(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 009 553 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
20.04.2016 Bulletin 2016/16

(51) Int Cl.:
D05C 17/02 *(2006.01)* ***D06N 7/00*** *(2006.01)*

(21) Application number: **14195815.7**

(22) Date of filing: **02.12.2014**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **15.10.2014 EP 14189015**

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(54) Primary carpet backing and tufted carpet backing

(57) A primary carpet backing is provided comprising at least one non-woven layer, wherein the at least one non-woven layer comprises fibers which contact one another at contact zones, wherein the fibers comprise i) first fibers which are manufactured from a first fiber forming polymer, and second fibers which are manufactured from a second fiber forming polymer, or ii) multicomponent fibers which comprise at least a first component manufactured from a first component forming polymer and at least a second component manufactured from a second component forming polymer, characterized in that both the first fiber forming polymer and the first component forming polymer is at least one polyamide, both the second fiber forming polymer and the second component forming polymer is at least one bonding polymer, the first fibers are melt bonded at their contact zones with the second fibers by a solidified melt, or the multicomponent fibers are melt bonded at their contact zones by a solidified melt, and the solidified melt is a solidified melt of the at least one bonding polymer, wherein the bonding polymer is obtained by polymerization of an olefin having a terminal or a non-terminal double bond. Furthermore a tufted backing is provided comprising pile yarns and the primary carpet backing.

EP 3 009 553 A1

Description

[0001] The work leading to this invention has received funding from the European Union Seventh Framework Program under grant agreement n° 280751.

[0002] The present invention pertains to a primary carpet backing and a tufted carpet backing.

[0003] Primary carpet backings and tufted carpet backings are known. For example, a known primary carpet backing consists of a nonwoven layer which consists of core/sheath bicomponent filaments with a polyester core and a polyamide sheath. Furthermore, tufted carpet backings are known which are obtained by tufting the primary carpet backing with pile yarns to form tufts. Such tufted primary carpet backings already exhibit a low thermal shrinkage, high breaking strength and high elongation at break. This combination of properties is highly appreciated in applications of the tufted backings, for example as carpet tiles, in broadloom or dust control mats, wherein the tufted carpet backings have to be as much as possible resistant against shrinkage over a wide range of temperatures in order to as much as completely cover the desired area, for example the floor of an office building. However, there is an everlasting demand for tufted carpet backings exhibiting an even lower thermal shrinkage, higher breaking strength and higher elongation at break than the known tufted carpet backings described above.

[0004] Therefore, the object of the present invention is to provide a primary carpet backing which provides improved properties in a tufted carpet backing, in particular lower thermal shrinkage, higher breaking strength and higher elongation at break.

[0005] Said object is achieved by a primary carpet backing comprising at least one nonwoven layer, wherein the at least one nonwoven layer comprises fibers which contact one another at contact zones, wherein the fibers comprise

i) first fibers which are manufactured from a first fiber forming polymer, and second fibers which are manufactured from a second fiber forming polymer, or
ii) multicomponent fibers which comprise at least a first component manufactured from a first component forming polymer and at least a second component manufactured from a second component forming polymer,
characterized in that
both the first fiber forming polymer and the first component forming polymer is at least one polyamide, both the second fiber forming polymer and the second component forming polymer is at least one bonding polymer, the first fibers are melt bonded at their contact zones with the second fibers by a solidified melt, or the multicomponent fibers are melt bonded at their contact zones by a solidified melt, and the solidified melt is a solidified melt of the at least one bonding polymer, wherein the bonding polymer is obtained by polymerization of an olefin having a terminal or a non-terminal double bond.

[0006] Surprisingly, although the primary carpet backing according to the invention as such exhibits a significantly higher thermal shrinkage than a known comparative primary carpet backing, a tufted carpet backing comprising pile yarns and the primary carpet backing according to the invention surprisingly exhibits

- lower thermal shrinkage both in machine direction (MD) and in cross machine direction (CMD),
- higher breaking strength, and
- higher elongation at break both in MD and CMD

than a known comparative tufted carpet backing.

[0007] Furthermore, if the pile yarns of the tufted carpet backing and the first fiber forming polymer or the first component forming polymer both consist of a polyamide, recycling of such a tufted backing is facilitated, because said polyamides can be depolymerized into their monomers, which in turn can be used - without a costly separation procedure to remove undesired monomers - to synthesize a new polyamide. Preferably, the pile yarns of the tufted carpet backing and the first fiber forming polymer or the first component forming polymer consist of the same polyamide to further improve the efficiency of the depolymerization process.

[0008] The nonwoven layer, also called web, may be manufactured with any of the technologies known for said purpose, e.g. with mechanical, pneumatic or wet processing or with electrostatic systems or by using a polymer to web process or with the aid of filament entanglements or with split film methods. Examples for said technologies are e.g. given in chapters 4 and 5 of "Nonwoven Fabrics", edited by W. Albrecht, H. Fuchs and W. Kittelman, Wiley-VCH Verlag GmbH & Co KGaA, ISBN 3-527-30406-1.

[0009] The primary carpet backing according to the invention comprises an embodiment i), wherein first fibers which have been manufactured from at least one polyamide as the first fiber forming polymer have been brought into contact with second fibers which have been manufactured from at least one bonding polymer as the second fiber forming polymer. During manufacturing of the nonwoven layer said first fibers and said second fibers contact one another at contact zones and the first fibers are melt bonded at their contact zones with the second fibers by a solidified melt of the at least one

bonding polymer. This means that at the contact zones of the first fibers and the second fibers, the second fibers have been at least partially molten to obtain a melt of the at least one bonding polymer at said contact zones and said melt after solidification serves to melt bond first fibers and second fibers.

[0010] Furthermore, the primary carpet backing according to the invention comprises an embodiment ii), wherein multicomponent fibers have been manufactured from at least one polyamide as the first component forming polymer and from at least one bonding polymer as the second component forming polymer. Said multicomponent fibers have been brought into contact with one another at contact zones during manufacturing of the nonwoven layer and have been melt bonded at their contact zones with one another by a solidified melt of the at least one bonding polymer. This means that at the contact zones of the multicomponent fibers the second component has been at least partially molten to obtain a melt of the at least one bonding polymer at said contact zones and said melt after solidification serves to melt bond the multicomponent fibers.

[0011] Consequently, for the primary carpet backing according to the invention it is necessary that the bonding polymer exhibits a melting temperature $T_{m(bp)}$ so that the bonding polymer can at least partially melt at the respective contact zones and after its solidification serves to melt bond the first fibers and second fibers in embodiment i) or the multicomponent fibers of embodiment ii). The polyamide does not need to have a melting temperature. Rather, for the polyamide it is sufficient that it remains stable during contact with the melt of the bonding polymer. However, if the polyamide exhibits a melting temperature $T_{m(pa)}$, it is necessary that the relation $T_{m(pa)} > T_{m(bp)}$ is fulfilled.

[0012] In a preferred embodiment of the primary carpet backing according to the invention the melting temperature $T_{m(bp)}$ of the bonding polymer ranges from 80 °C to 200 °C, especially preferred from 100 °C to 180 °C, however with the restriction that the relation $T_{m(pa)} > T_{m(bp)}$ is fulfilled.

[0013] In a further preferred embodiment of the primary carpet backing according to the invention the melting temperature $T_{m(pa)}$ of the polyamide ranges from 180 °C to 300 °C, especially preferred from 200 °C to 270 °C, however with the restriction that the relation $T_{m(pa)} > T_{m(bp)}$ is fulfilled.

[0014] In the primary carpet backing according to the present invention the fibers may exhibit any cross-sectional shape. Preferably, the cross-sectional shape of the fibers is round or elliptical. However, it is also possible that the cross-sectional shape of the fibers is triangular, rectangular or multilobal, like bilobal or trilobal. Selection of a certain cross-sectional shape for the fibers allows to fine-tune the bonding strength between said fibers.

[0015] In a preferred embodiment of the primary carpet backing according to the invention the polyamide is at least one synthetic thermoplastic homo-polyamide, at least one synthetic thermoplastic co-polyamide or a mixture thereof.

[0016] In a further preferred embodiment of the primary carpet backing according to the invention the thermoplastic homo-polyamide exhibits a recurring unit of formula (I)

$$-[-NH-CO-(-CR^1R^2-)_n]- \quad (I),$$

wherein n is an integer ranging from 1 to 22, preferably from 3 to 12, and
R^1 and R^2 independently from one another represent H or a linear alkyl group of formula $-(-CH_2)_x-CH_3$, wherein x is an integer ranging from 0 to 5,
or of formula (II)

$$-[-NH-(CR^3R^4-)_m-NH-CO-(CR^5R^6-)_p-CO-]- \quad (II),$$

wherein m and p are integers, and independently from one another range from 1 to 22, preferably from 3 to 12,
R^3 and R^4 independently from one another represent H or a linear alkyl group of formula $-(-CH_2)_y-CH_3$ wherein y is an integer ranging from 0 to 5, and R^5 and R^6 independently from one another represent H or a linear alkyl group of formula $-(-CH_2)_z-CH_3$, wherein z is an integer ranging from 0 to 5.

[0017] In the thermoplastic homo-polyamide of formula (I) R^1 preferably represents H, more preferably R^1 and R^2 both represent H so that the homo-polyamide is a linear polyamide.

[0018] In the thermoplastic homo-polyamide of formula (II) R^3 and/or R^5 preferably represents H, more preferably R^3, R^4, R^5 and R^6 all represent H so that the homo-polyamide is a linear polyamide.

[0019] The homo-polyamide exhibiting a recurring unit of formula (I) may be obtained from the polycondensation of the respective aminocarboxylic acid. The homo-polyamide exhibiting a recurring unit of formula (II) may be obtained from the polycondensation of the respective diamine and dicarboxylic acid.

[0020] In an especially preferred embodiment of the primary carpet backing according to the invention the homo-polyamide is polyamide 6 (PA 6), polyamide 6.6, polyamide 4.6 (PA 4.6), polyamide 4.10 (PA 4.10), or polyamide 4.12 (PA 4.12), or any mixture thereof.

[0021] In the further preferred embodiment of the primary carpet backing according to the invention, wherein the polyamide is at least one synthetic thermoplastic co-polyamide, the co-polyamide, if compared with the homo-polyamide, additionally contains in its polymer chain a residue which is preferably obtained either from copolymerizing a further

aminocarboxylic acid, a further diamine and/or a further dicarboxylic acid.

[0022] In the above described preferred embodiments of the primary carpet backing according to the invention the polyamide is an aliphatic polyamide.

[0023] However, it is possible that the polyamide may be a semi-aromatic polyamide, i.e. a polyamide having aliphatic and aromatic moieties in its polymer chain. However, for the purposes of the primary carpet backing according to the invention it is preferred, that the content of aromatic moieties in the semi-aromatic polyamide is limited to a value, at which the semi-aromatic polyamide is still thermoplastic.

[0024] In a further preferred embodiment of the primary carpet backing according to the invention the bonding polymer is obtained by polymerization of an olefin which is an alkene having one terminal double bond so that the bonding polymer is an polyolefin which exhibits a recurring unit of formula (III)

$$-[-CH_2-CR^7R^8-]- \qquad \text{(III)},$$

wherein R^7 and R^8 independently from one another represent H or CH_3.

[0025] In a further preferred embodiment of the primary carpet backing according to the invention the polyolefin exhibits a melt flow index ranging from 3 to 70 g/10 min, especially preferred from 5 to 40 g/10 min, in particular 10 to 30 g/10 min. The melt flow index is determined in accordance with ISO 1133 at 230°C/2.16 kg.

[0026] In an especially preferred embodiment of the primary carpet backing according to the invention the polyolefin is

- polyethylene, for example low-density polyethylene (LDPE) or linear low-density polyethylene (LLDPE), or
- polypropylene.

[0027] In a further preferred embodiment of the primary carpet backing according to the invention the bonding polymer is obtained by polymerization of an alkene having one non-terminal double bond, for example 2-butene or 2-, 3- or 4-octene.

[0028] Furthermore, the polarity of the polyolefin may be increased by reactive modification with a molecule such as maleic anhydride, acrylic acid, or an epoxy, to provide improved adhesion to the polyamide polymer of the first fiber forming polymer or of the first component forming polymer and/or to improve dye-ability of the polyolefin.

[0029] In a further preferred embodiment of the primary carpet backing according to the invention the bonding polymer is obtained by random-copolymerization of ethylene and propylene so that the bonding polymer is a random copolymer of ethylene and propylene.

[0030] In a further preferred embodiment of the primary carpet backing according to the invention the bonding polymer is obtained by block-copolymerization of ethylene and propylene so that the bonding polymer is a block-copolymer of ethylene and propylene.

[0031] Within the scope of the present invention it is understood that the term fibers refers to both staple fibers and filaments. Staple fibers are fibers which have a specified, relatively short length in the range of 2 to 200 mm. Filaments are fibers having a length of more than 200 mm, preferably more than 500 mm, more preferably more than 1000 mm. Filaments may even be virtually endless, for example when formed by continuous extrusion and spinning of a filament through a spinning hole in a spinneret. Preferably, the fibers of the primary carpet backing according to the invention are filaments to further improve the breaking strength and/or tear strength of the primary carpet backing and/or of the tufted carpet backing.

[0032] The linear density of the fibers may vary, but preferably ranges from 1 to 25 dtex, more preferably 2 to 20 dtex, most preferably 5 to 15 dtex to further optimize the tufting behavior and/or to further improve breaking strength and elongation at break in the primary carpet backing and/or in the tufted carpet backing. The linear density of the fibers is expressed as dtex, which is the weight of a fiber per 10000 meter length. In an embodiment, the primary carpet backing may comprise a mixture of fibers having different linear densities.

[0033] In a further preferred embodiment of the primary carpet backing according to the invention the at least one nonwoven layer comprises the first fibers and the second fibers in a weight ratio $W_{\text{first fibers}} : W_{\text{second}}$ fibers, and $w_{\text{first fibers}} : W_{\text{second}}$ fibers ranges from 40 : 60 to 90 : 10, preferably from 50 : 50 to 90 : 10, especially preferred from 70 : 30 to 80 : 20.

[0034] In a further preferred embodiment of the primary carpet backing according to the invention the at least one nonwoven comprises the multicomponent fibers, wherein the multicomponent fibers exhibit a weight ratio of the first component to the second component $w_{\text{first component}} : W_{\text{second component}}$, and $w_{\text{first component}} : w_{\text{second component}}$ ranges from 40 : 60 to 90 :10, preferably from 50 : 50 to 90 : 10, especially preferred from 70 : 30 to 80 : 20.

[0035] In a further preferred embodiment of the primary carpet backing according to the invention the multicomponent fibers are bicomponent fibers, wherein the bicomponent fibers are bicomponent filaments, wherein

α) the bicomponent filaments exhibit a core/sheath geometry, wherein the first component represents the core and the second component represents the sheath, or

β) the bicomponent filaments exhibit a side by side geometry, wherein the first component represents a side 1 and the second component represents a side 2, or

γ) the bicomponent filaments exhibit an islands in the sea geometry wherein the first component represents the islands and the second component represents the sea.

δ) the bicomponent filaments exhibit a segmented pie geometry of alternating segments of the first component and segments of the second component.

[0036] Preferably, the bicomponent filaments exhibit a core/sheath geometry, wherein the first component represents the core and the second component represents the sheath.

[0037] In a further preferred embodiment of the primary carpet backing according to the invention the bicomponent filaments exhibit a core/sheath geometry, wherein the core consists of polyamide 6 (PA 6) or polyamide 6.6 (PA 6.6) and the sheath consists of polyethylene or polypropylene. In this preferred embodiment a weight ratio of the core to the sheath w_{core} : w_{sheath} ranges from 40 : 60 to 90 : 10, preferably from 50 : 50 to 90 : 10, especially preferred from 70 : 30 to 80 : 20.

[0038] As already explained, the primary carpet backing according to the invention exhibits a significantly higher thermal shrinkage than a known comparative primary carpet backing. However, after tufting, the tufted carpet backing comprising pile yarns and the primary carpet backing according to the invention surprisingly exhibits

- lower thermal shrinkage both in machine direction (MD) and in cross machine direction (CMD),
- higher breaking strength, and
- higher elongation at break both in MD and CMD

than a known comparative tufted backing.

[0039] Therefore, a tufted carpet backing comprising pile yarns and a primary carpet backing according to the invention is also part of the present invention.

[0040] In a preferred embodiment of the tufted carpet backing according to the invention, the pile yarns and the first fibers or the first component of the multicomponent fibers consists of an aliphatic polyamide. Preferably, the pile yarns of the tufted carpet backing and the first fiber forming polymer or the first component forming polymer consist of the same polyamide to further improve the efficiency of the depolymerization process.

[0041] In a further preferred embodiment of the primary carpet backing according to the invention the pile yarns consist of polyamide 6 (PA 6) or polyamide 6.6 (PA 6.6), the primary carpet backing consists of at least one non-woven layer which consists of bicomponent filaments exhibiting a core/sheath geometry, wherein the core consists of polyamide 6 (PA 6) or polyamide 6.6 (PA 6.6) and the sheath consists of polyethylene or polypropylene.

[0042] In the present invention the following measuring methods were applied:

To determine the thermal shrinkage of the primary carpet backing or the tufted carpet backing a sample of 490 mm by 490 mm is die-cut, 4 hollow rivets are inserted into the sample forming a rectangular pattern of approx. 400 mm by 400 mm. The exact distance between the rivets in the sample is determined, preferably by an optical system with a video camera. The sample is subsequently placed in an oven at 140°C, free of tension, for 15 minutes. After removed from the oven, the sample is allowed to cool down to room temperature, after which the distance between the rivets is determined again, and the shrinkage can be calculated. The thermal shrinkage is reported as the average thermal shrinkage of 5 samples.

[0043] Breaking strength and elongation at break of the primary carpet backing and the tufted carpet backing is determined according to DIN EN 29073-3 (August 1992) with a clamping distance of 200 mm, and a clamp speed of 200 mm/min.

[0044] The present invention is illustrated in more detail in the following examples and comparative example.

Example 1

[0045] A primary carpet backing was prepared consisting of a nonwoven layer of fibers.

[0046] The nonwoven layer of fibers was formed of bicomponent core-sheath filaments, which were spun and wound on bobbins in the form of multifilament yarns followed by the steps of unwinding the multifilament yarns and laying the (individual) filaments down on a conveyor belt as a web of filaments and thermally consolidating the web by through air bonding to form the nonwoven layer of fibers.

[0047] The core component of the core-sheath filaments of the nonwoven layer of fibers represented 76 wt.% of the core-sheath filaments and consisted of polyamide-6 (PA6) having a melting temperature of 220°C, and the sheath component represented 24 wt.% of the core-sheath filaments and consisted of polypropylene having a melting temperature of 165°C and a Melt Flow Index of 25 g/10 min. The fibers were spun using a melt spinning installation using a

bicomponent spinneret, a blow box, a spinning duo, a stretching duo and a winder. The yarns had a linear density of 1800 dtex and consisted of 124 individual filaments. The mechanical properties of the yarns were determined using a tensile tester according to DIN 885, with two modifications. The testing speed was set to 500 mm/min and the grip distance was set to 250 mm. The mechanical properties of the multifilament yarns are summarized in Table 1.

[0048] The primary carpet backing had a weight of 100 g/m^2.

[0049] The mechanical properties of the primary carpet backing are summarized in Table 2 and Table 3, for the machine direction and cross machine direction, respectively.

[0050] The primary carpet backing was supplied into a tufting machine and was tufted with a looppile construction using a tuft yarn consisting essentially of polyamide-6. The tuft construction used in all examples is summarized in Table 4.

Example 2

[0051] The primary carpet backing of example 2 was prepared according to example 1, but with one modification. The core component of the core-sheath filaments of the nonwoven layer of fibers represented 80 wt.% of the core-sheath filaments and consisted of polyamide-6 (PA6) having a melting temperature of 220°C, and the sheath component represented 20 wt.% of the core-sheath filaments and consisted of polypropylene having a melting temperature of 165°C and a Melt Flow Index of 11 g/10 min. The mechanical properties of the yarns are summarized in Table 1.

Comparative Example

[0052] A primary carpet backing was prepared consisting of a nonwoven layer of fibers.

[0053] The nonwoven layer of fibers was formed of bicomponent core-sheath filaments, which were spun and wound on bobbins in the form of multifilament yarns followed by the step of unwinding the multifilament yarns and laying the (individual) filaments down on a conveyor belt as a web of filaments and thermally consolidating the web by through air bonding to form the nonwoven layer of fibers.

[0054] The core component of the core-sheath filaments of the nonwoven layer of fibers represented 76 wt.% of the core-sheath filaments and consisted of polyethylene terephthalate (PET) having a melting temperature of 250°C, and the sheath component represented 24 wt.% of the core-sheath filaments and consisted of polyamide-6 (PA6) having a melting temperature of 220°C. The fibers were spun using a melt spinning installation using a bicomponent spinneret, a blow box, a spinning duo, a stretching duo and a winder. The fibers had a linear density of 1800 dtex and consisted of 124 individual filaments. The mechanical properties of the yarns are summarized in Table 1.

[0055] The primary carpet backing had a weight of 100 g/m^2.

[0056] The primary carpet backing was supplied into the tufting machine and was tufted with a looppile construction using a tuft yarn consisting essentially of polyamide-6. The tuft construction used summarized in Table 4.

[0057] The mechanical and thermal properties of the multifilament yarns of examples 1 and 2, and the multifilament yarn of the comparative example are summarized in Table 1.

Table1 : Mechanical properties of the multifilament yarns.

	Linear density	Breaking strength	EAB	FASE 1	FASE 2
	dtex	N	%	N	N
Example 1	1808	80.3	80.7	3.5	8.4
Example 2	1813	82.0	72.5	4.5	9.7
Comparative Example	1811	63.2	59.6	7.9	15.6

Table1 continued: Mechanical properties of the multifilament yarns.

	FASE 5	FASE 10	FASE 20	Tenacity
	N	N	N	mN/tex
Example 1	18.8	30.5	42.6	444
Example 2	21.6	34.7	45.8	452
Comparative Example	25.5	30.4	38.6	349

[0058] The mechanical and thermal properties of the primary carpet backings of examples 1 and 2 and of the comparative example are summarized in Table 2 and Table 3, for the machine direction and cross machine direction, respectively.

Table 2: Mechanical and thermal properties of the primary carpet backings in machine direction.

MD	Breaking strength	EAB	LASE 2	LASE 5	LASE 15	Thermal Shrinkage
	N/5cm	%	N/5cm	N/5cm	N/5cm	%
Example 1	296	28	53	99	216	1.45
Example 2	141	11	51	90	--	1.15
Comparative Example	369	28	131	172	273	0.23

Table 3: Mechanical and thermal properties of the primary carpet backings in cross machine direction.

CMD	strength	EAB	LASE 2	LASE 5	LASE 15	Thermal Shrinkage
	N/5cm	%	N/5cm	N/5cm	N/5cm	%
Example 1	274	32	46	87	184	1.60
Example 2	146	13	48	87	-	1.07
Comparative Example	278	28	101	134	205	0.16

[0059] The primary carpet backings of examples 1 and 2 and of the comparative example were supplied into a tufting machine and were tufted with a looppile construction using a tuft yarn consisting essentially of polyamide-6. The tuft construction used in all examples is summarized in Table 4.

Table 4: Tuft construction

Gauge	1/10" staggered
Pile height	4 mm
Needle type	Cobble 0618
Stitches/10 cm	50

[0060] The mechanical and thermal properties of the tufted carpet backings in machine direction and in cross machine direction are summarized in Table 5 and Table 6, respectively.

Table 5: Mechanical and thermal properties of the tufted carpet backings in machine direction.

MD	Breaking Strength	EAB	LASE 2	LASE 5	LASE 15	Thermal Shrinkage
	N/5cm	%	N/5cm	N/5cm	N/5cm	%
Example 1	523	71	12	33	118	1.50
Example 2	552	73	9	25	94	1.83
Comparative Example	369	38	19	72	186	2.25

Table 6: Mechanical and thermal properties of the tufted carpet backings in cross machine direction.

CMD	Breaking Strength	EAB	LASE 2	LASE 5	LASE 15	Thermal Shrinkage
	N/5cm	%	N/5cm	N/5cm	N/5cm	%
Example 1	395	66	9	23	84	1.65
Example 2	432	71	8	21	77	1.60

(continued)

CMD	Breaking Strength	EAB	LASE 2	LASE 5	LASE 15	Thermal Shrinkage
	N/5cm	%	N/5cm	N/5cm	N/5cm	%
Comparative Example	234	44	7	23	91	3.00

[0061] The examples show that the primary carpet backings according to the invention have lower mechanical properties, in particular lower breaking strength, lower elongation at break (EAB) and lower load at specific elongation of 2%, 5% and 15% (LASE values) as well as a higher thermal shrinkage than the comparative primary carpet backing.

[0062] However, after tufting the primary carpet backing, surprisingly the tufted carpet backings comprising primary carpet backings according to the invention have higher breaking strength and higher elongation at break as well as a lower thermal shrinkage than the comparative tufted carpet backing. The tufted carpet backings comprising primary carpet backings according to the invention have comparable LASE values in cross machine direction as the comparative tufted carpet backing.

Claims

1. Primary carpet backing comprising at least one non-woven layer,
wherein the at least one non-woven layer comprises fibers which contact one another at contact zones, wherein the fibers comprise

i) first fibers which are manufactured from a first fiber forming polymer, and second fibers which are manufactured from a second fiber forming polymer, or
ii) multicomponent fibers which comprise at least a first component manufactured from a first component forming polymer and
at least a second component manufactured from a second component forming polymer,

characterized in that
both the first fiber forming polymer and the first component forming polymer is at least one polyamide, both the second fiber forming polymer and the second component forming polymer is at least one bonding polymer, the first fibers are melt bonded at their contact zones with the second fibers by a solidified melt, or the multicomponent fibers are melt bonded at their contact zones by a solidified melt, and the solidified melt is a solidified melt of the at least one bonding polymer, wherein the bonding polymer is obtained by polymerization of an olefin having a terminal or a non-terminal double bond.

2. Primary carpet backing according to claim 1, **characterized in that** the polyamide is at least one synthetic thermoplastic homo-polyamide, at least one synthetic thermoplastic co-polyamide or a mixture thereof.

3. Primary carpet backing according to claim 2, **characterized in that** the thermoplastic homo-polyamide exhibits a recurring unit of formula (I)

$$-[-NH-CO-(-CR^1R^2-)_n]- \quad (I),$$

wherein n is an integer ranging from 1 to 22, and
R^1 and R^2 independently from one another represent H or a linear alkyl group of formula $-(-CH_2)_x-CH_3$, wherein x is an integer ranging from 0 to 5,
or of formula (II)

$$-[-NH-(CR^3R^4-)_m-NH-CO-(CR^5R^6-)_p-CO-]- \quad (II),$$

wherein m and p are integers, and independently from one another range from 1 to 22,
R^3 and R^4 independently from one another represent H or a linear alkyl group of formula $-(-CH_2)_y-CH_3$ wherein y is an integer ranging from 0 to 5, and R^5 and R^6 independently from one another represent H or a linear alkyl group of formula $-(-CH_2)_z-CH_3$, wherein z is an integer ranging from 0 to 5.

4. Primary carpet backing according to claim 3, **characterized in that** the homo-polyamide is polyamide 6 (PA 6), polyamide 6.6, polyamide 4.6 (PA 4.6), polyamide 4.10 (PA 4.10) or polyamide 4.12 (PA 4.12).

5. Primary carpet backing according to one or more of claims 1 to 4, wherein the bonding polymer is obtained by polymerization of an olefin which is an alkene having one terminal double bond so that the bonding polymer is an polyolefin which exhibits a recurring unit of formula (III)

$$-[-CH_2-CR^7R^8-]- \qquad \text{(III)},$$

wherein R^7 and R^8 independently from one another represent H or CH_3.

6. Primary carpet backing according to claim 5, **characterized in that** the polyolefin is polyethylene or polypropylene.

7. Primary carpet backing according to one or more of claims 1 to claim 6, **characterized in that** the fibers are filaments.

8. Primary carpet backing according to one or more of claims 1 to claim 7, **characterized in that** the at least one nonwoven layer comprises the first fibers and the second fibers in a weight ratio $w_{\text{first fibers}}$: $W_{\text{second fibers}}$, and $w_{\text{first fibers}}$: $W_{\text{second fibers}}$ ranges from 40 : 60 to 90 : 10.

9. Primary carpet backing according to one or more of claims 1 to claim 7, **characterized in that** the at least one nonwoven comprises the multicomponent fibers, wherein the multicomponent fibers exhibit a weight ratio of the first component to the second component $w_{\text{first component}}$: w_{second} component, and Wfirst $_{\text{component}}$: $w_{\text{second component}}$ ranges from 40 : 60 to 90 :10.

10. Primary carpet backing according to one or more of claims 1 to claim 7 and 9, **characterized in that** the multicomponent fibers are bicomponent fibers, wherein the bicomponent fibers are bicomponent filaments, wherein
α) the bicomponent filaments exhibit a core/sheath geometry, wherein the first component represents the core and the second component represents the sheath, or
β) the bicomponent filaments exhibit a side by side geometry, wherein the first component represents a side 1 and the second component represents a side 2, or
γ) the bicomponent filaments exhibit an islands in the sea geometry wherein the first component represents the islands and the second component represents the sea
δ) the bicomponent filaments exhibit a segmented pie geometry of alternating segments of the first component and segments of the second component.

11. Primary carpet backing according to claim 10, **characterized in that** the bicomponent filaments exhibit a core/sheath geometry, wherein the core consists of polyamide 6 (PA 6) or polyamide 6.6 (PA 6.6) and the sheath consists of polyethylene or polypropylene.

12. Primary carpet backing according to claim 11, **characterized in that** a weight ratio of the core to the sheath w_{core} : w_{sheath} ranges from 40 : 60 to 90 : 10.

13. Tufted carpet backing comprising pile yarns and a primary carpet backing according to one or more of claims 1 to 12.

14. Tufted carpet backing according to claim 13, **characterized in that** the pile yarns and the first fibers or the first component of the multicomponent fibers both consists of an aliphatic polyamide, preferably the pile yarns and the first fibers or the first component of the multicomponent fibers both consists of the same aliphatic polyamide.

15. Tufted carpet backing according to any of claims 13 or 14, **characterized in that** the pile yarns consist of polyamide 6 (PA 6) or polyamide 6.6 (PA 6.6), the primary backing consists of at least one non-woven layer which consists of bicomponent filaments exhibiting a core/sheath geometry, wherein the core consists of polyamide 6 (PA 6) or polyamide 6.6 (PA 6.6) and the sheath consists of polyethylene or polypropylene.

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EUROPEAN SEARCH REPORT

Application Number
EP 14 19 5815

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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