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(54) **SUBSTRAT NON TISSE ET MOQUETTE LE COMPRENANT**

(54) **NONWOVEN BACKING AND CARPET COMPRISING SAME**

(57) The invention pertains to a nonwoven primary carpet backing comprising thermoplastic polymer filaments or fibres bonded by means of a binder polymer, wherein the backing comprises at least a distinguishable thermoplastic woven layer, a distinguishable thermoplastic continuous layer, or a distinguishable nonwoven layer also comprising filaments or fibres bonded by means of a binder polymer, which layer reduces the delamination strength of the backing, measured in accordance with DIN 54310, by at least 30 % and preferably by at least 50 %, with respect to the same backing without the said distinguishable layer. Although the breaking strength of the untufted backing according to the invention is lower than that of untufted prior art backings, the tufted backing according to the invention actually has a higher breaking strength and elongation than tufted prior art backings.

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(54) Title: NONWOVEN BACKING AND CARPET COMPRISING SAME		
(57) Abstract The invention pertains to a nonwoven primary carpet backing comprising thermoplastic polymer filaments or fibres bonded by means of a binder polymer, wherein the backing comprises at least a distinguishable thermoplastic woven layer, a distinguishable thermoplastic continuous layer, or a distinguishable nonwoven layer also comprising filaments or fibres bonded by means of a binder polymer, which layer reduces the delamination strength of the backing, measured in accordance with DIN 54310, by at least 30 % and preferably by at least 50 %, with respect to the same backing without the said distinguishable layer. Although the breaking strength of the untufted backing according to the invention is lower than that of untufted prior art backings, the tufted backing according to the invention actually has a higher breaking strength and elongation than tufted prior art backings.		

Nonwoven backing and carpet comprising same.

The invention pertains to a nonwoven primary carpet backing comprising thermoplastic polymer filaments or fibres bonded by means of a binder polymer.

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The manufacture of nonwoven primary carpet backings, with filaments or fibres of a thermoplastic polymer being bonded with the aid of, e.g., a thermoplastic polymer bonding agent, has been known for many years, e.g., from US 4,842,915. This publication relates to a spunbonded fabric consisting of polyester matrix filaments, which fabric is suitable to be used as a tufting base for carpets and is strengthened by means of a binding component in the form of softenable filaments, fibres, a powder and/or fine-grained granulates. The binding component consists of polypropylene with a melting range which is at least 90°C below the melting range of the polyester matrix filaments or fibres.

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Over the years, nonwoven primary carpet backings have been improved constantly in order to meet the ever more stringent demands of carpet manufacturers and consumers. Of particular importance are increasing the breaking strength and elongation at break after tufting, increasing the tear resistance after tufting and coating, generally improving the appearance of the resulting carpet, allowing effective mending of imperfections which occur during tufting, and facilitating tuftability, i.e. by providing lower tuft-needle penetration resistance and reduced needle deflection during tufting, avoiding rough back stitch, increasing stitch lock, and reducing noise during tufting.

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It is an object of the present invention to provide the said improvements. This is achieved in the carpet backings as described in the first paragraph, wherein the backing comprises at least a distinguishable thermoplastic woven layer, a thermoplastic continuous layer, or a nonwoven layer comprising filaments or fibres bonded by means of a binder polymer, which layer reduces the delamination strength of the backing, measured in accordance with DIN 54310,

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by at least 30 per cent, preferably at least 50 per cent, with respect to the same backing without the said distinguishable layer.

In general, tufting reduces the breaking strength of (high initial breaking
5 strength) nonwoven backings because of the disruption and/or damage caused
by the tufting needles. Also, it was found that a decrease in delamination
strength achieved through a (substitutive or additional) distinguishable layer
resulted in a substantial decrease in tensile breaking strength of the backing,
which decrease at first may seem disadvantageous. However, it appeared that
10 the deliberate reduction in breaking strength in accordance with the present
invention (i.e. by decreasing the delamination strength of the backing)
suppresses the reduction in breaking strength and elongation resulting from
tufting. Although the breaking strength of the *untufted* backing according to the
invention is lower than that of *untufted* prior art backings, the *tufted* backing
15 according to the invention actually has a higher breaking strength and
elongation than *tufted* prior art backings. This phenomenon will be illustrated
and substantiated by the examples hereinbelow.

The distinguishable layer, which on the one hand is responsible for the
20 reduction of the delamination strength (e.g., through higher mobility of the
filaments or fibres and/or by reduced adherence to the other layer(s)) and on
the other hand should provide sufficient coherence of the laminate to allow
(rough) handling and processing, can take many forms, such as a dry-laid, a
wet-laid, or a meltblown nonwoven. Other examples are woven fabrics and
25 continuous layers such as a film or foil. However, thermally or chemically
(spun)bonded nonwovens, which may in addition be needle-punched or hydro-
entangled, are preferred.

It is noted that European patent application EP 822283 concerns a spunbonded
30 web comprising two types, (a) and (b), of bicomponent sheath/core filaments
having a polyethylene terephthalate core which has a melting temperature

JP 09291457 concerns a laminate comprising web layers of a composite long fibre of side-by-side type or the sheath/core type composed of two kinds of polymers with different melting points, i.e. high-density polyethylene and high-density polypropylene. The amount of high density polyethylene is different in
5 each web layer. The laminate has super bulkiness, feel, and tensile strength.

JP 06128855 discloses a three layer structure nonwoven fabric comprising a surface layer, an intermediate layer, and a backside layer. The surface layer and the backside layer are composed of a conjugate type long fibre consisting
10 of a thermoplastic polymer component A and a thermoplastic polymer component B which is incompatible with A. The long fibres are bonded by the fusion bonding of component A. The intermediate layer contains fibre A consisting of only A and fibre B consisting of only B, which fibres are formed by dividing the conjugate type long fibre. Fibre A is entangled with fibre B without
15 substantially being fused.

US 5,660,910 discloses a spun-bonded nonwoven composite web comprising randomly laid continuous matrix filaments having an average linear density per filament less than 25 denier; and continuous reinforcement filaments having an
20 average linear density which exceeds 20 denier and exceeds the average linear density per filament of said matrix filaments by at least 10 denier; wherein said continuous matrix filaments are at least partially bonded together to form said web and said continuous filament are emeshed in said web without substantially bonding to other filaments in said web such that when the web is torn in
25 accordance with ASTM D 2261-83, more than three reinforcement filaments are pulled out more than 1 cm from the web into the tear.

According to the examples of US 5,660,910 fabrics consisting of 13.5 denier per filament yarn as matrix yarn reinforced with a single 300 denier nylon 6.6 or polyethylene terephthalate monofilament as reinforcement yarn after tufting and
30 molding exhibited an increased tear strength and showed pulled reinforcement behaviour.

- Within the framework of the invention, primary carpet backings consisting of two distinguishable layers are a viable option, but it is preferred that the layer which is responsible for the reduction in delamination strength is embedded (as an inner layer) in the backing, which thus comprises at least three distinguishable layers. In such a structure the outer layers can move relative to one another (locally), which helps holding of tufted yarn, and provide the required stability and other mechanical properties of the backing.
- 10 It is also preferred that the backing is thermally bonded and that each of the layers comprises a (thermoplastic) binder polymer and filaments or fibres of a thermoplastic polymer, wherein the concentration and/or the bonding temperature of the binder polymer in the layer responsible for the reduction in delamination strength is at least 20, preferably at least 30 per cent lower and/or
- 15 4°C, preferably at least 6°C higher than that of the binder polymer in the other layer or layers. By providing a lower degree of bonding, the delamination strength is effectively reduced and holding of the tufted yarn, also referred to as "stitch lock" or "stitch holding," is further enhanced owing to the greater mobility of the filaments or fibres in the said layer.
- 20 Alternatively, selecting a binder polymer which, to a carefully selected degree, is incompatible with the binder polymer in the adjacent layer(s) will reduce bonding to the said layer(s), resulting in a lower delamination strength.
- 25 The melting or softening temperature of the binder polymer is preferably 15 to 20°C lower than that of the filaments or fibres, but in some polymer combinations a smaller difference may be advisable or even essential.
- 30 When the binder polymer is part of the filaments or fibres (with the binder polymer preferably forming at least part of the outer surface of the filaments or fibres) - the term used in that case is bicomponent filaments or fibres - it will be

homogeneously distributed throughout the as yet unbonded nonwoven as the filaments or fibres are laid. Because of this homogeneous distribution there will be bonding agent at (virtually) all points where the filaments or fibres come into contact. As a result, there will be a large number of bonding points and, in
5 addition, the guarantee of an effective supply of bonding agent to the points of contact during the thermal bonding process.

Bicomponent fibres and filaments or fibres of the core/sheath or the side-by-side type in particular are highly suited to be used in the nonwovens according
10 to the invention.

Another very suitable method for adding the bonding agent to the thermoplastic filaments or fibres is by using a "bonding filament" or "bonding fibre" which is made up entirely or for the most part of the binder polymer. These bonding
15 filaments or bonding fibres are laid together with the other filaments or fibres, so that here also a homogeneous distribution of the bonding agent throughout the as yet unbonded nonwoven is obtained. Such a nonwoven is sometimes referred to as a "bifilament nonwoven."

20 For that matter, the invention is not restricted to the forms of the binder polymer described above. It is also possible for the bonding agent to be added to the unbonded filaments or fibres in the form of, e.g., a powder, an emulsion, or as fibrils.

25 Examples of polymers and copolymers which are highly suitable for use as a binder polymer in the nonwoven according to the invention are polyamide 6, copolyamides, copolyesters, polypropylene, copolypropylene, polyethylene, and mixtures of one or more of these materials. An example of another suitable material is polybutylene terephthalate. The binder may also be added in the
30 form of monomers which are cured (i.e., polymerised) during bonding.

Amongst others, polyester is highly appropriate for the thermoplastic filaments or fibres. Further suitable materials include, but are not restricted to, polyamide 6, polyamide 46, polyamide 66, copolyamides, and copolyesters.

- 5 If the layer responsible for the reduction in delamination strength is a nonwoven layer, the volume ratio of the binder polymer to the filament or fibre forming polymer is preferably lower than 20:80, more preferably lower than 15:85. In the other nonwoven layer or layers, the said ratio is preferably within the range from 20:80 to 50:50, more preferably in the range from 20:80 to 35:65.

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The linear density of the filaments or fibres is in a range from 5 to 20 dtex. At a linear density below about 1 dtex, the nonwoven material is rather dense (especially at higher basic weights) resulting in more damage to the backing and an increased number of needle deflections during tufting. At a linear density
15 in excess of about 25 dtex, the nonwoven material is very "open" (especially at lower basic weights) and stitch holding is reduced.

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The total basic weight of the carpet backings according to the present invention is preferably at least 50 g/m², more preferably at least 70 g/m². It is further preferred that the basic weight of the layer responsible for the reduction in delamination strength is less than 50 per cent, more preferably less than 40 per cent of the total basic weight of the carpet backing.

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Although the delamination strength of the backing of the invention is defined relative to backings which do not contain the (substitutive or additional) distinguishable layer described above, it is usually preferred that the delamination strength, measured in accordance with DIN 54310 is lower than 6 N.

The invention further pertains to a carpet comprising the nonwoven backing described above. Such a carpet exhibits increased strength and elongation and is more even.

5 The aforementioned bonding temperature is the temperature at which the (binder) polymer melts and/or softens and bonding points between contacting filaments or fibres are established. This bonding temperature can be manipulated in various ways, e.g., by selecting a binder polymer that has a different melting temperature and/or Melt Flow Index or meltviscosity.

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The melting temperature is measured with the generally known DSC (Differential Scanning Calorimetry) technique, where a specimen of about 5 mg (which is in a nitrogen atmosphere) is heated at a rate of 10°C per minute. The peak temperature of the melt endotherm obtained using this DSC technique is referred to within the framework of this invention as the "melting temperature."

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The term "distinguishable" indicates that, although some mixing and/or interlocking of the filaments or fibres in the different layers cannot be avoided in nonwovens, the transition from one layer to the next is essentially not gradual. It is preferred that each of the layers is substantially homogeneous (i.e., exhibits no large gradients in composition over its thickness) and/or consists of a single type of filaments or fibres or a homogeneous blend of more than one type of filaments or fibres.

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25 The reduction in "concentration" of binder polymer in a layer can be achieved in various ways, for instance by employing sheath/core filaments or fibres with a lower sheath/core ratio or by blending in less "bonding filament" or "bonding fibre".

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Examples

All samples were spunbonded using commonly known technology for depositing three distinguishable layers of filaments on top of each other on a collector surface. In each sample, the basic weight of the backings amounted to 120
5 g/m². The filaments were all of the sheath/core type, having a polyethylene terephthalate core and a polyamide 6 sheath. After deposition the samples were thermally bonded.

Samples 1a and 1b, i.e. the controls, consisted of three identical layers, each
10 having a basic weight of 40 g/m² and consisting of filaments having a 26/74 sheath/core volume ratio and a linear density of 9 dtex. Samples 2a and 2b, i.e. in accordance with the invention, consisted of two identical outer layers of filaments having a 26/74 sheath/core volume ratio and an inner layer of
15 all three layers had a basic weight of 40 g/m². Sample 3, also in accordance with the present invention, consisted of two identical outer layers, each having a basic weight of 36 g/m² and consisting of filaments having a 26/74 sheath/core volume ratio and a linear density of 9 dtex, and an inner layer having a basic
20 weight of 48 g/m² and consisting of filaments having a 10/90 sheath/core volume ratio and a linear density of 6 dtex. Samples 1a and 2a were produced at a lower bonding temperature than samples 1b, 2b, and sample 3.

The following properties of the samples were determined: Breaking strength and elongation at break before tufting measured in accordance with
25 DIN 53857-2; Breaking strength and elongation at break after tufting measured in accordance with ASTM D2646; Delamination strength measured in accordance with DIN 54310; and Appearance based on the scores of ten experts the tufted samples were qualified as "even" or "uneven."

Table 1 Properties before tufting

Sample	Strength (MD/CMD)/2 in N/5cm	Elongation (MD/CMD)/2 in %	Delamination strength in N
1a control	334	22	7.4
1b control	324	22	11.6
2a invent.	194	11	2.3
2b invent.	203	12	4.0
3 invent.	166	9	5.3

Table 2 Properties after tufting

Sample	Strength (MD/CMD)/2 in lbs.	Elongation (MD/CMD)/2 in %	Appearance
1a control	112	65	uneven
1b control	105	64	uneven
2a invent.	138	76	even
2b invent.	136	72	even
3 invent.	144	73	even

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These experiments clearly show that, although the backings in accordance with the invention have reduced strength and elongation before tufting (Table 1; about 35 to 60% lower when compared to the control backing), they exhibit considerably improved strength and elongation after tufting (Table 2; up to approximately 40% higher when compared to the control backing). Also, the appearance of carpets produced with the backings according to the invention are much more even than carpets produced with the controls.

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Claims

1. A nonwoven primary carpet backing comprising thermoplastic polymer filaments or fibres bonded by means of a binder polymer, characterised in that the backing comprises at least a distinguishable thermoplastic woven layer, a distinguishable thermoplastic continuous layer, or a distinguishable nonwoven layer also comprising filaments or fibres bonded by means of a binder polymer, which layer reduces the delamination strength of the backing, measured in accordance with DIN 54310, by at least 30% and preferably by at least 50%, with respect to the same backing without the said distinguishable layer and that the linear density of the filaments or fibres is in the range from 5 to 20 dtex
2. The nonwoven backing according to claim 1 wherein the said layer is embedded in the backing, which thus comprises at least three distinguishable layers.
3. The nonwoven backing according to claim 1 or 2 wherein each of the said layers comprises thermoplastic polymer filaments or fibres thermally bonded by means of a binder polymer and wherein the concentration and/or the bonding temperature of the binder polymer in the layer which reduces the delamination strength of the backing is at least 20%, preferably at least 30% lower and/or at least 4°C, preferably at least 6 °C higher than that of the binder polymer in the other layer or layers.
4. The nonwoven backing according to any one of the preceding claims wherein the binder polymer in at least one of the layers forms at least part of the outer surface of the filaments or fibres.
5. The nonwoven backing according to claim 4 wherein filaments or fibres are sheath/core filaments or fibres with the binder polymer forming the sheath.

6. The nonwoven backing according to any one of the preceding claims wherein the binder polymer in at least one of the layers is selected from the group consisting of polyamide 6, copolyamides, polybutylene terephthalate, copolyesters, polypropylene, copolypropylene, polyethylene, and mixtures of one or more of these materials.
- 5
7. The nonwoven backing according to any one of the preceding claims wherein the thermoplastic polymer building the filaments or fibres in at least one of the layers is selected from the group consisting of polyester, polyamide 6, polyamide 46, polyamide 66, copolyamides, and copolyesters.
- 10
8. The nonwoven backing according to any one of the preceding claims having a delamination strength lower than 6 N.
- 15
9. Carpet comprising the nonwoven primary backing according to any one of the preceding claims.