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(54) SUPPORT FOR ABRASIVE

(57) The present invention relates to a support for an abrasive comprising a nonwoven fabric being a through-air thermally bonded nonwoven fabric comprising multicomponent binder fibers. The present invention relates also to a method of forming said support and to the use of said support in the manufacture of an abrasive article.

EP 3 299 123 A1

Description

[0001] The invention relates to a support for an abrasive and also to a method of forming said support and to the use of said support in the manufacture of an abrasive article.

[0002] Abrasive articles typically comprise a support, an abrasive and a binder fixing the abrasive on the support. The support in an abrasive article has to meet various technical requirements. In particular, the support should be tough and strong in order not to tear during grinding and in order to efficiently transfer the grinding force to a workpiece. The support should additionally have a high level of flexibility in order that it may conform to the contours of a workpiece without becoming permanently deformed in the process.

[0003] Papers are often used as supports, for example in the manufacture of sandpaper. Sandpaper plays an important part in the treatment of surfaces in a variety of industrial sectors. The disadvantage with the use of sandpaper is that it does not have satisfactory mechanical properties and will therefore often tear in use, necessitating its early replacement.

[0004] The use of wovens is an alternative, textile solution. Wovens do have superior mechanical properties as compared with sandpaper, in particular superior breaking strength, dimensional stability, delamination resistance and flexibility, but the manufacture of woven supports is far from straightforward and is oftentimes associated with high manufacturing costs. Woven supports are accordingly disadvantageous for economic reasons.

[0005] Woven supports are further disadvantageous because they do not have a planar surface, compromising their use for fine abrasives.

[0006] The use of polymer films is a further alternative solution. However, polymer films are disadvantageous because typically their porosity is poor, which makes it difficult to secure the abrasive on their surface.

[0007] It is likewise known to use nonwoven fabrics as abrasives support.

[0008] DE 102013224549 A1 describes a support for abrasives which comprises an impregnated supporting material based on synthetic fibers. The supporting material used is preferably a densified web of synthetic continuous filament fibers. The bonding and densification of the supporting material takes place in one single step, which is known in the industry as hot roll calandering process, where a fleece of thermoplastic fibers pass through a calander with controlled pressure and temperature.

[0009] Disadvantageous of the hot roll calandering process is that the degree of bonding and densification is exposed to variations due to normal changes on superficial temperature and pressure related to this process. To minimise these effects it is necessary to tightly adjust the process. Excess of temperature and/or pressure during calandering, may easily lead to an unwanted reduction of air permeability and superficial roughness. On the other hand, adjusting the temperature and/or pressure to low, results in poor bonding, unbounded filaments, poor abrasion properties, poor tear strength, etc.

[0010] A further disadvantage of calandering is that thermal transfer is done by an instant contact in the nip point of both cylinders. This instant contact, especially at relatively high speed generates a gradient of temperatures from surfaces to the center of the material. The coarser the fibrous substrate and the faster the production speed, the worse. This results in relative poor bonded fibers inside the web and excessive bonding on its surfaces. As a consequence total or partial delamination of the supporting material can occur.

[0011] Also disadvantageous is the restricted air permeability due to the thermal stress on superficial fibers imparted by the calandering step. The fibers on the surface are flattened and bonded, which reduce superficial pore size and, consequently, air permeability. Low air permeability, in the range of 20 l/m^2s or less, is reflected in poor penetration of bonding material.

[0012] WO 2014137972 A1 describes a nonwoven abrasive article having a nonwoven web and a binder adhering ceramic abrasive particles to fibers of the nonwoven web. This document relates to a bulky material based on extremely thick fibers, out of the range of finesses of fiber used for flat materials. Due to the use of thick fibers, the nonwoven surface is uneven and abrasive particles penetrate into the nonwoven structure, which is disadvantageous for sandpapers.

[0013] A further important aspect in the manufacture and use of abrasive articles is the level of adherence of the abrasive on the abrasives support. High mechanical and thermal stresses in grinding can cause the abrasive to become detached from the support if adherence is insufficient.

[0014] It is an object of the present invention to specify an improved support for abrasives which at least partly overcomes the disadvantages of conventional abrasives supports. Such a support for abrasives shall preferably have a high level of tensile strength and advantageously also a high level of flexibility, breaking strength, dimensional stability, delamination resistance, elasticity and abrasive adherence. The support shall further be inexpensive to manufacture. Further objects of the invention are to specify a manufacturing process for such a support, its use and also an abrasive article comprising such a support.

[0015] These objects are achieved by the subject-matter of the independent claims. The dependent claims recite advantageous embodiments.

[0016] The present invention provides a support for an abrasive which comprises a nonwoven fabric being a through-air thermally bonded nonwoven fabric comprising multicomponent binder fibers.

[0017] It was found that such a support at least partly overcomes the aforementioned disadvantages of conventional abrasives supports.

[0018] The invention provides a support for an abrasive. This support for an abrasive may herein also be referred to as "support for an abrasive article", "abrasives support" or else just as "support" for short.

[0019] The term "fiber" is to be understood for the purposes of the present invention as meaning a flexible structure which is thin for its length. Fibers have a low diameter and can be built up into nonwoven fabrics with one another by corresponding methods of consolidation.

[0020] Binder fibers for the purposes of the invention are fibers which on heating to a temperature above melting and/or softening point of at least one of the constituent polymers, are capable of forming and/or form consolidated points and/or regions at their crossing points at least. In effect, at these crossing points, the binder fibers are capable of forming material-lock interbonds with other fibers and/or with themselves. A scaffold may be constructed and a thermally consolidated nonwoven fabric may be obtained as a result.

[0021] The term "nonwoven" is to be understood as meaning a textile fabric formed from fibers of finite length, fibers of continuous length (filaments) or staple fibers of any kind and any origin, which are joined together in some way to form a fibrous layer (also called web) and have been bonded together in some way. The ambit of said term excludes articles of manufacture by weaving, knitting, lacemaking or braiding. Fibrous layers or webs are obtainable by various web-based processes, for example melt spinning, melt blowing, carding, air-laid processes or wet-laid processes.

[0022] According to the invention the fibrous layers are bonded via through-air thermal bonding to form a nonwoven fabric. Through-air bonding involves the application of hot air to the surface of the fibrous layers which is pushed or pulled through the fibrous layers e.g. using negative pressure or suction. Pulling the air through the fibrous layers allows very rapid and even transmission of heat and minimises fabric distortion. Through-air bonded nonwovens are obtainable in a hot air oven for example. The through-air bonding results in the multicomponent binder fibres in the nonwoven fabric at least partly forming a material lock and thereby bonding the nonwoven fabric.

[0023] It was found that, as compared to hot roll calandering, through-air bonding occurs much more evenly throughout the nonwovens cross-section i.e. internally as well as externally. This allows to optically differentiate hot roll calandered nonwoven fabrics and through-air bonded nonwoven fabrics. A further optical difference is that in contrast to through-air bonded nonwoven fabrics hot roll calandered nonwoven fabrics usually show a flattened surface due to the compression by the calendar rolls.

[0024] To ensure even bonding throughout the nonwovens cross-section the time of the through-air bonding may be adjusted so that a sufficient amount, preferably more or less all fibers are bonded. In the case of sheet/core multicomponent binder fibers, the sheet functions as binder and the core as carrier fiber.

[0025] In contrast, hot roll calandered nonwovens comprise inner fibers which are less bonded than fibers on the surface of the nonwoven. Weekly bonded inner fibers, however, result in low peeling resistance which facilitates the nonwoven to be split in different layers.

[0026] Further advantageous of the use of through-air bonded nonwoven fabrics as compared to hot roll calandered nonwovens is that overbonding of the surface - which may lead to the surface having the appearance of plastic film - may be avoided.

[0027] Also, unwanted reduction of the air permeability, which in hot roll calandering processes is due to the effect of temperature and pressure that fuse and deform the fibers and thereby reduce pore size may be avoided. For example, based on same density, same finesses of fiber and fiber distribution, through-air bonded materials can reach up to 50 times more air permeability. High air permeability is an indicator of the active surface of the fiber inside the structure to promote bonding of abrasive particles.

[0028] According to the invention the air permeability of the nonwoven fabrics, measured at 200Pa preferably is more than 100 l/m^2s, more preferably more than 500 l/m^2s, for example in the range of 100 l/m^2s to 2000 l/m^2s, more preferably of 500 l/m^2s to 2000 l/m^2s, more preferably of 1000 l/m^2s to 2000 l/m^2s, more preferably of 1200 l/m^2s to 1700 l/m^2s, even more preferably of 1300 l/m^2s to 1500 l/m^2s. Advantageous of the high air permeability is that it allows for a high penetration of binding agents that fix the abrasive particles to the surface.

[0029] Further advantageous of the use of through-air bonded nonwoven fabrics as compared to hot roll calandered nonwovens is that the fibers may keep their original shape and may consequently offer a larger active surface to promote bonding of abrasive particles. This improves the endurance of the abrasive article.

[0030] Additionally, in through-air bonded nonwoven fabrics the natural topography of the fiber surface may be retained, and no artificial embossing is needed to reach the necessary surface roughness.

[0031] Another advantage of the through-air process is based on the fact that the temperature range where the fiber is active for bonding is wider than in alternative technologies.

[0032] As explained above, hot roll calandering imparts nonwovens with unwanted properties regarding the intended use as support for abrasives. Therefore, it is preferred that no hot roll calandering step is performed e.g. to adjust thickness and density of the nonwoven. Instead, for this purpose, the nonwoven is preferably compressed in a calibrating unit. Preferably, the calibration step takes place immediately after the through-air bonding step while the fiber is still hot and activated for bonding. In doing so the thickness and density of the nonwoven may be easily adjusted whereas the above discussed disadvantages of hot roll calandering may be avoided.

[0033] It was found that the through-air bonded support of the present invention, wherein the thermal consolidation is effected via at least partially melted multicomponent binder fibers, has excellent mechanical properties, in particular a high level of strength (breaking strength, dimensional stability, delamination resistance and tensile force). It was further found that the support advantageously also has a high level of flexibility and elasticity and, what is more, enables good attachment of binders and/or abrasives. For this reason, the support is very useful in the manufacture of a very durable, robust and very conveniently handleable abrasive article.

[0034] It was found in practical tests that the support of the present invention advantageously has a high maximum tensile force of preferably more than 110 N/50 mm, e.g. from 110 N/50 mm to 250 N/50 mm, more preferably of more than 125 N/50 mm e.g. from 125 N/50 mm to 250 N/50 mm, and yet more preferably of more than 140 N/50 mm, e.g. from 140 N/50 mm to 250 N/50 mm, all measured in the machine direction (MD). At same time, the support of the present invention advantageously has a maximum tensile force in the cross direction (CD) higher than 50 N/50 mm, more preferably of more than 58 N/50 mm, e.g. from 58 N/50 mm to 120 N/50 mm and yet more preferably of more than 65 N/50 mm, e.g. from 65 N/50 mm to 120 N/50 mm.

[0035] The tensile force in machine direction is usually higher than tensile force in cross direction. A MD/CD tensile force ratio in the range of about 2:1 is particularly beneficious when sandpaper is used in continuous rotating sanding belts. This kind of devices is particularly demanding in the machine direction. The present invention relates a nonwoven where ratio between tensile force MD and tensile force CD preferably is at least 1.75:1, more preferable at least 2.0:1 and yet more preferable at least 2.25:1.

[0036] Some initial elongation is desired in order to confer to the support certain drapeability, but limited final elongation is preferred in order to restrict deformation when continuous sanding belts are mounted into sanding machines.

[0037] The support advantageously has a low breaking extension of preferably less than 40% elongation at break, more preferably less than 35% elongation at break more preferably of less than 30% elongation at break and yet more preferably of less than 25% elongation at break in the machine direction.

[0038] Relative higher elongation in the cross direction has positive effect on manual sanding, where support is normally cut in sheets. The present invention allows to produce a support with more than 25% elongation at break, preferably of more than 30% elongation at break, preferably of more than 35% elongation at break, and yet more preferably of more than 40% elongation at break in the cross direction.

[0039] The present invention allows reaching relative high mechanical properties for a relative low basis weight.

[0040] The support advantageously further has a high tenacity, preferably higher than 1.6 N/g (50 mm), in the machine direction, and preferably a tenacity higher than 0.8 N/g (50 mm) in the cross direction.

[0041] Lastly, the support advantageously has a very high tear strength of at least 4 N in machine direction and 8N in cross direction, more preferable at least 5 N in machine direction and at least 9 N in cross direction and even more preferable at least 6 N in machine direction and at least 10 N in cross direction.

[0042] Without wishing to be tied to any one mechanism, it is believed that the good mechanical properties are brought about by the specific bonding of the nonwoven fabric via the through-air thermal bonding. This bonding, as explained above, is obtainable by treating a fibrous web comprising multicomponent binder fibers in a hot air oven. Preferably, immediately after that bonding step, while the fibers are still activated, the thickness is reduced by passing the web through a calibration unit. In doing so the density may be adjusted to the desired level, and at same time, the degree of bonding may be increased.

[0043] The air permeability correlates with the density of the nonwoven, said density preferably being in the range from 0.05 to 0.5 g/cm^2, more preferably in the range from 0.1 to 0.2 and especially in the range from 0.15 to 0.18 g/cm^2.

[0044] Since the support of the present invention offers a large surface for anchoring binding agents that fix the abrasives particles to the surface, the required amount of binding agent is reduced. In comparison with cotton woven, it was found that binding agent may be reduced up to 40%, which redounds in raw material cost reduction, energy consumption and higher production speeds.

[0045] The support of the present invention includes multicomponent binder fibers, in particular bicomponent binder fibers, for thermal consolidation. Multicomponent binder fibers for the purposes of the present invention are fibers comprising two or more different polymers everyone in different segments, at least one of which is usable and/or used for thermal bonding. It is advantageous to this end for at least one of the polymers, to have a melting and/or softening point below the melting and/or softening point of at least one further fiber material. In one preferred embodiment, the difference between the melting and/or softening points is at least 10°C, preferably at least 100°C, e.g 10°C to 250°C.

[0046] For example a bicomponent fiber of the type core-sheath, with polyester PET core (256°C) and polyethylene sheath (130°C). In this case the difference between both melting points is about 126°C.

[0047] Multicomponent binder fibers may consist of a variety of fiber materials, provided at least one polymer is capable of functioning as a thermal type of bonding component. It is preferable for the purposes of the present invention for multicomponent binder fibers to include synthetic types of fiber materials, for example polyolefin, in particular polypropylene and/or polyethylene, polyethylene terephthalate, polybutylene terephthalate, polyethylene naphthalate, polybutylene naphthalate, polyamide, polyphenylene sulphide, polyolefin, polycarbonate and combinations thereof.

[0048] Multicomponent binder fibers preferably include one or more of the following polymers as carrier for the bonding component: polyolefin, in particular polypropylene, polyethylene terephthalate, poly-Lactic acid, polyamide 6.6 etc.

[0049] Multicomponent binder fibers may have different arrangements for the polymers in the individual fibers, for example a "side-by-side" arrangement (the cross section through the fiber calls to mind a cake cut into two halves which each consist of a different polymer), a "segmented pie" or "citrus" arrangement (the cross section through the fiber calls to mind a cake divided into several pieces consisting, alternatingly in particular, of the different polymers), an "islands-in-the-sea" arrangement (the cross section through the fiber calls to mind several islands of a polymer which are surrounded by a sea of some other polymer) and/or a "sheath-core" arrangement (the core consists of a fiber of a first polymer and is surrounded by a sheath of a second polymer).

[0050] Sheath-core binder fibers are particularly suitable for the purposes of the present invention, more preferable concentric sheath-core. Sheath-core binder fibers contain two polymers of different softening and/or melting temperature. The component with the lower softening and/or melting temperature is positioned therein at the fiber surface (sheath), while the component with the higher softening and/or melting temperature is positioned in the core. In sheath-core fibers, therefore, the binder function is performable by the materials arranged at the surface of the fibers.

[0051] Particular preference is given to bicomponent fibers, in particular sheath-core binder fibers, comprising combinations of polyethylene/polypropylene, polyethylene/polyester, polypropylene/polyester, copolyester/polyethylene terephthalate, nylon-6/nylon-6,6, polybutylene terephthalate/polyethylene terephthalate.

[0052] In a preferred embodiment of the invention the multicomponent binder fibers are sheath-core binder fibers wherein the sheath has a melting and/or softening point which is at least 10°C, preferably at least 100°C lower than the melting and/or softening point of the core.

[0053] In a further preferred embodiment of the invention the multicomponent binder fibers are sheath-core binder fibers wherein the sheath preferably comprises polyolefin, in particular polyethylene, polypropylene, copolymers of polypropylene, polybutylene terephthalate, polydicyclohexilene terephthalate, polyamide 6. The core preferably comprises polyolefin, in particular polypropylene, polyethylene terephthalate, poly-Lactic acid, polyamide 6.6.

[0054] In sheath-core binder fibers which have been found to be particularly suitable in practical tests, the sheath comprises pure polypropylene or mixtures with other polymers or additives, thereof and the core comprises pure polyester or mixtures with additives. In one particularly preferred embodiment of the sheath-core binder fibers, the sheath contains polypropylene and the core contains polyester.

[0055] In sheath-core binder fibers the sheath core ratio by mass, expressed as percentage is preferred from 70% to 30% sheath and 30% to 70% core, more preferable from 60% to 40% sheath and 40% to 60% core and even more preferable about 50% sheath and about 50% core.

[0056] In one embodiment of the invention the nonwoven contains sheath-core fibers in an amount of at least 60 wt.%, preferably 100 wt.%, relative to the overall weight of the nonwoven. Most preferred the nonwoven consists of sheath-core fibers. Nevertheless, the sheath-core fibers can be used in blend with other fibers. The fibers to be used in combination with bonding fibers could be added as structural component. Structural fibers that can be used in combination with bonding fibers may be based on polyethylene terephthalate (PET), Polypropylene, Viscose, Tencel®, cotton, Polyamide, Polylactic acid (PLA), etc. Structural fibers are usually added in a percentage lower than 40 wt.%, preferable lower than 20 wt.%, more preferable lower than 10 wt.%, more preferable lower than 5 wt.%, and even more preferable not added (0%).

[0057] The fibers to be used in combination with bonding fibers can also function as additives. Fibers that can be added as additive are only as example, silver fibers, stainless steel fibers, sulphur cooper fibers (generally speaking "conductive fibers"), bacteriostatic fibers, colored fibers, etc. The additive fibers are added in a percentage lower than 15%, preferable lower than 5% and even more preferable not added (0%).

[0058] Multicomponent binder fibers may comprise continuous filament fibers, staple fibers or a combination thereof. In a preferred embodiment the multicomponent binder fibers comprise staple fibres. For example, the nonwoven fabric may comprise multicomponent binder staple fibers not less than about 20 millimetres (mm), not less than about 30 mm or at least about 40 mm, and less than about 110 mm, less than about 85 mm or less than about 65 mm in length, although shorter and longer fibers (continuous filaments, for example) may also be beneficial.

[0059] If present, the proportion of the overall weight of multicomponent binder fibers that is accounted for by staple fibers is advantageously not less than 50 wt%, for example not less than 60 wt% and/or not less than 60 wt% and/or not less than 70 wt% and/or not less than 80 wt% and/or not less than 90 wt% and/or not less than 95 wt%, all relative to the overall weight of multicomponent binder fibers. The use of staple fibers fibers is advantageous in that these are particularly economical to manufacture and have good mechanical properties.

[0060] In a further one preferred embodiment of the invention, the multicomponent binder fibers comprise a mixture of continuous filament fibres and staple fibers. In this embodiment the proportion of the overall weight of multicomponent binder fibers that is accounted for by continuous filament fibres is advantageously not less than 60 wt%, preferably from

70 wt.% to 100 wt.%, all relative to the overall weight of the multicomponent binder fibers.

[0061] In a further preferred embodiment of the invention, the multicomponent binder fibers, have an average fiber titre in the range from 3 to 50 μm, preferably from 5 to 40 μm, more preferably from 10 to 32 μm, more preferably from 12 to 30 μm and especially from 14 to 28 μm.

[0062] In a particular preferred embodiment of the invention the multicomponent binder fibers and/or preferably the sheath-core binder fibers are of a length of 30 mm to 65 mm and/or of a titer of from 3 to 50 μm. Further preferred the multicomponent binder fibers comprise bicomponent sheath-core binder fibers based on polyethylene terephthalate core and polypropylene sheath, with a titer of from 14 to 28 μm and/or preferably and, a length of 30 mm to 65 mm.

[0063] The hydrophilicity of the support is related to anchoring of binding agent which fixes the abrasive particles. Especially, at high processing speed, hydrophilicity may improve the coating or impregnation process.

[0064] In a preferred embodiment of the invention, the fiber materials, i.e. the multicomponent binder fibers and the further fibers, are treated superficially with a spin finish or similar tensioactive in order to promote hydrophilicity of the fibers. The hydrophilicity can be measured by using Edina Test WSP 10.1 (05) Liquid absorbency time (in seconds). The necessary time to completely wet the fiber is preferably less than 5 seconds, more preferable less than 3 seconds.

[0065] The support may be executed in a variety of forms, for example as continuous or finite sheet material in one or more layers.

[0066] In a preferred embodiment of the invention, the support has an average thickness in the range from 0.1 to 1.2 mm, preferably from 0.2 to 0.8 mm and especially from 0.3 to 0.5 mm and/or a basis weight in the range from 40 to 120 g/m^2, preferably from 50 to 100 g/m^2 and especially from 60 to 80 g/m^2.

[0067] In addition, the support may, if desired, be coloured, for example by spin dyeing.

[0068] The support of the present invention is very useful in the manufacture of an abrasive article, in particular in the manufacture of an abrasive belt, of an abrasive disc or of an abrasive sheet.

[0069] The invention further provides an abrasive article, in particular an abrasive belt, disc or sheet, comprising a nonwoven fabric support according to at least one embodiment of the present invention and also a binder to bind an abrasive to the surface of the nonwoven fabric.

[0070] The abrasive in the present invention is not subject to any limitations. Any materials which can be applied to the support and which makes stock removal from a workpiece on grinding can be used in principle. The abrasive may for example be selected from the group consisting of natural abrasives and manufactured abrasives, in particular diamond, corundum, emery, garnet, burrstone, chert, quartz, sandstone, chalcedony, flint, quartzite, silica, feldspar, pumice and talc. Examples of manufactured abrasives are boron carbide, cubic boron nitride, fused alumina, ceramic aluminium oxide, heat-treated aluminium oxide, alumina-zirconia, glass, silicon carbide, iron oxides, tantalum carbide, cerium oxide, tin oxide, titanium carbide, synthetic diamond, manganese dioxide, zirconium oxide and silicon nitride and/or mixtures thereof.

[0071] The abrasive is preferably in the form of particles, grains, splinters or the like. The abrasive preferably has an average particle size ranging from about 0.1 μm to about 1500 μm, more preferably from about 0.1 μm to about 1300 μm, and/or a Mohs hardness of not less than 8, more preferably of about 9.

[0072] To apply the abrasive to the support, a binder is generally provided to the support. The binder used may be one of the binders usually used for binding abrasive. The binder is preferably selected from the group consisting of resins having a weight-average molecular weight of at least 50 000 g/mol, in particular phenolic resin, epoxy resin, formaldehyde resin, polyurethane resin, urea resin, latex resin, dextrines, starch, fillers and/or mixtures thereof.

[0073] In a preferred embodiment of the invention, the binder comprises a basecoat and a topcoat. Advantageously, the basecoat is applied to the support first. Then the abrasive material is applied, followed by the production of the topcoat. The abrasive article may thus comprise on the support a binder comprising a basecoat and a topcoat as well as an abrasive.

[0074] The basecoat may for example be selected from epoxy resin, phenolic resin, alkyd resin, urea resin or combinations thereof. The topcoat used is generally a hard thermosetting resin to additionally anchor the abrasive. The topcoat may for example be selected from epoxy resin, phenolic resin, alkyd resin, urea resin or combinations thereof.

[0075] The abrasive article of the present invention is useful for both wet and dry grinding. It may for example be embodied as an abrasive belt, as an abrasive disc or as an abrasive sheet.

[0076] The present invention accordingly further provides for the use of the abrasive article as an abrasive belt, as an abrasive disc or as an abrasive sheet and/or for the manufacture thereof.

[0077] The invention further provides a method. Said method makes it possible to manufacture a support for abrasive in at least one embodiment of the invention.

[0078] In one embodiment at least, the method comprises the steps of:

(A) producing and/or providing a fibrous web and/or a prebonded nonwoven fabric comprising multicomponent binder fibers;

(B) through-air thermal bonding the fibrous web and/or the prebonded nonwoven fabric, preferably in an hot through-air oven, to activate and bond the multicomponent binder fibers to form a through-air thermally bonded nonwoven fabric useful as support for abrasive.

[0079] The through-air thermally bonded nonwoven fabric preferably corresponds to the support in at least one of the embodiments described above.

[0080] Step (A): Producing the fibrous web and/or the prebonded nonwoven fabric may be effected in various ways known to a person skilled in the art, for example by melt spinning, melt blowing, carding, air-laid processes or wet-laid processes.

[0081] The term "fibrous web" is to be understood as meaning a textile fabric formed from fibers of finite length, fibers of continuous length (filaments) or staple fibers of any kind and any origin, which are joined together in some way to form a fibrous web (also called web or fibrous layer). Pre-bonding the fibrous web leads to a "prebonded nonwoven fabric". Pre-bonding might be effected for example by interlacing, needling, hot air, calandering, etc.

[0082] Suitable polymers for producing the fibrous nonwoven web and/or prebonded nonwoven fabric as well as the suitable fiber species and types have already been described above. The polymers may contain at least one additive selected from the group consisting of colour pigments, antistatics, antimicrobials such as copper, silver, gold, or hydrophilizer additives in an amount of 150 ppm to 15 wt%. The use of said additives in the polymers used allows adaptation to meet specific customer needs.

[0083] The use of bicomponent fibers concentric based on PET core and PP sheath, with a titer of from 14 to 28 μm and/or preferably and, a length of 30 mm to 65 mm as multicomponent binder fibers is most preferred.

[0084] Step (B): Through-air thermal bonding the fibrous web and/or nonwoven fabric to activate the multicomponent binder fibers for bonding may likewise be effected in a conventional manner, for example by pulling through a hot air tunnel oven or by pulling onto a drum having hot air flowing through. As mentioned, it is preferred that the binder fibers intermelt in the course of this thermal bonding not just on the surface, but also in the interior of the fibrous web and/or nonwoven fabric. In doing so an homogeneous degree of bonding in all thickness and all across and along the production may be obtained. Advantageously, in the case of sheath-core binder fibers the external polymer (sheath) is fused or softened with no risk of damage or fuse or the internal polymers (core) due to their sufficiently different melting points. To ensure even bonding throughout the nonwovens cross-section the period of the through-air bonding preferably is adjusted so that a sufficient amount, preferably more or less all fibers are activated for bonding. Of course, the optimal period depends on various parameters, such as thickness and material of the nonwoven. However, in many cases, through-air bonding for a period of more than 3,0 seconds, for example from 2,5 seconds to 10 seconds is advantageous. As example, for the aftermentioned sheath-core binder fibers with PET core and PP sheath, could be bonded perfectly in 3,5 seconds in a conventional air through drum oven.

[0085] The temperature setting can be used to establish the properties of the supporting material. It is advantageous that the temperature be chosen accordingly to avoid damage on inner part of the fibers (core) but guarantying comprehensive and homogeneous bonding fiber activation.

[0086] Preferably, the method additionally comprises a further step (C) in which the thickness of the through-air thermally bonded nonwoven fabric is adjusted while the binding fibers are still active, by passing the through-air thermally bonded nonwoven fabric through a calibration unit.

[0087] It is advantageous for the flexibility and strength of the abrasives support according to the present invention that the nonwoven fabric reaches a certain level of density. It may be densified for this purpose, and particularly, this may be done by using a calibration unit, in step (C). The calibration step is particularly efficient when performed while the bonding fiber on the web is still activated. This may be accomplished in a simple manner by the nonwoven fabric obtained from step (B) being compacted immediately following step (B). The calibration unit preferably comprises two rotating surfaces, for example belonging to a pair of belts and/or a pair of cylinder. The distance between both surfaces may be set at a predetermined distance to compress the nonwoven and to thereby reach the desired thickness and density. In such calibrating unit, an engraved cylinder as mentioned in DE 102013224549 A1 is not necessary, since the pressure used for calibration is much lower than the pressure needed for bonding. Accordingly, flattened surfaces may be avoided.

[0088] In a preferred embodiment the two rotating surfaces are flat and even. In a further preferred embodiment the two rotating surfaces are conditioned at a predetermined temperature in order to avoid premature cool down of the binding fibers.

[0089] The properties of the supporting material can be established in step (C) via the distance between both surfaces ("nip") and the roll temperature for example. Densification can be applied here so as to achieve predetermined, above-described, advantageously high air permeability. Typical setting of calibration unit could be defined as a gap between 0.01 mm and 1.5 mm, most preferable 0.02 mm and 1.0 mm and even more preferable 0.05 mm to 0.07 mm. The temperature is normally set between 10 to 20°C below to the temperature set on the oven where binding fiber is activated, more preferable 15°C below to the temperature set on the oven where binding fiber is activated.

[0090] The surface of the supporting material and/or nonwoven web may be modified in its properties, for example wettability by water or reduced electrostatic charge build-up, by a surface treatment process, for example corona treatment or plasma treatment, according to requirements.

[0091] The post-consolidation fibrous nonwoven fabric may further be subjected to a chemical bonding or finishing operation, for example an anti-pilling treatment, further hydrophilization, an antistatic treatment, a treatment to improve the fire resistance and/or to modify the tactile properties or the lustre, a mechanical treatment such as raising, sanforizing, sanding or a tumbler treatment and/or a treatment to change the appearance such as dyeing or printing.

[0092] In a further embodiment, step (C) is followed by a step (D) comprising applying a basecoat to that side of the supporting material which is to comprise the abrasive.

[0093] The basecoat may for example be selected from epoxy resin, phenolic resin, alkyd resin, urea resin or combinations thereof. The resins are preferably applied to the support in the form of a dispersion or solution in a suitable solvent. The abrasive may then be sprinkled onto the still wet basecoat (step (E)), in which case the individual particles and/or grains may be optimally orientated on the abrasives support of the invention using electrostatic devices for example. Subsequently, the abrasives support coated with the still wet basecoat and the abrasive adhering thereto may be dried (step (F)), for example in a drying oven. After drying, the abrasive and/or support may be coated with a topcoat (step (G)). The topcoat used is generally a hard, thermosetting resin to additionally anchor the abrasive. The topcoat may for example be selected from epoxy resin, phenolic resin, alkyd resin, urea resin or combinations thereof. This exemplary application of the abrasive is concluded by the step of curing the topcoat (step (H)).

[0094] According to a preferred embodiment the method does not include any hot roll calandering step.

[0095] The method of the present invention provides an advantageous support and thus also an advantageous abrasive article. The invention accordingly also provides a support obtainable according to at least one embodiment of the method according to the present invention. The invention further provides an abrasive article comprising such a support. This abrasive article may be obtainable by a method of producing abrasive articles according to at least one embodiment of the present invention.

[0096] The support is accordingly obtainable by a method comprising the above-described steps (A), (B) and optionally (C) to (H) according to the respective embodiments.

Test methods:

[0097] Basis weight is determined according to DIN EN ISO 536.

[0098] Air permeability is determined according to DIN EN ISO 9237:1995 at 200 Pa differential pressure.

[0099] The thickness of a support or supporting material is determined according to DIN EN ISO 534 using 20 N contact pressure and a measurement area of 200 mm^2.

[0100] Maximum tensile force dry along and across is determined according to EN 13934-1 at a basis weight of 75 gsm.

[0101] Breaking extension dry along and across is determined according to EN 13934-1 at a basis weight of 75 gsm.

[0102] Tear strength dry along and across is determined according to EN 13937-2.

[0103] Tenacity is calculated by dividing Tensile strength (N/50mm) by basis weight (g/m2).

[0104] The standards referred to above are used in the German-language form, the disclosures of which are thus incorporated herein by reference.

Example:

Producing an inventive supporting material

[0105] The supporting material used was a carded web of sheath-core binder fibers (polypropylene/polyester, staple fibers) having an average fiber diameter of 2De, equivalent to 17,5 μm. The supporting material had a basis weight of 75 g/m^2, a thickness of 0,44 mm, an air permeability of 1400 l/m^2s @200Pa.

[0106] The carded web was heated in a hot air oven at a temperature of 175°C with a residence time of 3,5 seconds in the oven and then thermocalibrated at 155°C with a fixed gap of 0,12mm.

[0107] The support was notable for a high level of flexibility, breaking strength, dimensional stability, delamination resistance, elasticity.

[0108] The properties of the supporting material are presented in the following table:

	Parameter	Units	Value	Method
1	basis weight	g/m2	76.0	DIN EN ISO 536
2	thickness	mm	0.44	DIN EN ISO 534

(continued)

	Parameter	Units	Value	Method
3	MD maximum tensile force	N/50 mm	169.5	EN 13934-1
4	MD breaking extension	%	43.2	EN 13934-1
5	CD maximum tensile force	N/50 mm	71.2	EN 13934-1
6	CD breaking extension	%	81.1	EN 13934-1
7	density	g/cm^3	0.172	computed from 1 and 2
8	tensile strength MD	N/g (50 mm)	2.23	computed from 1 and 3
9	tensile strength CD	N/g (50 mm)	0.93	computed from 1 and 3
10	tear strength MD	N	5,98	EN 13937-2
11	tear strength CD	N	9,55	EN 13937-2

Claims

1. Support for an abrasive comprising a nonwoven fabric being a through-air thermally bonded nonwoven fabric comprising multicomponent binder fibers.

2. Support according to claim 1 **characterised by** an air permeability of the nonwoven fabrics, measured at 200Pa being in the range of more than 100 l/m^2s and/or by a density in the range from 0.05 to 0.5 g/cm^2.

3. Support according to claim 1 or 2 **characterised by** a maximum tensile force MD of more than 110 N/50 mm and/or by a maximum tensile force CD of higher than 50 N/50 mm and/or by a ratio between tensile force MD and tensile force CD of at least 1.75:1.

4. Support according to one or more of the preceding claims **characterised by** a breaking extension of less than 35% elongation at break MD and/or of more than 30% elongation at break CD.

5. Support according to one or more of the preceding claims **characterised by** a tenacity of higher than 1.6 N/g (50 mm) MD and/or by a tenacity higher than 0.8 N/g (50 mm) CD.

6. Support according to one or more of the preceding claims **characterised in that** it comprises no artificial embossing on its surface.

7. Support according to one or more of the preceding claims **characterised in that** the multicomponent binder comoprise sheath-core binder fibers wherein the sheet preferably comprises polyolefin, in particular polyethylene, polypropylene, copolymers of polypropylene, polybutylene terephthalate, polydicyclohexilene terephthalate, polyamide 6 and the core preferably comprises polyolefin, in particular polypropylene, polyethylene terephthalate, poly-Lactic acid, polyamide 6.6.

8. Support according to one or more of the preceding claims **characterised in that** the sheath contains polypropylene and the core contains polyester.

9. Support according to one or more of the preceding claims **characterised in that** the sheath-core binder fibers have a titer of from 3 to 50 μm and/or a length of 30 mm to 65 mm.

10. Support according to one or more of the preceding claims **characterised by** an average thickness in the range from 0.1 to 1.2 mm.

11. Support according to one or more of the preceding claims **characterised in that** the the nonwoven contains the sheath-core fibers in an amount of at least 60%.

12. Use of a support according to one or more of the preceding claims in the manufacture of an abrasive article, in

particular in the manufacture of an abrasive belt, of an abrasive disc or of an abrasive sheet.

13. Method for manufacturing a support for an abrasive comprising the steps of:

(A) producing and/or providing a fibrous web and/or a prebonded nonwoven fabric comprising multicomponent binder fibers;
(B) through-air thermal bonding the fibrous web and/or the prebonded nonwoven fabric, preferably in an hot through-air oven, to activate and bond the multicomponent binder fibers to form a through-air thermally bonded nonwoven fabric useful as support for an abrasive.

14. Method according to claim 13 **characterised in that** it further comprises a step (C) in which the thickness of the through-air thermally bonded nonwoven fabric is adjusted while the binding fibers are still active, by passing the through-air thermally bonded nonwoven fabric through a calibration unit.

15. Method according to claim 13 or 14 **characterised in that** it does not comprise any hot roll calandering step.

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EUROPEAN SEARCH REPORT

Application Number
EP 16 19 0322

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2004/242108 A1 (RUSSELL STEPHEN J [GB] ET AL) 2 December 2004 (2004-12-02) * paragraphs [0038], [0058]; figure 1 * -----	1-15	INV. B24D11/02
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TECHNICAL FIELDS SEARCHED (IPC)

B24D

1

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	7 March 2017	Koller, Stefan

CATEGORY OF CITED DOCUMENTS

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REFERENCES CITED IN THE DESCRIPTION

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- WO 2014137972 A1 **[0012]**