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A method for the manufacture of a deformable tufted product, a deformable tufted product, in particular a deformable tufted carpet top layer, in particular for the interiors of automobiles

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Not given

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Abstract

The object of the invention is to propose a simple and economical method for the manufacture of a deformable tufted product, in particular a particularly easily deformable tufted carpet top layer, in particular for automobile interiors. In accordance with this method a meltblown nonwoven is laid upon a deformable polyester tuft backing and the meltblown nonwoven and the polyester tuft backing are simultaneously tufted together.

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ORIGINAL COMPLETE SPECIFICATION
STANDARD PATENT

Invention Title

A method for the manufacture of a deformable tufted product, a deformable tufted product, in particular a deformable tufted carpet top layer, in particular for the interiors of automobiles

The following statement is a full description of this invention, including the best method of performing it known to me/us:-

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TRANSLATION

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A method for the manufacture of a deformable tufted product, a deformable tufted product, in particular a deformable tufted carpet top layer, in particular for the interiors of automobiles

The invention relates to a method for the manufacture of a deformable tufted product, in particular for a deformable tufted carpet top layer manufactured according to this method, in particular for the interiors of automobiles.

For the production of a tufted carpet the so-called tufting is employed, i.e. a technique to manufacture three-dimensional fabrics, which in principle functions in accordance with a sewing machine.

In such a process, tufting needles insert a tufting yarn into a primary backing, the so-called tuft backing. The tufting needles mounted at a needle bar are arranged across the width of the primary backing, for instance a nonwoven fabric, and simultaneously stitch through the primary backing.
Before the tufting needles again return upwardly into their home or resting position, the inserted tufting yarn is gripped on the underside of the primary backing by gripping elements, so-called loopers. In this way loops are formed which produce the so-called pile, nap or face representing the visible surface (top layer) of the finished carpet.

Depending on their application, these loops can be cut already during the tufting process by using special blades or knives. In this way, the so-called velours carpet is created

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whose preferred use, especially in fitting out interiors of automobiles, represents more than 95%.

Summary of the invention

It is the object of the invention to propose a method which is as simple as possible and economical for the manufacture of a deformable tufted product, in particular a tufted carpet top layer which is particularly easily deformable. The carpet top layer manufactured according to the method is intended in particular for use in automobile interiors or for interiors of residential, commercial or public use buildings. This relates to use of the carpet top layer in areas of heavy traffic or extreme use in particular in offices, hotels, airports and/or hospitals.

The solution to the task set is provided by the characteristics of Claim 1.

In accordance with this method a meltblown nonwoven fabric is laid down upon a deformable polyester tuft backing and the meltblown nonwoven fabric and the polyester tuft backing are tufted together simultaneously. Due to the meltblown nonwoven being laid upon the tuft backing synchronously with the tufting process, the method is particularly economical.

By virtue of the special combination of the material selection and the process design, the tufted product thus manufactured distinguishes itself in particular for use in automobile interiors as automobile carpet top layer by its particularly good deformability and correspondingly high tensile strength, elongation and tear force data.

The dependent claims describe advantageous further developments of the subject of the invention.

In a preferred embodiment of the method, the tufted product is introduced into the further carpet manufacturing process merely by a thermal treatment of the tuft insertion side, in particular without precoating.

In the tufting manufacture, the precoating represents the pretreatment of the raw material for different coating methods of the backing or tuft backing. The precoating serves to fix the pile tufts in the primary backing or tuft backing. The desired binding of the tufts is thereby achieved and prevents threads from being pulled out of the pile or fraying of the pile material. The precoating material conventionally consists of synthetic latex including filler.

The exclusion of latex precoating in the manufacturing process, as proposed by the present invention, dispenses with one process step. Furthermore, this is in the interest of environmental protection since the waste water is not contaminated with latex residue from the manufacturing, recycling and waste removal processes and since during use of the tufted product thus treated there are no emissions due to latex precoating.

As a consequence, the method according to the invention satisfies the environmental regulations and industry standards which have been substantially raised of late.

Advantageously, a spun polyester nonwoven is employed as polyester tuft backing for the method, with a preferred area weight of between 70 g/m² and 140 g/m², more preferred of between 100 g/m² and 120 g/m².

Furthermore, the meltblown nonwoven with a preferred area weight of between 70 g/m² and 500 g/m² is employed, more preferred of between 80 g/m² and 200 g/m² and even more preferred of between 80 g/m² and 130 g/m².

By virtue of the particularly low area weights, the material consumption can be held particularly low and the processing speed can be increased thereby saving additional costs.

In a preferred embodiment of the method, the raw material employed for the meltblown nonwoven is a thermoplastic or spinnable raw material or a raw material which can be processed by injection moulding, in particular selected from polyolefines, copolyolefines, polyesters, copolyesters, polyamides and/or copolyamides with a MFI value (Melt Flow Index) (according to DIN 1238 or ISO 1133) of between 100 and 300 g/10 min.

By virtue of the low viscosity of the meltblown raw material due to a high melt flow index and the low viscosity of the meltblown nonwoven manufactured therefrom, the penetration of the molten meltblown nonwoven functional layer into the tufted tuft backing is advantageously affected. As a consequence, a three dimensional composite layer is produced preventing an undesirable delamination between the functional layer and the tuft backing.

The preferred use is a meltblown nonwoven with a thickness of between 0.5 mm and 1.5 mm, more preferred of between 0.5 mm and 1.0 mm.

The fibre titre of the meltblown nonwoven is advantageously between 0.06 dtex and 0.2 dtex, preferred between 0.06 dtex and 0.1 dtex.

The voluminous, soft meltblown nonwoven functional layer with high specific fibre surface, low fibre titre and high fibre mobility advantageously facilitates the tufting together without needle deviation and increases the number of the contact points between the meltblown nonwoven functional layer and the fibres of the tuft backing, thereby enhancing the bonding strength between the functional layer and the tuft backing evenly across the cross section.

The simultaneous tufting together of the meltblown nonwoven and the polyester tuft backing is preferably achieved without prior needling or calendaring with a tufting gauge of between 1/8" and 1/16".

Alternatively, the meltblown nonwoven is advantageously consolidated by an ultrasound calendar with a bonding area smaller than 5 %, preferred smaller than 2%, and simultaneously tufted together with the polyester tuft backing with a gauge of between 1/8" and 1/16".

In a particularly advantageous embodiment of the method, the meltblown nonwoven and the polyester tuft backing are simultaneously consolidated by an ultrasound calendar with a bonding area smaller than 5 %, preferred smaller than 2 %, and subsequently simultaneously tufted together with a gauge of between 1/8" and 1/16".

The joint consolidation step guarantees a particularly good handling and a better process stability than when using separate layers. Furthermore, the combination with the very small bonding area simultaneously permits sufficiently high fibre mobility so that fibre damage during tufting is at least reduced and the tuft product quality, in particular with regard to its deformability, is enhanced.

In a further carpet manufacturing process, it is preferred for an acoustic nonwoven and/or at least another insulating layer, for instance a heavy layer with area weights of for instance between 2 and 7 kg/m² made from ethylene vinyl acetate/ethylene/propylene-diene rubber or from coextruded foil with polyethylene/polyamide (polyethylene), to be deposited onto the tuft insertion side of the tufted product.

The tufted products manufactured in accordance with the invention and having a tear force in longitudinal direction at room temperature (according to DIN 53859-3) preferably of between 170N and 240 N have a particularly high tear force value and thus a particularly good deformability so that these tufted products are particularly well suited to be used for carpet top layers in the interiors of automobiles as automobile carpet top layers.

The deformable tufted products, in particular the deformable tufted automobile carpet top layers at room temperature further have

- a prefered maximum tensile strength in longitudinal direction (according to EN 29073-3) of between 250 N/5cm and 400 N/5cm, more preferred of between 275 N/5cm and and 375 N/5cm,
- a preferred maximum tensile strength in transverse direction (according to EN 29073-3) of between 180 N/5cm and 300 N/5cm, more preferred of 203 N/5cm and 250 N/5cm,
- a maximum elongation in longitudinal direction (according to EN 29073-3) of between 45% and 60 % and
- a maximum elongation in transverse direction (according to EN 29073-3) of between 42 % and 55 %.

At 140°C the deformable tufted products, in particular the deformable tufted automobile carpet top layers, preferably have

- a maximum tensile strength in longitudinal direction (according to EN 29073-3) of between 185 N/5cm and 200 N/5cm,
- a maximum tensile strength in tranverse direction (according to EN 29073-3) of between 85 N/5cm and 120 N/5cm,
- a maximum elongation in longitudinal direction (according to EN 29073-3) of between 65% and 70 %, and
- a maximum elongation in transverse direction (according to EN 29073-3) of between 65% and 70%.
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Detailed description of the preferred embodiments

The subject of the invention is described in greater detail by reference to an example.

Manufacture of a meltblown nonwoven:

The raw material employed for the meltblown nonwoven is a polyethylene with an MFI of 155 g/10 min according to DIN 1133 and spun by means of a meltblown spinneret. The polyethylene fibres thus obtained have a fibre titre of 0.07 dtex.

Subsequently, the fibres are laid down on a suction drum which has a distance from the spinneret of approximately 600 mm in order to produce a voluminous and soft fleece whose fibre mobility has been retained during the tufting process.

The 80 g fleece thus manufactured can subsequently be optionally consolidated by means of an ultrasound calendar with a light sonotrode pressing force of about 0.006 bar with a bonding area of smaller than 5 %, preferred smaller than 2 %, so that a still largely voluminous nonwoven is obtained. Alternatively, also a light thermal consolidation via embossed or roughened calendaring rollers is feasible.

Manufacture of a tufted product

The 80 g meltblown nonwoven manufactured by way of the previously described method is laid down onto the tuft backing in non-preconsolidated form and only then, together with the tuft backing, jointly consolidated by means of an ultrasound calendar with a light sonotrode pressing force of about 0.006 bar with a bonding area of approx. 1.6 %. As the tuft backing, a polyester spun nonwoven, Lutradur ® LDT 5312 (Freudenberg) with an area weight of 120 g/². is employed.

This composite of meltblown nonwoven and polyester tuft backing lightly preconsolidated by ultrasound is fed to the tufter inlet where the meltblown nonwoven side represents the needling or tuft insertion side.

The laboratory tufter has a needle working width of approx. 50 cm and a gauge of 1/10" (10 needles per 2.54 cm) velours quality.

The number of stitches is approx. 56/10 cm. The tufting yarn used is a socalled BCF yarn (a bulked continuous filament), which has a polyamide 6 quality with a total thickness of 1300 dtex and 128 individual filaments. Other conventional tufting yarns can also be used.

The tuft yarn weight is approx. 400 g/m². The complete laboratory tufting configuration produces, in narrow width, a carpet construction traditionally employed in automobile interiors (with the exception of the additionally introduced layer).

Prior to the tufting needles retracting to their home position, the inserted tufting yarn is fixedly held by gripping elements, so that loops or tufts are formed.
In this way a loop pile carpet is produced. When the loops are cut open, as is done in this case, with blades or knives, a cut pile carpet or a so-called velours carpet is created.

After the tufting together of the meltblown nonwoven with the polyester tuft backing, a thermal treatment is undertaken from the tuft insertion side until the polyethylene of the meltblown nonwoven has molten. The carpet top layer manufactured in this way is tested for the following properties.

Properties at room temperature of the carpet top layer thus manufactured:

- maximum tensile strength in longitudinal direction (according to EN 29073-3): 368 N/5cm
- maximum tensile strength in transverse direction (according to EN 29073-3): 203 N/5cm
- maximum elongation in longitudinal direction (according to EN 29073-3): 58 %
- maximum elongation in transverse direction (according to EN 29073-3): 44%
- tear force in longitudinal direction (according to EN 29073-3): 218 N

The greater the values of the tear force, the greater the deformability.

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By comparison, the tear force of the tufted tuft backing alone (Lutradur ® LDT 5312, 120 g/m²), i.e. without the meltblown nonwoven, amounts to 198 N, and the tear force of the tufted tuft backing (Lutradur ® LDT 5312, 120 g/m²) together with a conventional precoating or latex binder treatment (approx. 100 g/m²) is 150 N.

By a traditional precoating treatment, the deformability is consequently negatively affected whilst the tufted product manufactured in accordance with the invention has a particularly high tear force value and thus a particularly good deformability so that this tufted product is particularly well suited for use as carpet top layer in automobile interiors.

Properties at 140° C of the carpet top layer thus manufactured:

- maximum tensile strength in longitudinal direction (according to EN 29073-3): 196 N/5cm
- maximum tensile strength in transverse direction (according to EN 29073-3): 111 N/5cm
- maximum elongation in longitudinal direction (according to EN 29073-3): 75 %
- maximum elongation in transverse direction (according to EN 29073-3): 69 %

In addition to the determination of the strength and elongation behaviour of the tufted product by measurements undertaken by way of a tensile strain testing device, the deformation properties of the tufted product were determined by an internal measuring method. This measuring method involves circular samples of the tuft product having a diameter of 24 cm being cut and then clamped into a clamping ring and fixed by brass screws and thread bolts. The fixed sample is heated to a certain temperature, in this instance to 140°C, on the rear side, i.e. from the tuft insertion side, by infrared heating whilst observing a constant distance of 16 cm to the infrared field.

When the temperature has been reached, the clamping ring fixedly holding the carpet sample is automatically placed onto a movable hollow cylinder which, at a speed of 50 mm/s, impacts upon a metal ball. The metal ball is cooled by means of water to 18°C and has a diameter of 10 cm. The carpet sample is thereby deformed from the tuft insertion side. The measured deformation depths serve to calculate the deformation percentage.

At a maximum deformation depth of 12.2 cm

- the maximum degree of deformation is 106% and
- the maximum deformation force: 1543 N

At a deformation depth of 9 cm

- the maximum degree of deformation is 50 % and
- the maximum force of deformation is 723 N.

The embodiment example of the carpet top layer manufactured in accordance with the present invention offers the further advantage that it can be laminated with a heavy layer without the conventional polyethylene powder application customary in the carpet industry. The reason why this polyethylene powder application may be dispensed with is due to the fact that an adhesive layer of polyethylene is already present on the carpet needle insertion side of the carpet top layer of the embodiment example.

The reference in this specification to any prior publication (or information derived from it), or to any matter which is known, is not, and should not be taken as, an acknowledgement or admission or any form of suggestion that that prior publication (or information derived from it) or known matter forms part of the common general knowledge in the field of endeavour to which this specification relates.

Throughout this specification and the claims which follow, unless the context requires otherwise, the word "comprise", and variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

The claims defining the invention are as follows:

1. A method for the manufacture of a deformable tufted product, in particular of a deformable tufted carpet top layer, in particular for the interior of automobiles, whereby a meltblown nonwoven fabric is laid down upon a deformable polyester tuft backing and whereby the meltblown nonwoven fabric and the polyester tuft backing are tufted together simultaneously.

2. The method according to Claim 1, whereby the tufted product is introduced into the further carpet manufacturing process merely by a thermal treatment of the tuft insertion side, in particular without precoating.

3. The method according to Claim 1 or 2, whereby a polyester spun nonwoven is employed as polyester tuft backing, with a preferred area weight of between 70 g/m² and 140 g/m², more preferred of between 100 g/m² and 120 g/m².

4. The method according to any one of the preceding Claims, whereby the meltblown nonwoven with a preferred area weight of between 70 g/m² and 500 g/m² is employed, more preferred of between 80 g/m² and 200 g/m² and even more preferred of between 80 g/m² and 130 g/m².

5. The method according to any one of the preceding Claims, whereby the raw material employed for the meltblown nonwoven is a thermoplastic or spinnable raw material or a raw material which can be processed by injection moulding, in particular selected from polyolefines, copolyolefines, polyesters, copolyesters, polyamides and/or copolyamides with a MFI value (Melt Flow index) (according to DIN 1238 or ISO 1133) of between 100 and 300 g/10 min.

6. The method according to any one of the preceding Claims, whereby the meltblown nonwoven with a thickness of between 0.5 mm and 1.5 mm, more preferred of between 0.5 mm and 1.0 mm, is employed.

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7. The method according to any one of the preceding Claims, whereby the meltblown nonwoven with a fibre titre of between 0.06 dtex and 0.2 dtex, preferably between 0.06 dtex and 0.1 dtex, is employed.

8. The method according to any one of the preceding Claims, whereby the meltblown nonwoven and the polyester tuft backing are tufted together simultaneously with a tuft gauge of between 1/8" and 1/16" without prior needling or calendaring.

9. The method according to any one of Claims 1 to 7, whereby the meltblown nonwoven is advantageously consolidated by an ultrasound calendar with a bonding area smaller than 5 %, preferred smaller than 2%, and tufted together simultaneously with the polyester tuft backing with a tuft gauge of between 1/8" and 1/16".

10. The method according to any one of Claims 1 to 7, whereby the meltblown nonwoven and the polyester tuft backing are jointly consolidated by an ultrasound calendar with a bonding area smaller than 5 %, preferred smaller than 2 %, and tufted together simultaneously with a tuft gauge of between 1/8" and 1/16".

11. The method according to any one of Claims 2 to 10, whereby as a further carpet manufacturing process an acoustic nonwoven and/or at least another insulating layer, is deposited onto the tuft insertion side of the tufted product.

12. A deformable tufted product, in particular a deformable tufted carpet top layer, in particular for the interior of automobiles, manufactured by a method in accordance with any one of the preceding Claims which, at room temperature, have

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- a maximum tensile strength in longitudinal direction (according to EN 29073-3) of between 250 N/5cm and 400 N/5cm, more preferred of between 275 N/5cm and and 375 N/rcm,
- a maximum tensile strength in transverse direction (according to EN 29073-3) of between 180 N/5cm and 300 N/5cm, more preferred of between 203 N/5cm and 250 N/5cm,
- a maximum elongation in longitudinal direction (according to EN 29073-3) of between 45% and 60 % and
- a maximum elongation in transverse direction (according to EN 29073-3) of between 42 % and 55 %.

13. A deformable tufted product, in particular a deformable tufted carpet top layer, in particular for the interior of automobiles, manufactured by a method in accordance with any one of the preceding Claims 1 to 11 which, at 140°C, have
- a maximum tensile strength in longitudinal direction (according to EN 29073-3) of between 185 N/5cm and 200 N/5cm,
- a maximum tensile strength in tranverse direction (according to EN 29073-3) of between 85 N/5cm and 120 N/5cm,
- a maximum elongation in longitudinal direction (according to EN 29073-3) of between 65% and 70 %, and
- a maximum elongation in transverse direction (according to EN 29073-3) of between 65% and 70%.

14. A deformable tufted product, in particular a deformable tufted carpet top layer, in particular for the interior of automobiles, manufactured by a method in accordance with any one of Claims 1 to 11, which at room temperature has a tear force in longitudinal direction (as per DIN 53859-3) of between 170 N and 240 N.

15. A method for the manufacture of a deformable tufted product, substantially as herein described.

16. A deformable tufted product, substantially as herein described with reference to the accompanying drawings.