at least 35 mN/m. According to a particularly preferred embodiment of the invention, the hydrophilic fibres, binders and/or fillers have a surface energy, as measured to DIN 55660, of from 35 mN/m to 300 mN/m, preferably from 35 mN/m to 200 mN/m, more preferably from 35 mN/m to 150 mN/m, and especially from 35 mN/m to 75 mN/m.

The nonwoven used in the process of the invention has a specific surface area, as measured to DIN ISO 9227, of at least 0.15 m^2. Particularly good adhesion properties are obtained if the nonwoven has a specific surface area, as measured to DIN ISO 9277, of from 0.15 m^2 to 1.5 m^2, more preferably from 0.2 to 1.5 m^2 and especially from 0.25 to 1.5 m^2.

The distribution of the hydrophilic fibres, binders and/or fillers in the nonwoven can be uniform or nonuniform, with the proviso that a sufficient amount of hydrophilic fibres and/or fillers is present at the nonwoven surface provided for the coating. It is preferable that the distribution of the fibres, binders and/or fillers in the nonwoven is uniform.

It is particularly preferable according to the invention to use hydrophilic fibres as hydrophilic component.

According to the invention, the term nonwoven is used in the conventional sense: a nonwoven is a textile sheet made of fibres of finite or infinite length, bonded to one another chemically, thermally or mechanically. In contrast to this, woven fabrics and knitted fabrics are produced from yarns, and membranes are produced from self-supporting films/sheets.

The fibres used for the production of the nonwoven, in particular the hydrophilic fibres, can be staple fibres which can have a

length of from 30 to 80 mm, preferably from 30 to 70 mm, more preferably from 30 to 60 mm, chopped fibres and/or filaments. It is preferable that the nonwoven is produced by using chopped fibres with a length of from 1 mm to 30 mm, preferably from 1 mm to 25 mm, especially from 1 mm to 20 mm. The fibres used can have round, angular, lobed, ribbon-like, oval, hollow, core-sheath cross sections or other conceivable cross sections. The fibres may have been subjected in advance to a refining or grinding process for the purpose of further fibrillation. It is very particularly preferable to use fibre pulp. According to a particularly preferred embodiment of the invention, production of the nonwoven uses fibre pulp, optionally in combination with other chopped fibres. The proportion of fibre pulp in the fibre mixture and/or in the nonwoven is preferably from 10 to 70 weight percent, more preferably from 20 to 60 weight percent, based on the overall weight of the nonwoven. According to a particularly preferred embodiment of the invention, the fibre pulp has a Schopper-Riegler freeness of 10-60°SR, preferably 10-50°SR.

The use of staple fibres as basis material has the advantage, in comparison with filaments, that nonwovens with higher homogeneity can be obtained. High homogeneity is important for the use according to the invention as carrier material for coating with an overcoat, in particular with a layer of varnish, a layer of paint and/or a self-supporting film/sheet, because it can provide a uniform coating result. A uniform coating result is an essential criterion especially for layers of varnish.

Production of the nonwoven can also use other, non-hydrophilic fibres to form the fibre matrix, examples being polyolefins, especially aliphatic and/or aromatic polyolefins. These can be present in the form of monofilaments or bicomponent fibres, and can have the same fibre length and/or linear fibre density as the hydrophilic fibres. The amount of the non-hydrophilic fibres present in the nonwoven is preferably up to 40 wt%, preferably from 5 to 30 wt%, based on the overall weight of the nonwoven.

A low average fibre diameter has likewise proved advantageous

for the fibres, especially the hydrophilic fibres: particularly good adhesive bond strengths can be achieved with nonwovens having an average fibre diameter, as measured to DIN 53811, of 0.1 to 25 µm, preferably 1 to 25 µm.

Particularly good results are achieved if the proportion of the fibres, especially of the hydrophilic fibres, having an average fibre diameter, as measured to DIN 53811, of 0.1 to 25 µm, preferably 1 to 25 µm, is at least 50 wt%, preferably 80-100 wt%, based on the overall amount of fibres in the nonwoven.

According to another preferred embodiment of the invention, the nonwoven is produced by chemical bonding, especially by the consolidation of a nonwoven by means of a binder. The binder can be applied by impregnation, spreading, printing, padding or spraying. Binders used are preferably hydrophilic polymers, especially acrylates, vinyl acrylates, vinyl acetates, ethylene-vinyl acetates (EVA), acrylonitrile-butadienes (NBR), styrene-butadienes (SBR), acrylonitrile-butadiene-styrenes (ABS), vinyl chlorides, ethylene-vinyl chlorides, polyvinyl alcohols, polyurethanes, starch derivatives, cellulose derivatives and also their copolymers and/or mixtures thereof.

Use of the binder has the advantage that it can increase its adhesion capability by increasing the hydrophilicity of the nonwoven surface. The binder moreover provides a barrier which inhibits penetration of the entire nonwoven by the overcoat material, for example a varnish or a paint.

According to another preferred embodiment of the invention, a binder is used to impregnate the nonwoven after production thereof. It is thus possible to achieve even more effective inhibition of penetration of the entire nonwoven by the overcoat material.

The binders used for the downstream impregnation of the nonwoven can be the same as those described for the consolidation of the nonwoven. However, it is also possible to use other binders for

this purpose. It has been found overall that the following are particularly suitable in respect of their hydrophilicity and barrier function: acrylates, vinyl acrylates, vinyl acetates, ethylene-vinyl acetates (EVA), acrylonitrile-butadienes (NBR), styrene-butadienes (SBR), acrylonitrile-butadiene-styrenes (ABS), vinyl chlorides, ethylene-vinyl chlorides, polyvinyl alcohols, polyurethanes, starch derivatives, cellulose derivatives and also their copolymers and/or mixtures.

The abovementioned binders are preferably used in the form of suspensions which by way of example have solids contents of from 5 wt% to 60 wt%, preferably from 10 wt% to 55 wt%, more preferably from 20 wt% to 50 wt%. The binders used here can be of thermoplastic and/or crosslinkable type and can optionally comprise fillers.

The amounts of the binder used for impregnation can vary as required by the desired barrier function. The amount of binder preferably used to impregnate the nonwoven is from 5% to 80%, preferably from 10% to 70%, based in each case on the overall weight of the nonwoven.

According to another preferred embodiment of the invention, the nonwoven is consolidated thermally. For this purpose, the nonwoven can comprise binder fibres, for example monofilament fibres or bicomponent fibres. It is preferable that the thermoplastic binder component of the binder fibres consists of polymers with a melting point that is below the melting point of the matrix fibres by at least 10°C, preferably at least 15°C. The proportion of the binder component is preferably 5-50 wt%, more preferably 10-45 wt%, especially 15-40 wt%, based in each case on the overall weight of the nonwoven. It is particularly preferable that the binder component consists of (co)polyesters, polybutylene terephthalate or (co)polyamides, in particularly polyamide 6, or polyurethanes or polyolefins, especially polyethylenes, for example polypropylene and/or mixtures thereof. The binder fibres can be hydrophilic fibres for the purposes of the invention. It is advantageous here that these

can increase the hydrophilicity of the nonwoven. However, it is also conceivable to use non-hydrophilic binder fibres, for example polyolefins, instead of or in addition to hydrophilic binder fibres. In this embodiment it is advantageous that the non-hydrophilic binder fibres inhibit penetration of the entire nonwoven by the overcoat material.

The nonwoven can be produced by a very wide variety of fibre-laying methods known to the person skilled in the art: according to the invention it is possible to use dry-laid nonwovens, wet-laid nonwovens and/or spunbonded nonwovens.

Practical tests have revealed that nonwovens with particularly good adhesion properties can be obtained when the nonwoven is a wet-laid nonwoven. Another feature of wet-laid nonwovens in the use according to the invention is that they have a very dense, uniform structure and isotropic fibre distribution. This is advantageous because it permits particularly uniform coating of the surface. It is moreover advantageous that mixtures of fibres can be used, providing a simple method of establishing a desired structure and quality of the surface.

Production of the wet-laid nonwoven preferably uses chopped fibres, especially those with a length of from 0.01 mm to 30 mm, preferably from 0.01 to 25 mm, optionally in a mixture with other fibres. According to a particularly preferred embodiment of the invention, fibre pulp is used to produce the wet-laid nonwoven, optionally in combination with other chopped fibres. The proportion of fibre pulp in the fibre mixture and/or in the nonwoven is preferably 10-70 wt%, more preferably 20-60 wt%, based in each case on the overall weight of the nonwoven. According to a preferred embodiment of the invention, the Schopper-Riegler freeness of the fibre pulp is 10-60°SR, preferably 10-50°SR.

The laying of the fibre web takes place in a known manner in which the fibres are first dispersed at high dilution in water and then are laid on inclined wires. The fibre web is then

preferably bonded thermally or chemically.

The use according to the invention of a large proportion of fibres with a low linear fibre density permits achievement of a pore size distribution with a distribution maximum between 2.5 and 50 µm, preferably 2.5 and 40 µm, especially 2.5 and 30 µm: a feature of the pore size distribution of the nonwoven of the invention, as measured to ASTM E1294, preferably being that the diameter of 80-100% of the pores is from 2.5 to 50 µm, preferably from 2.5 to 40 µm, especially from 2.5 to 30 µm. Without any intention of adopting a particular mechanism according to the invention, it is believed that the specific pore size distribution contributes significantly to the good adhesion capability of the nonwoven.

The pore size distribution of the nonwoven is therefore significantly influenced by the high proportion of the fibres with a linear fibre density of less than 5 dtex, where these fibres are preferably hydrophilic fibres. Practical tests have revealed that particularly good adhesion capabilities can be obtained by using fibres with a linear fibre density of from 0.1 to 5 dtex, more preferably from 0.1 to 4 dtex, especially from 0.1 to 3.3 dtex. It is possible here that the hydrophilic fibres and/or the other fibres have this linear fibre density, and it is preferable that the hydrophilic fibres have this linear fibre density.

According to a particularly preferred embodiment of the invention, nonwovens are used which have a comparatively high packing density. The packing density is a nonwoven property which is inversely proportional to the porosity and/or air-permeability. High packing density in the nonwoven is attended by low air-permeability and, respectively, relatively low porosity. High packing density and, respectively, low porosity and/or air-permeability can be obtained by way of example by subjecting the nonwovens to a high degree of compaction by means of pressure and heat.

The packing density α of a nonwoven is defined as the ratio of the average volume of the solid of which the nonwoven is composed to the volume of the nonwoven, and is calculated as follows:

$$\alpha = \frac{m_{nonwoven} / \rho_{solid}}{V_{nonwoven}} = \frac{\rho_{solid}}{\rho_{nonwoven}}$$

α = packing density

ρ = average density of solid and, respectively, nonwoven

It is preferable that the nonwovens have a packing density of at least 0.1, preferably from 0.12 to 0.8, more preferably from 0.15 to 0.6, and/or an air-permeability, as measured to EN ISO 9237 at a differential pressure of 200 Pa of at most 7000 l/m²s, preferably from 1000 l/m²s to 2 l/m²s, more preferably from 800 l/m²s to 20 l/m²s.

Use of such nonwovens has the advantage that, when comparison is made with nonwovens of higher porosity and, respectively, air-permeability, smaller amounts of overcoat material are needed to arrive at a uniform coating result. Otherwise, the appearance of the visible side may be dominated by the nonwoven.

With the aim of obtaining maximum uniformity of coating result, it has moreover proved to be advantageous to use a very smooth nonwoven. It is particularly preferable to use nonwovens with a smoothness of at least 0.5 s in accordance with DIN 53107 at -48 kPa.

However, nonwovens that are especially suitable have a smoothness of from 5 to 200 s, preferably from 8 to 170 s.

According to the invention, the proportion of fibres with a linear fibre density at less than 5 dtex is at least 30 wt%, based on the overall weight of the nonwovens. It is preferable that the proportion of fibres with a linear fibre density of less than 5 dtex, from 0.1 to 5 dtex, more preferably from 0.1 to 4 dtex, more preferably from 0.1 to 3.3 dtex, is 40 to

100 wt%, more preferably 50 to 100 wt%, based in each case on the total weight of the nonwoven, where these fibres are preferably hydrophilic.

Another feature of the nonwoven according to the invention is a short specific wetting time for water. This can be measured as follows under standard conditions (23°C, 1 bar): the nonwoven sample to be tested is placed in the centre of a metal ring of diameter 10 cm. It is necessary to ensure here that the size of the sample is DIN A5 and that the weight per unit area of the nonwoven is in the range from 10 to 200 g/m^2. The thickness of the ring, i.e. the distance between nonwoven and support plane, must be selected here in a manner such that there is no contact between the nonwoven and the surface situated thereunder during the entire measurement time, therefore being at least 0.3 cm. A 50 µl droplet of deionized water is then carefully placed in the middle of the sample (centred) by means of an Eppendorf pipette (application volume 20-200 µl, 200 µl pipette tips). It is necessary to ensure here that firstly the pipette tip does not touch the nonwoven, i.e. that the droplet is not injected into the nonwoven. Secondly, it is important that the droplet is placed onto the nonwoven, i.e. does not experience free fall. The time required by the nonwoven to absorb the water droplet completely is then measured.

Figure 1 shows an example of a test arrangement. The reference signs 1-6 in the drawing denote the following:

1. Work surface

2. Nonwoven

3. Metal ring

4. Distance between nonwoven and work surface, at least 3 mm

5. Water droplet (50 µl)

6. Water flow

Practical tests have revealed that in the procedure described above wetting times of less than 20 min, preferably of less than 15 min, more preferably of less than 10 min, can be achieved by the nonwovens according to the invention. This shows that these nonwovens can provide particularly good adhesive bond strengths, and also a coating of particularly uniform appearance.

The nonwovens according to the invention preferably feature a strength, as measured to DIN ISO 9073-1, of at least 10 N/5 cm, preferably from 10 N/5 cm to 400 N/5 cm, more preferably from 20 N/5 cm to 300 N/5 cm and especially from 20 N/5 cm to 200 N/5 cm in longitudinal direction.

Another feature of the nonwovens according to the invention is preferably an elongation, as measured to DIN ISO 9073-1, of from 5% to 75%, preferably from 5% to 70% and especially from 5% to 65% in longitudinal direction.

It is also preferable that the nonwovens according to the invention feature a tear-propagation force in longitudinal direction, as measured to DIN 53356, of from 0.1 to 30 N, preferably from 0.2 N to 15 N.

In order to ensure optimal adhesion between nonwoven and overcoat, the nonwoven advantageously has a certain minimum thickness in order to prevent penetration of the entire nonwoven by the overcoat material. Good results are achieved in this respect with nonwovens of thickness from 10 to 400 µm, more preferably from 10 to 250 µm, and especially from 10 to 100 µm. The weight per unit area of the nonwoven, as measured to DIN ISO 9073-1, is likewise advantageously from 10 to 200 g/m^2, more preferably from 10 to 150 g/m^2 and especially from 10 to 100 g/m^2.

When the average thickness of the nonwoven is selected (measured by a method based on DIN 9073-2 with a contact area of 10 cm^2,

a contact pressure of 1.25 kPa and a duration of 1 s) and, respectively, the weight per unit area, it must be ensured that penetration of the entire nonwoven by the overcoat material is also inhibited by configuring the nonwoven with a high packing density and, respectively, low porosity. This permits thinner design of the nonwoven, allowing lower-cost manufacture.

Practical tests have revealed that when a packing density in the range from 0.12 to 0.8 is selected, it is possible to obtain comparatively thin products with, by way of example, an average thickness in the range from 10 µm to 250 µm, especially 10-100 µm, which can nevertheless provide good coating results.

According to another preferred embodiment of the invention, the materials for the production of the nonwoven are selected to have low shrinkage that is preferably smaller than 5%, measured at 200°C (see Example 11). Use of aromatic polyesters to produce the nonwoven has proved to be particularly suitable for this purpose, especially in combination with cellulose pulp.

The nonwoven can comprise not only the hydrophilic fibres but also other non-hydrophilic fibres. As mentioned above, thermoplastic binder fibres can be used as non-hydrophilic fibres, an example being polyolefin, for example polyethylene or polypropylene. The non-hydrophilic fibres can be present by way of example in an amount of from 1 to 30 wt%, preferably from 1 to 20 wt%, and especially from 1 to 10 wt% in the nonwoven, based on the overall weight of the nonwoven.

As required by the intended use, the following properties can be provided to the nonwoven: flame-retardant, fungicidal, insecticidal, biocidal, corrosion-protection, UV-protection, acid-protection, and/or magnetic. It is likewise conceivable that properties are provided to the nonwoven that increase its electromagnetic capability, and/or that it is treated with a hydrophilizing or hydrophobizing agent. Treatment with a hydrophilizing or hydrophobizing agent can selectively control the adhesion or fixing or, respectively, penetration of the

overcoat, in that the surface tension of the nonwoven is increased or reduced. According to a preferred embodiment of the invention, however, the nonwoven is not subjected to any pretreatment, especially not to any treatment with an adhesion promoter and/or with a wetting agent. According to the invention, it has specifically been found that, even without pretreatment, the nonwoven according to the invention exhibits excellent adhesion to a very wide variety of overcoats, in particular to layers of varnish and/or layers of paint. It is thus possible according to the invention to omit any pretreatment of the nonwoven, thus permitting simpler and less expensive conduct of the process.

It is also conceivable that the nonwoven is subjected to fluorination, grafting, plasma treatment, corona treatment and/or flame treatment. Finally, it is also conceivable that a barrier-layer functionality in respect of emission of substances is provided to the nonwoven. The nonwoven and/or the overcoat can moreover comprise dies and/or pigments for decorative purposes. These can also serve to reflect IR radiation. For reduction of thermal conductivity it is also possible, additionally or alternatively, to use hollow fibres or insulating additives, for example aerogels.

As explained above, the nonwoven according to the invention has excellent suitability as carrier material for coating with an overcoat: a very wide variety of overcoats, for example layers of varnish and/or layers of paint, can be applied to the nonwoven, and coating systems with good adhesion in the composite can be obtained. The overcoat materials can be applied in liquid or paste form and, as explained above, are preferably hardened before application of the coating system to the surfaces to be protected.

Particularly decorative surfaces and good adhesions in the composites are achieved with use of acrylate varnish, polyurethane varnish and/or mixtures thereof as overcoat material.

According to the invention, preference is given to radiation-curable varnishes, for example electron-beam- and/or UV-crosslinkable varnishes. In the light of this, it is preferable according to the invention to select the materials for the production of the nonwoven to be resistant to electron beams and/or UV radiation. Use of these varnishes has the advantage, when comparison is made with water-based varnishes, that it can avoid swelling of the base material and impairment of strength properties thereof caused by the water.

In comparison with varnishes in powder form, radiation-curable varnishes have the advantage that it is also possible to use substrates that are not electrically conductive. The substrate is moreover exposed to less thermal stress.

The thickness of the coating system can vary as required by the planned application sector. An advantageous minimum thickness for inhibiting penetration of the nonwoven by the overcoat material is from 0.01 mm to 0.5 mm, preferably from 0.03 to 0.5 mm.

According to a preferred embodiment of the invention, the coating system is applied to a carrier, preferably after hardening of the overcoat, by way of the side facing away from the coating. The expression "hardening of the overcoat" is interpreted conventionally, specifically to mean that the overcoat material has been completely reacted, for example completely polymerized. The overcoat can be hardened in various ways, as required by its composition, for example by air drying, or by electron beam and/or UV irradiation and/or IR irradiation.

In order to ensure good bonding between coating system and carrier, that side of the nonwoven that faces away from the coating is advantageously as free as possible from overcoat material. This can be achieved by way of example, as explained above, by using a nonwoven that is binder-bonded or thermally bonded, and/or by impregnating the nonwoven with a binder.

According to another embodiment of the invention, a self-supporting film/sheet, preferably provided with an adhesive layer, is used as overcoat for the nonwoven. By way of example, (co)polyesters, (co)polyamides, acrylates, polyurethanes, (partially hydrolysed) polyvinyl acetates or polyolefins can be used as adhesive material and/or as self-supporting film/sheet material; it is particularly preferable that the self-supporting film/sheet is applied directly to the nonwoven, i.e. without adhesive layer. This can be achieved by way of example via extrusion coating. The thickness of the self-supporting film/sheet is preferably 5 to 100 µm, particularly preferably 10 to 90 µm. It is advantageous in this embodiment that the distribution of the adhesive material onto the nonwoven surface having the overcoat is restricted, and therefore the adhesion of the coating system of the carrier is not hindered.

For improved adhesion between coating system and carrier, an adhesive layer, preferably based on polyurethane, can advantageously be provided to that side of the nonwoven that faces away from the overcoat. The adhesive layer here can fulfil its adhesive functions in the form of thermoplastic layer and/or in the form of reactive layer, and can by way of example take the form of powder, film or web. If a thermally reactivatable binder is used for the bonding of the fibres, the said property can be utilized in order to produce a self-adhesive coating system. Alternatively, fibre bonding can be achieved by using a binder which is per se inherently adhesive and therefore leads to a self-adhesive coating system.

For protection of the adhesive layer, there can be a peelable protective layer provided to the same, for example of polyethylene and/or polypropylene and/or polyester. It is likewise conceivable that there is a protective layer provided to the overcoat applied on the nonwoven. This permits handling of the coating system without direct contact with the functional layers.

A very wide variety of materials can be used as carrier, for example wood, metal, PVC, and/or GRPs and CRPs. Use of the coating system has the advantage, when compared with the direct application of the overcoat to the carrier, that during application the overcoat can already be in hardened form. Furthermore, handling of the coated materials is facilitated, because by way of example when layers of varnish or layers of paint are in the as yet unhardened state they are very susceptible to adverse effects from impacts or contamination. Another advantage is avoidance, at the application site, of atmospheric pollution by solvents liberated during the drying of the overcoat.

The nonwoven can also have been coated with a self-adhesive binder.

The invention is explained in more detail below with reference to Inventive Examples:

Example 1: Production of a nonwoven:

The nonwoven is formed by dispersing monofils and bicomponent polyolefin fibres in a mixture in water and using a hydroformer for laying these in the form of sheets. The web is dried with the aid of a continuous drier at 90-120°C as required by the melting range of the binder fibres. The product is calendered at 90-100°C and at linear pressures of 20-40 N/mm.

Example 2: Production of a nonwoven:

Calendered staple-fibre nonwovens are produced from a mixture of monofil PET fibres and undrawn PET fibres. The fibres are bonded at familiar temperatures between 205 and 235°C and at a pressure of from 10 to 50 MPa.

Examples 3-5: Production of a nonwoven:

The web of Examples 3-5 is produced and laid by a method based

on Example 1. Fibre mixtures made of PET and cellulose pulp are used here, these being additionally treated with an acrylate binder. The drying temperatures are 150-210°C, calendering is carried out at 80-120°C and at linear pressures of 160-200 N/mm.

Example 6: Production of a nonwoven:

Production takes place as described in Examples 3-5. A core-sheath bicomponent fibre is used instead of monofil PET; the sheath polyester of the said fibre has a lower melting point than the core, and serves for bonding of the fibres. The drying takes place at temperatures of from 150 to 210°C; calendering is carried out at 185-215°C and at a linear pressure of 20-40 N/mm.

Example 7: Production of a nonwoven:

Calendered staple-fibre nonwovens are produced from a mixture of monofil viscose fibres and undrawn PET fibres. The fibres are bonded at familiar temperatures between 205 and 235°C and at a pressure of from 10 to 50 MPa.

Example 8: Production of a nonwoven:

A filament web is produced from a continuous polyester-polyamide bicomponent filament with a weight per unit area of 60 g/m^2, and this is subjected to bilateral water jet needling using pressures up to 250 bar. The continuous bicomponent filaments have a linear density of up to 0.1 dtex after the water jet needling, which leads to simultaneous splitting of the input filaments.

Example 9: Production of a nonwoven:

A filament web is produced from a continuous polyester-copolyester bicomponent filament with a weight per unit area of 50 g/m^2, and this is smoothed by means of a calender at 140-170°C and at a linear pressure of 50-70 N/mm. The final fibre

bonding takes place at 190-220°C in a thermofusion oven.

The surface energies of the fibre polymers used in the Examples are as follows:

Polymer	Surface energies [mN/m]:
PE	34
PP	29
PET	42
PA 6,6	41
PA 6	46
Cellulose (cotton)	42
Cellulose (pulp)	42-46

Table 1 shows characteristic values for the nonwovens used according to the invention.

	Weight (g/m^2)	Thickness [mm]	MTF MD [N/5cm]	Elongation MD [%]	Tear-propagation force MD [N]	Air-permeability @ 200 Pa [l/m^2s^2]	Smoothness Side 1/ Side 2 [s]	Specific surface area [m^2/g]	Pore size range [µm]	Pore size distribution maximum [µm]	Wetting time [s]	Shrinkage @ 200°C [%]	Packing density	Adhesion
Example									1. Smallest pore 2. Largest pore 3. Mean flow pore diam.		H20 [s/50 µl]			
1	50	0.144	163.3	23.2	2.63	580	10/10	0.29	1. 11.16 2. 51.34 3. 18.67	6-24	> 600	70.09	0.377	poor
2	60	0.069	220	25	2.5	27	35/28	0.13	1. 1.27 2. 36.34 3. 8.47	0.1-26	> 600	4.33	0.630	poor
3	40	0.061	102.9	9.27	0.98	238	119/116	0.29	1. 5.54 2. 69.66 3. 15.17	3-30	507	3.60	0.501	good
4	50	0.082	118.7	9.88	1.39	61	81/84	0.29	1. 2.89	3-15	184	4.00	0.465	good

									2. 37.98 3. 8.28					
5	60	0.091	156.4	6.74	1.25	38	87/76	0.29	1. 2.13 2. 35.86 3. 7.26	2.5-14	196	1.60	0.503	good
6	50	0.091	76	5	0.2	2	152/140	0.58	1. 1.8 2. 20.6 3. 4.8	2-10	21	1.80	0.382	good
7	50	0.088	108	5	0.49	33	122/83	0.31	1. 1.76 2. 32.71 3. 8.32	3-23	226	3.20	0.395	good
8	60	0.348	160	42.7	5.3	310	7	0.9	1. 5.29 2. 25.72 3. 10.15	6.5-15	2	4.60	0.138	good
9	50	0.22	120	24	20	6163	0.5	0.25	1. 9.75 2. 65.12 3. 17.46	13-40	25*	0.89	0.165	good

* Measured with 20 µl of ethylene glycol

Table 1: Property profile of Inventive Examples

Example 10: Varnish adhesion test

Varnish used is an electron-beam-crosslinkable varnish system based on polyurethane acrylates, crosslinked with a radiation dose of 30-50 kGy and a voltage of from 220 to 270 kV.

Varnish adhesion (MD) is determined as follows:

A nonwoven is laminated onto the varnish coating by means of an adhesive (sample size: DIN A4, microfibre spunbond nonwoven, 130 g/m^2 with 25 g of polycaprolactone adhesive). The lamination is achieved at 80°C and 1.4 bar during 30 sec. A strip of release paper, width 5 cm, is inserted here perpendicularly to the longitudinal direction at the edge to facilitate separation. Test strips (280 mm × 50 mm) are then punched out. Adhesion is then determined by breaking the coating at the adhesive-bonding join and determining adhesion in accordance with conditions in DIN 53357. If the varnish separates from the carrier nonwoven in the tensile test with a separation force < 5N, adhesion is judged to be poor; if the separation force is > 5N, adhesion is judged to be good.

As shown in Table 1, inadequate varnish adhesion is found in Examples 1 and 2. On consideration of the values stated in Table 1, Ex. 1 exhibits a sufficient surface area and poor size distribution. However, poor adhesion is found, by virtue of the structure made of 100% of hydrophobic olefin fibres. When these are then replaced by materials that are more hydrophilic (Ex. 3-5 and 7), good varnish adhesion is achieved.

Ex. 2 is composed of PET fibres with sufficient surface energy but a small surface area and, respectively, with very small pores. When the surface energy is then raised here via admixture of cellulosic fibres (Ex. 8), here again good varnish adhesion is achieved. A further improvement is achieved by shifting the pore size distribution in the direction of larger pores and, respectively, increasing the overall specific surface area.

Example 11: Shrinkage measurement

A DIN A4-size sample of the nonwoven is taken. It must be ensured here that the longer side of the sample is parallel to machine direction. The sample is then stored at 200°C for 30 sec in a convection oven. Shrinkage is determined as average value from the change of dimension along the two axes.

It has been found to be advantageous that the nonwoven used has the following characteristics:

- production thereof uses a sufficient amount of fibres with low linear fibre density,

- the nonwoven comprises hydrophilic components with a surface energy of at least 35 mN/m and

- the specific surface area of the nonwoven is at least 0.15 m^2, as measured to DIN ISO 9277.

The high surface energy and high specific surface area of the nonwoven can be achieved as described above via suitable selection of the components of the nonwoven. These nonwovens can provide good adhesion of varnishes on the nonwoven.

The pore size distribution in accordance with ASTM E1294 of the nonwoven is moreover advantageously such that 80-100% of the pores have a diameter of 2.5-50 µm, preferably 2.5-40 µm, especially 2.5-30 µm. Without any intention of adopting a particular mechanism according to the invention, it is believed that the specific pore size distribution contributes significantly to the good adhesion capability of the nonwoven. With this pore size distribution it is possible to achieve good wetting of the nonwoven, and this can provide the necessary penetration depth of the varnish system, in turn leading to satisfactory varnish adhesion. The combined effect of the abovementioned factors can be characterized by way of example as described above via the wetting time of the nonwoven for

water or ethylene glycol.

Patentkrav

1. Anvendelse af et ikke-vævet stof der har en specifik overflade, målt ifølge DIN ISO 9277, på mindst 0,15 m2/g og en tykkelse på 10 til 400 µm, hvilket ikke-vævede stof omfatter fibre, der har en titer på mindre end 5 dtex i en mængde på mindst 30 vægt-%, baseret på den samlede vægt af det ikke-vævede stof, hvilket ikke-vævede stof indeholder følgende hydrofile bestanddele:
- fibre der har en overfladeenergi, målt ifølge DIN 55660, på > 35 mN/m, og
- mindst et bindemiddel der har en overfladeenergi, målt ifølge DIN 55660, på > 35 mN/m, som er valgt blandt acrylater, vinylacrylater, vinylacetater, ethylenvinylacetater (EVA), acrylnitrilbutadien (NBR), styrenbutadien (SBR), acrylnitrilbutadienstyren (ABS), vinylchlorider, ethylenvinylchlorider, polyvinylalkoholer, polyurethaner, stivelsesderivater, cellulosederivater og blandinger deraf og/eller copolymerer deraf og eventuelt
- mindst ét fyldstof der har en overfladeenergi, målt ifølge DIN 55660, på > 35 mN/m,
som et bæremateriale til belægning med en belægning, især med et lag lak, et lag maling og/eller en folie.

2. Anvendelsen ifølge krav 1, kendetegnet ved, at andelen af fibre, især de hydrofile fibre, der har en titer på mindre end 5 dtex, ligger på 40-100 vægt-%, fortrinsvis 50-100 vægt-%.

3. Anvendelse ifølge krav 1 eller 2, kendetegnet ved, at de hydrofile fibre er cellulose-, viskose-, lyocel-, polyamid-, copolyester-, alifatiske og/eller aromatiske copolyamid-, polyphenylensulfid-, glas-, basalt-, polyurethan-, polyimid-, melaminharpiks-, modacryl- og/eller polyacrylnitril-fibre.

4. Anvendelse ifølge et eller flere af de foregående krav, kendetegnet ved, at andelen af hydrofile fibre i det ikke-vævede stof ligger på fra 20 vægt-% til 100 vægt-%, fortrinsvis fra 30 vægt-% til 80 vægt-%, baseret på den samlede vægt af det ikke-

vævede stof.

5. Anvendelse ifølge et eller flere af de foregående krav, kendetegnet ved, at de hydrofile fibre har en titer på fra 0,1 til 5 dtex.

6. Anvendelse ifølge et eller flere af de foregående krav, kendetegnet ved, at de hydrofile fibre er til stede som fibermasse med en Schopper-Riegler- formalingsgrad på 10-60 °SR, fortrinsvis 10-50 °SR.

7. Anvendelse ifølge et eller flere af de foregående krav, kendetegnet ved, at de hydrofile fibre har en gennemsnitlig fiberdiameter, målt ifølge DIN 53811, på fra 0,1 til 25 µm, fortrinsvis på fra 1 til 25 µm.

8. Anvendelse ifølge et eller flere af de foregående krav, kendetegnet ved, at det ikke-vævede stof er kendetegnet ved en specifik befugtningstid for vand på mindre end 20 minutter, fortrinsvis mindre end 15 minutter.

9. Anvendelse ifølge et eller flere af de foregående krav, kendetegnet ved, at det ikke-vævede stof har en tykkelse på fra 10 til 250 µm.

10. Anvendelse ifølge et eller flere af de foregående krav, kendetegnet ved, at det ikke-vævede stof er et vådt ikke-vævet stof.

11. Anvendelse ifølge et eller flere af de foregående krav, kendetegnet ved, at laget af lak og/eller maling omfatter en lak, især en acrylatlak, en polyurethanlak og/eller blandinger heraf.

12. Anvendelse ifølge et eller flere af de foregående krav, kendetegnet ved, at det overtrukne ikke-vævede stof påføres på en bærer.