NONWOVEN FABRICS AND THE METHOD OF MANUFACTURE THEREOF


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5 Claims. (Cl. 161—155)

ABSTRACT OF THE DISCLOSURE

A nonwoven fabric is made by forming an open, nonwoven web of staple fibres or continuous filaments, electrostatically projecting potentially adhesive fibres onto the web and developing the crimp in the flock fibres to entangle them with the web fibres. Either the flock fibres or web fibres or both may be potentially adhesive fibres which are bonded to the neighboring fibres at the cross-over points.

DISCLOSURE

This invention relates to nonwoven fabrics and, in particular, to nonwoven fabrics comprising an open web in which the fibres are bonded together by short length textile fibres, the fibres being electrostatically projected by crimping the fibres in the web together to yield a non-woven fabric having a degree of strength which is known to the art. Thus fibres in webs may be bonded together by an adhesive to the whole or selected parts of the web, by needle punching or, where the web contains potentially adhesive fibres, by causing the potentially adhesive fibres to become tacky and bond themselves to other fibres in the web at points of contact.

We have now found that particularly attractive and novel fabrics can be obtained by electrostatically projecting short length staple fibres, generally known as flock, into an open web of fibres and then causing the flock fibres to crimp and bond the web together.

According to one aspect of the present invention therefore there is provided a nonwoven fabric comprising a web the fibres in which are bonded together by crimped flock, the fibres of the flock having an uncrimped length no greater than ¼ inch.

The most desirable results from the standpoint of tensile strength in the resulting fabric are obtained when the fibres of the flock have a crimp frequency not less than 20 crimps per inch.

In the specification the term “bonded” includes bonding by fibre entanglement, bonding by fusion and bonding by chemical adhesion brought about by rendering one component of the fabric tacky by the addition of some substance, e.g., a solvent, which can subsequently be removed to cause that component to revert to the nontacky state, but does not include bonding which is the result of the deliberate addition of an adhesive to the web.

The fabrics of this invention can be manufactured by projecting flock, comprising potentially crimpable fibres, which may contain a potentially adhesive component into an open fibrous web, by the action of electrostatic forces. The web may be composed of staple length fibres or of continuous filament components and may also contain a significant proportion of a potentially adhesive component. The fibres in the web are then bonded together by causing the flock fibres to crimp and become entangled with the web fibres to give a nonwoven fabric of some strength. The fabric may be further strengthened by causing the potentially adhesive component of the flock to become tacky and bond the fibres in the web and flock together at their crossover points.

The flock employed may be composed of heterofilament fibres in which one component of the heterofilament is potentially adhesive, in which case particularly good bonding of the flock onto the web is obtained. The web may also be composed of heterofilaments, in staple fibre form if required, in which one component is potentially adhesive.

Suitable heterofilaments for flock or web fibres may be in the form where the components exist in a side-by-side or sheath and core relationship, in the latter instance of course the potentially adhesive component will be the sheath components.

Accordingly, from another aspect the present invention provides a process for the manufacture of fabrics wherein flock composed of potentially crimpable fibres is projected into fibrous web by the action of electrostatic forces and the structure obtained treated to cause the flock fibres to crimp and thereby bond together fibres in the fibrous web, by entanglement of the fibres of the flock with fibres of the web.

When the flock fibres contain a potentially adhesive component, it may be rendered tacky, thereby further strengthening the fabric, in the same treatment by which the flock fibres are crimped or in a subsequent treatment.

In order to improve the penetration of the flock into the web, the flock may be forced further into the web by mechanical means, for example, by rolling, preferably whilst subject to the action of the electrostatic forces.

Any of the flock fibres which have not penetrated sufficiently into the web may then be removed by a vacuum extractor before the fabric is further treated.

To give added strength to the fabric, flock may be projected into both faces of the web before treating the fabric to crimp the fibres in the flock.

The invention will now be more fully described, in the following examples, which are illustrative only and are in no way intended to be limiting.

EXAMPLE 1

A carded open web of ½ inch staple fibres of polyhexamethylene adipamide having a weight of 4 ounces per square yard is laid on the earthed working top of a conventional flocking unit and below a flock container, comprising a sieve and a brush, which is charged by a high tension source at 110 kv. The unit is also provided with a roller and vacuum extractor. Flock for this experiment consists of 3 mm. staple fibres cut from heterofilaments composed of 66 nylon and 66/6 (80/20) nylon copolymer components existing in a side-by-side relationship.

The flock, is fed to the sieve, distributed uniformly by the brushes, allowed to fall into the electric field maintained between the charged container and the earthed working top, and projected into the staple fibre web. The web is then rolled using an insulated roller whilst under the influence of the electric field, to press the fibres further into the web. Flock which has not penetrated into the web is removed by the vacuum extractor. Examination of the web at this stage shows that the flock fibres in the web are oriented within the web in a direction substantially perpendicular to the plane of the web.

The web is immersed in boiling water for 3 minutes to cause the flock fibres to crimp and entangle themselves into the web. The crimped flock possesses a crimp frequency of approximately 25 per inch. At this stage the fabric has some strength owing to the mechanical bonding effect of the crimped flock in the web, but on handling tends to shed flock. To bond the flock firmly in the web,
therefore, the fabric is heated in an oven at 250° C. for 2 minutes in an oxygen free atmosphere to cause the lower melting component to soften and bond the flock and web together.

The fabric obtained, containing 15% by weight of flock, has a soft handle, good drape and a tenacity of about 0.2 gram per denier.

**EXAMPLE 2**

The process of Example 1 was repeated to give fabrics containing various percentages of flock. The percentage flock in the fabric and the tenacity of the fabric are given in Table 1.

<table>
<thead>
<tr>
<th>Percentage Flock in Fabric</th>
<th>Denier of Fabric</th>
<th>Tenacity of Fabric, g/6.</th>
</tr>
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<tbody>
<tr>
<td>30</td>
<td>24,700</td>
<td>0.10</td>
</tr>
<tr>
<td>40</td>
<td>32,300</td>
<td>0.14</td>
</tr>
<tr>
<td>50</td>
<td>41,300</td>
<td>0.13</td>
</tr>
<tr>
<td>60</td>
<td>42,900</td>
<td>0.13</td>
</tr>
<tr>
<td>68</td>
<td>78,800</td>
<td>0.16</td>
</tr>
</tbody>
</table>

Fabrics containing more than about 45% of flock tend to have a harsh handle and relatively poor drape.

The heterofilament flock may be crimped by means other than immersion in boiling water, thus it may be subjected to a steam treatment, or dry heated, or to a chemical treatment. If superheated steam is used and the potentially adhesive component of the heterofilament has a sufficiently low melting point, then the crimping and bonding steps can be carried out simultaneously.

Variations in the handle and surface effect of flocked web and can be obtained by applying other processes, e.g. needle punching to the flocked web before the bonding operation.

The invention is not limited to the use of webs or flock based only on polyamides; any suitable materials may be employed provided that effective bonding between the flock and the web can be attained, i.e. the potentially adhesive component where employed should be compatible with the other components of the fabric.

**What we claim is:**

1. A nonwoven fabric in the form of an open, nonwoven fibrous web having crimped flock fibres embedded within the body of the fibrous web, said flock fibres having an uncrimped length no greater than ¾ inch and being substantially shorter than the web fibres composing said web, said flock fibres being entangled with the web fibres by virtue of the crimp in said flock fibres, said cramped flock fibres extending generally at right angles to the plane of said web and being substantially completely embedded in said web, thereby bonding the web fibres in place and imparting strength to said fabric.

2. A nonwoven fabric as in claim 1 wherein the web fibres are heterofilaments having at least one potentially adhesive component bonded to the flock fibres at the cross-over points between fibres.

3. A process for enhancing the strength of nonwoven fabrics comprising: substantially completely embedding potentially crimpable flock fibres into a preformed, nonwoven web by projecting the flock-fibres into said web by the action of electrostatic forces and subsequently entangling the flock fibres with the web fibres by developing crimp in the flock fibres, thereby bonding the web fibres in the nonwoven fabric and enhancing the strength of the nonwoven fabric.

4. A process as in claim 3 wherein the flock fibres are projected into the web in a direction generally perpendicular to the plane of the web.

5. A process as in claim 3 wherein the web, with the flock fibres embedded therein, is mechanically compacted prior to developing the crimp in said flock fibres.

**References Cited**

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Patent Number</th>
<th>Date</th>
<th>Inventor</th>
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<tbody>
<tr>
<td>3,038,236</td>
<td>6/1962</td>
<td>Breen</td>
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