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PROCESS OF PRODUCING A LUBRICATED HEAT BONDED THERMOPLASTIC FIBER FABRIC AND THE LUBRICATED FABRIC

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ABSTRACT OF THE DISCLOSURE

Improved carpet backing formed from highly crystalline and molecularly oriented fibers that have been needled into a cohesive bat, bonded together by heating, and followed by application of an ethoxylated alcohol lubricant.

BACKGROUND OF THE INVENTION

This invention relates to the formation of a nonwoven textile fabric formed from a bat of fibers having improved physical properties. In accordance with one aspect, this invention relates to the bonding of a nonwoven bat of needled fibers disposed in a random nonparallel fashion by heating near the crystalline melting point followed by application of an ethoxylated alcohol lubricant. In accordance with a further aspect, this invention relates to the production of carpet backing from bats of needled polypropylene fibers by heating with heated rollers to fuse into a bonded fabric and then lubricating the fabric thus formed with an ethoxylated alcohol lubricant.

It is known in the art that nonwoven coherent fabrics can be formed by depositing a mass of fibers or filaments in either random or ordered orientation to form a bat, needling the bat to intermix the fibers, and bonding the fibers together to form a fabric. One method of bonding the fibers is to pass the needled bat through a heating device wherein at least a portion of the fibers in the bat fuse, thus interlocking the individual fibers into a coherent fabric. Also it is known in the art that lubricants can be applied to textile materials including fabrics to improve various characteristics. However, a number of major difficulties arise with the prior art methods of heating and lubricating textile materials. One of the problems encountered with many of the prior art products is the problem of fiber breakage and lack of strength and dimensional stability for the textile material.

Accordingly, it is an object of this invention to provide a method for forming nonwoven textile fabrics having improved physical characteristics.

A further object of this invention is to provide a lubricant for textile materials which will substantially improve the physical properties of the textile products.

Other objects and aspects, as well as the several advantages of the invention, will be apparent to those skilled in the art upon reading the specification and the appended claims.

SUMMARY OF THE INVENTION

According to the invention, the process for improving physical properties of synthetic fiber nonwoven fabrics formed from thermoplastic fibers is provided which comprises passing bats of thermoplastic fibers through a needling zone to intermix the fibers, then through a heating zone to fuse the fibers into a fabric and then applying to said fabric a lubricant consisting of an ethoxylated alcohol.

In accordance with a specific embodiment of the invention carpet backing is produced by passing needled bats of polypropylene fibers between heated rolls to fuse the fibers into a fabric and then applying a lubricant consisting of an ethoxylated alcohol to the product for reduced fiber breakage and noise and for increased strength and dimensional stability.

In accordance with a further embodiment of the invention, carpet backing is produced consisting essentially of nonwoven fabric of highly crystalline and molecularly oriented needled fibers disposed in a random nonparallel fashion and a coating of a lubricant consisting of an ethoxylated alcohol.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The invention can be used with any bat containing fusible organic thermoplastic fibers. The bat can consist entirely of such fusible fibers, or can be a blend of fusible fibers with other synthetic or natural fibrous materials.

The bat can be formed by any conventional means. For example, the fibers can be supplied by a carding machine in the form of a unidirectionally oriented web, in which case all fibers would be oriented in the direction of the mat travel. Alternately, the fibers can be cross-lapped by layering a unidirectionally oriented web from one or more cards or garnets back and forth on a moving conveyor. Further, the fibers can be deposited on a conveyor belt by air deposition, thereby giving a random orientation.

The heat fusible materials which can be used in forming bats for the process of the invention include substantially all of the synthetic organic thermoplastic materials. Polyolefins, such as the polymers of ethylene, propylene, butene, and copolymers thereof, are particularly suitable. Also suitable are polyesters and polyamides and other known organic thermoplastics which are capable of being formed into filaments.

Bats formed by any of the above methods can be taken directly to the bonding process or can be subjected to some preliminary treatment which would increase the coherency of the mat prior to heat bonding. Preferably the mat is subjected to a conventional textile needling operation prior to the fusion bonding process. The bat of thermoplastic fibers or filaments is bonded by heating briefly to a temperature above the softening point. In order to fuse fibers of polypropylene the fibers of the needled bat are heated briefly to a temperature up to about 350° F. by passage between heated rolls. Temperature of the heated rolls will be in the range of 325 to 400° F. Under these conditions the fibers in the center of the bat may remain unfused or unbonded.

The continuous nonwoven fabrics used as carpet backing in the present invention are from 10 to 30 mils thick and preferably in the range 10–25 mils thick. The filaments or fibers making up the nonwoven sheet material have a denier between about 3 and 15 d.p.f.

The bat may also include a sheet of cheesecloth which may be positioned at the bottom or in the middle of the several layers of fibers. Alternatively, a warp of spun yarns of cotton, rayon, polyester, etc. may also be positioned within the bat. The cheesecloth or warp yarn gives the finished fabric additional strength and is inserted in the bat prior to needling.

Following bonding or fusing of the fibrous bat, the lubricant used in 100 percent concentration consisting of ethoxylated alcohol is applied to the bonded fabric to reduce fiber breakage and noise during tufting and for increasing strength and dimensional stability of the product. The amount of lubricant applied to the fabric ordinarily will range from 0.1 to 2.0 weight percent of the fabric as measured by methanol extraction.

The ethoxylated alcohols employed according to the invention have the formula

$$CH_3—(CH_2)_x—CH_2—(O—CH_2CH_2)_n—OH$$

wherein x is from 8 to 16, preferably 10–14, and n is 1–10, preferably 2–5. The presently preferred ethoxylated alcohol has an x value of 10–12 and an n value of 3.

The ethoxylated alcohols employed according to the invention have a molecular weight in the range of 200 to 1000, preferably from 300 to 500. Ethoxylated alcohols with molecular weights above 1000 cannot be used as liquids in 100 percent concentrations and are therefore undesirable.

The operable ethoxylated alcohol lubricant in the invention can be applied to the self-bonded, nonwoven fabric by any of the methods known in the art. Thus, application by spraying, padding, roll coating, etc. can be used. As indicated above, the lubricant is applied without a diluent or other additive.

SPECIFIC EXAMPLE

Nonwoven fabric was produced as described previously in detail and briefly by depositing layers of 4½ denier polypropylene stable fibers upon a warp of polyester threads. The bat thus formed was needled and heat fused by passage between fusion rolls heated to a temperature of 350° F. The fused fabric was then passed continuously through a bath of ethoxylated alcohol lubricant with the formula

$$CH_3(CH_2)_{10-12}\cdot CH_2(OCH_2CH_2)_3OH$$

Such a lubricant is sold by Continental Oil Company under the tradename of "Alfonic" 1412–4 ethoxylate.

Fabrics containing 0, 1.44, and 3.95 weight percent lubricant as measured by methanol extraction were thus produced and used as carpet backing for the production of tufted carpeting. The finished carpeting was then studied for the following performance characteristics:

(1) Growth or shrinkage in width during tufting.
(2) Growth or shrinkage through finishing.
(3) Noise, pounding and needle heat.
(4) Carpet strength.
(5) Tufting efficiency.

The results of the tests of the finished carpeting made with the non-woven carpet backing with 0, 1.44, and 3.95 weight percent lubricant were as follows:

(1) Noise, pounding and needle heat

The nonlubricated carpeting gave increased noise and needle heat (during tufting). All others were equivalent.

(2) Tufting growth and shrinkage

The nonlubricated carpeting gave excessive tufting growth in some cases. The 3.95 percent lubricant level permitted excessive tufting shrinkage. The 1.5 percent lubricant level gave the best balance between tufting growth and shrinkage.

(3) Growth and shrinkage throughout finishing of the carpet

The nonlubricated carpet gave excessive instability during piece dyeing; that is, both growth and shrinkage were encountered. The high and low levels of lubricant application gave excellent stability.

(4) Carpet strength

The carpeting made with nonlubricated fabric backing was unsatisfactory in this test. The lubricated product was satisfactory.

(5) Tufting efficiency

No observable differences.

The improved performance characteristics of the carpeting made with lubricated backing is thus evident with an application level of 1.44 weight percent being optimum based on superiority in tufting growth and shrinkage.

We claim:

1. A process for improving the physical properties of synthetic fiber fabric formed from thermoplastic fibers which compises (a) heating bats of thermoplastic fibers above the softening point of the thermoplastic to fusion bond the fibers into a fabric and (b) applying a coating to said fused bat of a liquid lubricant consisting of an ethoxylated alcohol having a molecular weight in the range 200–1000 and the formula

$$CH_3—(CH_2)_x—CH_2—(O—CH_2CH_2)_n—OH$$

wherein x is from 8–16 and n is 1–10 in an amount sufficient to reduce fiber breakage and increase dimensional stability of the mat product.

2. The process according to claim **1** wherein the amount of polyoxyalkylene applied is in the range 0.1 to 2.0 weight percent.

3. The process according to claim **1** wherein said thermoplastic fiber is polypropylene.

4. The process according to claim **3** wherein x in said ethoxylated alcohol ranges from 10–12 and n is 3.

5. The process according to claim **4** wherein said fused bat of step (a) is formed by being passed between heated rollers maintained at a temperature in the range of 325 to 400° F.

6. A textile product consisting essentially of (a) a non-woven bat of fusion bonded highly crystalline and molecularly oriented continuous filaments disposed in a random nonparallel fashion and overlapping and intersecting throughout the thickness of the sheet and (b) a coating of a liquid lubricant consisting of an ethoxylated alcohol having a molecular weight in the range 200–1000 and the formula

$$CH_3—(CH_2)_x—CH_2—(O—CH_2CH_2)_n—OH$$

wherein x is 8–16 and n is 1–10.

7. A product according to claim **6** wherein said filaments are formed from polypropylene and wherein said ethoxylated alcohol has an x value of 10–12 and an n value of 3.

8. A textile product according to claim **6** wherein the amount of polyoxyalkylene present is in the range 0.1 to 2 weight percent.

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