LAUNDERABLE AND DURABLE MECHANICALLY BONDED NONWOVEN FABRIC

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ABSTRACT
In at least one aspect of the present disclosure, a field durable, repeatedly launderable nonwoven fabric is provided including a cross-lapped and needle punched nonwoven fabric that is bonded together by entangling fibers with hydroentanglement.
Fiber Weighing, Opening and Blending

Fibrous Web Formation Carding, Air- Laid etc.

Cross-Lapping Webs

Needle-Punching Process

Spunlacing Process

Dyeing and Printing

Garment Assembly 100% Spunlaced Nonwoven Fabric

FIG. 1
LAUNDERABLE AND DURABLE MECHANICALLY BONDED NONWOVEN FABRIC

RELATED APPLICATIONS


BACKGROUND

[0002] Today, most apparel applications use traditional woven or knitted fabrics. One reason for this is that woven and knitted fabrics contain twisted yarns that are tightly woven or knitted to provide the dimensional stability and service life to the fabrics for garments. The garments made using these traditional textiles can be washed multiple times using home laundering machines by consumers without any significant damage to the fabrics and without any pilling on the fabric surface. Although the traditional woven or knitted fabrics show the best fit for multiple use apparel applications, the main drawback with these fabrics is that even the most modern looms are run at very low production rates, of only a few feet of fabric per minute. Additionally, woven technology is increasingly becoming outdated and outsourced to third world countries.

[0003] Nonwoven fabric technologies offer innovative solutions with improved scale of economy due to the speed of production. For example, machines for making nonwoven fabric can be run at several hundred feet per minute. However, the fabrics from nonwoven processes do not offer an equivalent product to a woven or knitted fabric in terms of performance, wash durability, abrasion and service life. A nonwoven fabric from conventional processes would essentially disintegrate within a single laundering cycle of washing and tumble drying using a home laundering machine. Generally, the worse the mechanical fiber bonding/entanglement of the base nonwoven fabric, the poorer the performance of the fabric in apparel use.

[0004] Typically, nonwoven fabrics are treated after fabric formation in order to provide stability to the fibers. Such post formation applications include chemical and thermal treatments. Chemical treatment includes excessive amounts of cross-linking and binding chemicals to stabilize the movement of fibers especially during the laundering process. Thus, additional chemical binding agents are necessary to stabilize the fiber bonding and fabric structure to take the fabric through required laundering cycle. One drawback to the use of binding chemicals is that these lead to a stiffer fabric with poor textile drape and most often a reduction in physical and mechanical properties. Additionally, the finishing chemicals applied for imparting wash durability may not be safe for handling, skin contact and environment. Furthermore, the flame retardant properties of the fabric could be negatively affected.

[0005] The thermal approach for imparting wash stability to the fibers includes using a portion of fibers having lower melting polymers such as polyethylene, polypropylene, low melt polyester and nylon fibers. These fabrics can be passed through a set of heated calender rolls under pressure or sent through a hot air oven with temperature set above the melting point of the lower melting fibers. The area around the lower melting fibers act to form a bond or anchor point for other non melting fibers in the fabric thereby providing stability and durability to the entire fabric structure.

[0006] An additional approach for fibers having lower melting polymers includes using sound waves as in ultrasonic bonding technologies to impart similar properties as that of calendered fabrics. While fabrics treated in this way may possess desired durability, the textile hand and stiffness is affected thereby limiting their use for garments. Additionally, these synthetic fibers could melt and drip impacting the flame retardant characteristics of the fabric.

[0007] To this date, nonwoven fabrics have been used in disposable areas for limited and non launderable applications such as medical garments, lab coats, turnout gear etc. Flame retardant nonwoven fabrics are used today as layers for composite fabrics. One such example is a fireman turnout gear that is not laundered or subjected to limited wash cycles. This flame resistant garment has multiple layers, a fire resistant and durable woven fabric as an outer layer, a middle laminated fabric layer that imparts water and moisture barrier and an inner most nonwoven fabric that provides fire and thermal barrier and comfort. Typically, the nonwoven fire barrier layer fabric is made of meta-aramid and blends of fire retardant fibers that do not melt and drip. These FR fibers are non-dyeable and thus the FR nonwoven fabrics/layers cannot be dyed or printed. Thus, the nonwoven fabrics are used only as layers of garments and do not make up the entire garment because of their poor dimensional stability and wash durability and lack of textile drape and feel.

SUMMARY

[0008] In at least one aspect of the present disclosure, a field durable, repeatably launderable nonwoven fabric is provided including a cross-lapped and needle punched nonwoven fabric that is bonded together by entangling fibers with hydroentanglement. The resulting fabric is capable of being laundered at least 25 times per AATCC 135 standard testing method using a home laundering machine with substantially no fabric damage and pilling.

[0009] In another aspect of the present disclosure a field durable, repeatably launderable nonwoven fabric is provided including a plurality of fire resistant fibers formed into a cross-lapped and needle punched nonwoven fabric. The fabric is bonded together by entangling fibers with hydroentanglement. The resulting fabric is capable of being laundered at least 25 times per AATCC 135 standard testing method using a home laundering machine with substantially no fabric damage and pilling.

[0010] The exemplary nonwoven fabrics of the present disclosure can further include fibers that are inherently fire resistant without the need for chemical treatment.

[0011] The exemplary nonwoven fabrics of the present disclosure can further include individual fibers that are not bonded by thermal or chemical means for retention of textile drape for apparel use.

[0012] The exemplary nonwoven fabrics of the present disclosure exhibit enhanced mechanical properties wherein the reduction in tear strength of the nonwoven fabric is less than 40% and preferably less than 20% after 25 home laundering when tested per ASTM D-5734.

[0013] In yet another aspect of the present disclosure, a process for preparing a field durable, repeatably launderable nonwoven fabric is provided. The process includes carding a plurality of fibers to form a series of fibrous webs, cross-lapping the series of fibrous webs, needle punching the cross-
lapped fibrous webs, and bonding the fibers of said fibrous webs together with hydroentanglement to form a nonwoven fabric. The resulting fabric is capable of being laundered at least 25 times per AATCC 135 standard testing method using a home laundering machine with substantially no fabric damage and pilling.

[0014] The foregoing and other objects, features and advantages of the present disclosure will become more readily apparent from the following detailed description of exemplary embodiments as disclosed herein.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] Embodiments of the present application are described, by way of example only, with reference to the attached Figures, wherein:

[0016] FIG. 1 illustrates a flow chart of an exemplary process for preparing an exemplary field durable, repeatedly launderable nonwoven fabric.

DETAILED DESCRIPTION

[0017] A detailed description of embodiments of the present invention is disclosed herein; however, it is to be understood that the disclosed embodiments are merely exemplary of the invention, and that the invention may be embodied in various and alternative forms of the disclosed embodiments. Therefore, specific structural and functional details which are addressed in the embodiments disclosed herein are not to be interpreted as limiting, but merely as a basis for the claims and as a representative basis for teaching one skilled in the art to variously employ the present invention.

[0018] Disclosed herein is a nonwoven and needle punched fabric bonded together via hydroentanglement. Further, such nonwoven fabric can be formed from inherently non-meltable and flame retardant fibers. Fabric formed as described herein is capable of being laundered at least 25 times per AATCC 135 standard testing method using a home laundering machine with substantially no fabric damage and pilling. Accordingly, a stable fabric having mechanical strength and integrity may be formed by use of only mechanical means, without the use of other stable imparting non-mechanical processes such as thermal and chemical treatments.

[0019] Any type of fibers may be employed for the presently disclosed nonwoven including such fibers as natural, synthetic, high performance, antimicrobial, and microfibers. While any fibers may be used for preparation of the nonwoven fabric described herein, for applications which flame retardancy is of interest, inherently non-meltable, flame retardant fibers may be employed. By using inherently flame retardant fabrics, a post formation chemical flame retardant treatment can be avoided. This further enables production of a non-woven fabric by mechanical means.

[0020] Flame retardant fibers which may be employed include for example, flame retardant (“FR”) Rayon, FR cotton, FR acetate, Para-Aramid, Meta-Aramid, PolyBenzimidazole, Modacrylic, Novoloid, PolyPhenylene Sulphide, etc., and their blends. FR rayon may be obtained from Lenzig Fibers of Austria under the trade name Lenzing FR®; and Para-aramid fibers may be obtained from Teijin Aramid of the Netherlands under the trade name Twaron®. For purposes of the present disclosure, inherently flame retardant fibers include those which are naturally flame retardant or have been treated prior to carding and formation into nonwoven fabric.

1. Carding

[0021] Formation of the nonwoven fabric of the present disclosure includes a carding process. First, fibers, including fire resistant fibers, are received in bales from manufacturers. The compacted fibers from the bales are fed into various pre-opening and blending stations before being fed to a picker-in roll of the carding machine. The blended fibers are then pneumatically fed to a carding machine. Carding, as the name indicates, is the heart of the textile process. More uniform carded webs would produce better quality textile fabrics. The carding process is based on individualizing and orienting the fibers in the machine direction. This is accomplished by subjecting the blended fibers to the action of several individual rollers and a main cylinder. The main cylinder runs at a slower speed than the small individual rollers that are located on top of the cylinder. This difference in surface velocity is the reason for the cleaning and individualization of the fiber bundles. The carded webs are then doffed off and twisted into sliver and formed into yarns in the traditional textile process. However, in the case of nonwoven fabric formation process, the carded web is bonded by mechanical, thermal or chemical means to form the final nonwoven fabric. A Trutzschler carding machine with an operating width of 90 inches may be used to make uniform nonwoven webs. While carding machines may be used, any applicable equipment may be used for forming a nonwoven web.

2. Cross-Lapping

[0022] Cross-Lapping is a technique to impart diagonal or 45 degree orientation to the fibers of the carded web. This process is carried out to yield blending of fibers for fabric uniformity and balanced properties in the machine and the cross direction of the nonwoven fabric. During the cross-lapping process, several carded webs are deposited onto conveyor belts that are located perpendicular to each other. The fibrous web from the carding machine is deposited onto a conveyor belt which is then suddenly forced into a 90 degree turn thus resulting in a diagonal orientation of the fibers within the body of the web before being needle punched into a nonwoven fabric. The number of layers used will depend on the throughput rate of the carding machine and the target basis weight of the needle punched fabric.

3. Needle Punching

[0023] Needle-punching is one of the mechanical bonding processes of fibrous layers to create nonwoven and nonwoven composite fabrics. Needle-punched nonwovens are created by orienting and mechanically interlocking the fibers of a carded web. This mechanical interlocking is achieved with thousands of barbed felting needles repeatedly passing into and out of the web. A typical needle punching machine made by DILO Group, would have a pre-needle board and a main needle board. The needle boards have several thousand individual needles embedded for bonding across the width of the fibrous web. Pre-needling board is used to work on the top side of the web only to provide sufficient integrity to the fibrous web for action by the main needle board. The main needle board typically has top and bottom needle beds with several thousand needles across the needle board. All types of fibers, synthetic and natural can be used for needle punching.
The finer and longer the fiber, the better is the ability to needle and entangle with other fibers in the nonwoven matrix. Because of the fuzz created by the process and the fabric bulk, the stand alone needlefaced fabrics have been used for wiping cloths and shoe liners etc. and not considered for apparel garment applications. Modern needle looms are capable of running at over 2000 strokes per minute with double needle beds resulting in production rates of hundreds of yards per minute.

4. Hydroentanglement/Spunlacing

[0024] The entanglement and the twisting of the fibers that occur in the case of spunlace fabrics is somewhat similar to the twist in the yarns of the woven fabrics and thus, spunlace fabrics provide the best drape characteristics among the commercially available nonwoven fabrics. The final fabric properties of exemplary nonwoven fabric disclosed herein including the degree of bonding of fibers, fiber strength and fiber surface abrasion resistance can be impacted by several factors during the spunlace processing including, but not limited to the use of the right type of nozzles, their length, design, diameter and number of holes per jet strip, coupled with the position of the jet manifolds, the number of manifolds per side of the fabric and the water jet pressure. Even the spunlace nonwoven composites exhibit a higher degree of elongation or stretch than desired and poorer recovery from deformation.

[0025] The individual carded webs or nonwoven layers are bonded to each other by a process using the energy from water jets, called hydroentangling or spunlacing, to create the nonwoven composite fabric. The carded webs including single or multiple webs containing fibers and their blends are placed on a conveyor belt with or without the optional rip-stop knitted fabric layer and subjected to initial bonding using high pressure water jets as in the hydroentangling or spunlacing process. The fibers from fibrous layers are intimately bonded at the interface creating a soft, textile-like yet very strong and coherent nonwoven composite. The fibrous layers are subjected to a pre-wetting step using a water jet pressure of about 800 PSI and numerous hydroentangling jet manifolds with at least two jet manifolds operating at a minimum pressure of 3000 PSI on the top and bottom of the nonwoven composite fabric. The hydroentangling or spunlacing machine has numerous water jet manifolds similar to that of commercial equipment from Nonfin GmbH, called a Fleissner Aquajet. It is sufficient, however, to position five water jet manifolds on each side of the composite to achieve complete bonding. Optionally, the composite fabric may be re-passed reversing the side of the fabric to smooth the other side of the fabric as that comes in contact with the wire mesh cloth attached to the drums of the hydroentangling machine.

[0026] FIG. 1 illustrates a flow chart of an exemplary process for preparing an exemplary field durable, repeatedly launderable nonwoven fabric. The methods defined in this invention provide for an approach which combines a sequence of nonwoven processing steps or methods as shown in FIG. 1 to fully stabilize the individual fibers of the FR nonwoven fabric for apparel applications. First, the inherently FR fibers are weighed, opened and blended using traditional textile processing equipment. The blended fibers are then pneumatically fed to a carding machine or any other type of nonwoven web forming equipment. Several layers of these webs are then cross-lapped to provide uniformity and a 45 degree orientation to the fibers so that the resultant fabric would exhibit similar mechanical properties in the machine and cross-machine direction. The cross-lapped fabrics are then subject to the action of two sets of needle looms typically used in a needle punching process to cause mechanical entanglement of the individual fibers within the body of the nonwoven webs. The fabric at this stage has very good integrity due to individual fiber entanglement. However, the fabric is typically very thick with a lot of loose surface fibers and exhibits very poor drape. In essence, the fabric is rough and unsuitable as needle-punched for apparel applications. The needle-punched fabric must be subjected to a spunlacing process where the action of very high pressure water jets bind the loose surface fibers with the body of the needled web thus further consolidating the webs into a much thinner and smoother textile fabric. The spunlacing process imparts the necessary drape and flexibility to the final fabric for use in apparel applications. Thus the needle punching process and the spunlacing processes alone would not be sufficient and they need to be used in tandem to get a fabric for potential use in apparel applications.

[0027] According to the above, a nonwoven fabric may be prepared having mechanical strength and stability, and maintaining this stability through multiple launderings (i.e. 25 or more) without degradation, pilling and damage to the fabric. This stable nonwoven fabric may be produced with solely mechanical means, without thermal or chemical treatment. Furthermore, by use of inherently fire retardant fibers, process and post process fire retardant treatments may be avoided. Accordingly, the mechanical process for formation of the fire retardant nonwoven fabrics described herein includes carding, spunlacing, needle-punching and finally hydroentanglement. The resulting fabric is a capable of being laundered at least 25 times per AATCC 135 standard testing method using a home laundering machine with substantially no fabric damage and pilling.

ILLUSTRATIVE EXAMPLES

[0028] The individual fibers were procured from fiber suppliers in the form of bales. The fibers used were nonmodified and inherently FR fibers such as FR Rayon and Para-Aramid. FR Rayon fibers with the trade name Lenzing FR® were procured from Lenzing Fibers of Austria and the para-aramid fibers with the trade name Twaron® were procured from Teijin Aramid of Netherlands. Although the process described above can be used to make durable nonwoven fabrics using any and all types of fibers and their blends, FR fibers were used in the example here for reference. FR Rayon fiber used had a fiber denier of 1.5 with a cut length of 1.5 inches and the Para-Aramid had a fiber denier of 2.5 with a cut length of 1.5 inches.

[0029] The fibers were opened and blended at a weight ratio of 65% FR Rayon and 35% Para-Aramid before being conveyed pneumatically to the carding machine. Trutzschler carding equipment feeding to the DIL.O needling looms was used to make various nonwoven fiber webs. A fabric basis weight of around 3.5 ounces per square yard was targeted for the current example. About 22 individual web layers were deposited onto the belt for cross lapping to yield 45 degrees orientation of fibers within the nonwoven web. The cross-lapped webs were then subjected to the action of a pre-needle loom acting only on top of the webs. The pre-needle is designed to provide sufficient integrity to the overall web to avoid any breakage of web in the next stage of the process where the fibers of nonwoven webs are more aggressively entangled by the action of the main needle loom to form a
high strength fabric. The needle beds of the main loom are position ed to act on the top and the bottom of the nonwoven web thus looping the fibers around each other within the body of the web in a more intimate fashion. The needle types were chosen in such a fashion that the depth of penetration of the needles is possible without causing any needle or fiber breakage.

[0030] The following process parameters were used to produce the needled nonwoven webs:

[0031] Machine Speed: 6 yards per minute

[0032] Fabric width: 80 inches

[0033] Fabric ID: 3 ARM

[0034] Nonwoven Basis Weight: 3.5 ounces per square yard or 120 Grams per Square Meter

[0035] Pre-needle punch density: 180 needles/cm²

[0036] Main needle punch density: 350 needles/cm²

[0037] The needled fabric was tested for breaking strength using ASTM D 5034 using test samples of 6"×4" in the machine and cross direction. An average of 5 samples were used to determine the breaking strength and the following results were obtained:

[0038] Breaking Strength in Machine Direction: 36 lbs

[0039] Breaking Strength in Cross Direction: 17 lbs

[0040] The needled webs were then inspected for uniformity in fabric basis weight across the total width of the fabric before being wound onto the spools for further consolidation at the spuncalendering process.

[0041] Spuncalendering or Hydroentangling is the process where the needled nonwoven webs are subjected to the action of very high pressure water jets to reduce the thickness and significantly improve the inter-fiber bonding. The mechanical and physical properties of the needle punched nonwoven fabrics are further enhanced at the spuncalendering process. The needle punched web rolls are mounted on a frame and unwound to be subjected to the action of high pressure water jets. The nonwoven webs are subjected to the action of pre-wetting jets that spray water enough to soak the fabric, followed by the action of high pressure water jets as the webs are pressed against drums with a suction device to remove the water before being finally sent through a set of finishing water jets located at the end of the machine. The webs at this point are sent through a through-air woven or dryer where the fabric is dried before being wound in roll form. The following conditions were used at the spuncalendering process:

[0042] Machine Speed: 7 yards per minute

[0043] Pre-wet water jet pressure: 500-600 PSI

[0044] Main Jet water pressure: 2500-3000 PSI

[0045] Finishing Jet water pressure: 2000 PSI

[0046] Dryer Temperature: 180-200 deg. F.

Example 1

[0047] A 3.5 oz/sq.yd FR nonwoven fabric with a fabric ID, 3ARM was needle punched with a formulation containing 65% FR Rayon fiber and 35% Para-Aramid fiber. The needled web was then subjected to a series of high pressure water jets to consolidate the webs into a thin and flexible textile fabric suited for garment applications. This fabric was then dyed and printed using the US Army Universal Camouflage Pattern. Of particular interest during the dyeing and printing process is the dimensional stability of the nonwoven fabrics as the traditional nonwovens tend to exhibit excessive shrinkage and they had to be pulled back to width. This affects the durability and mechanical properties of the fabrics.

Example 2

[0048] A 3.5 oz/sq.yd FR nonwoven fabric with a fabric ID, 2HP was spuncalendered with a formulation containing 65% FR Rayon fiber and 35% Para-Aramid fiber. Unlike in Example 1, the fabric was made without subjecting the nonwoven web to cross-lapping and needle punching techniques. The spuncalendering machine conditions were kept the same for both 3 ARM and 2 HP fabric samples.

[0049] The FR nonwoven fabrics were then dyed for the appropriate back ground shade and printed with the US Army Universal Camouflage pattern using vat dyes on a continuous dye and screen printing machine such as the one located at Duro Industries, Fall River, Mass.

[0050] Table 1 contains the results of fabric dimensional stability and shrinkage at the dyeing and printing process that was performed at Duro Industries, Fall River, Mass.

<table>
<thead>
<tr>
<th>Fabric ID</th>
<th>Percent Shrinkage During Commercial Dyeing Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>2HP</td>
<td>28</td>
</tr>
<tr>
<td>3ARM</td>
<td>5</td>
</tr>
</tbody>
</table>

It is evident that under the same dyeing and printing processes, 3ARM fabric had similar dimensional stability aspects as that of a traditional woven fabric whereas the 2HP fabric had very poor dimensional stability or shrinkage issues typical of unstabilized nonwoven fabrics.

[0052] The printed FR nonwoven fabric samples 2HP and 3ARM were then laundered 25 times using home laundering per AATCC 135 under the following conditions:

<table>
<thead>
<tr>
<th>Type</th>
<th>Home Laundering Machine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>120 deg. F.</td>
</tr>
<tr>
<td>Cycles</td>
<td>45 minutes Hot/Cold Permanent Press</td>
</tr>
<tr>
<td>Dryer</td>
<td>45 minutes drying cycle with Permanent Press</td>
</tr>
</tbody>
</table>

The fabrics were then inspected for visual appearance and the results are shown in Table 2. The Rating Scale is as follows: 1 represents severe fabric damage and severe pilling and 5 represents no fabric damage and no pilling on the surface of the fabric.

<table>
<thead>
<tr>
<th>Fabric ID</th>
<th>Visual Rating of Fabrics After 25 Home Laundering Cycles</th>
</tr>
</thead>
<tbody>
<tr>
<td>2HP</td>
<td>1</td>
</tr>
<tr>
<td>3ARM</td>
<td>5</td>
</tr>
</tbody>
</table>

As can be seen from the test results during the commercial dyeing process and the home laundering that the FR nonwoven webs must be fully entangled or stabilized to be used in a 100% nonwoven fabric (without any supporting woven or knit fabric or thermal or chemical bonds) type in garment applications.

[0059] Additionally, the wash durability or field wash durability of fabrics is characterized by change in tearing strength of fabrics after 25 home laundering cycles. An FR woven fabric made of similar fiber blend as that of 3 ARM but 85% heavier was subjected to 25 home laundering cycles and both the FR nonwoven and the FR woven fabrics were tested for any reduction in their tearing strength per ASTM D-5734. The results are shown in Table 3.
TABLE 3

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Weight (oz/sqyd.)</th>
<th>Tearing Strength Warp or Machine Direction (lbs)</th>
<th>Tearing Strength Fill or Cross Direction (lbs)</th>
<th>Percent Reduction in Tearing Strength Before Laundering 25 times</th>
<th>Percent Reduction in Tearing Strength After Laundering 25 times</th>
</tr>
</thead>
<tbody>
<tr>
<td>3ARM</td>
<td>3.5</td>
<td>5.9</td>
<td>4.9</td>
<td>17</td>
<td>6.0</td>
</tr>
<tr>
<td>FR</td>
<td>6.5</td>
<td>9.3</td>
<td>4.2</td>
<td>55</td>
<td>9.7</td>
</tr>
</tbody>
</table>

It is evident from Table 3 that the fully stabilized spunlace FR nonwoven fabric of the current invention is less prone to tearing after 25 home launderings as opposed to the traditional woven fabric because of the differences in fabric construction. Nonwoven fabrics have multiple fiber layers arranged in three dimensions as opposed to a planar structure of the woven fabrics. This leads to deflection of tear as opposed to linear tear propagation in the case of woven fabrics. Although the patent covers inherently FR fibers, it is apparent that any and all non-FR fibers and their blends may be used to develop a wash and field durable spunlace nonwoven fabric using the sequence of nonwoven process outlined in the present disclosure.

Example embodiments have been described hereinabove. Various modifications to and departures from the disclosed example embodiments will occur to those having ordinary skill in the art. The subject matter that is intended to be within the spirit of this disclosure is set forth in the following claims.

What is claimed is:

1. A field durable, repeatedly launderable nonwoven fabric comprising:
   a plurality of fibers formed into a cross-lapped and needle punched nonwoven fabric, said fabric being bonded together by entangling said plurality of fibers with hydroentanglement,
   said fabric capable of being laundered at least 25 times per AATCC 135 standard testing method using a home laundering machine with substantially no fabric damage and pilling

2. The nonwoven fabric of claim 1, wherein said plurality of fibers are inherently fire resistant without chemical treatment.

3. The nonwoven fabric of claim 2, wherein said plurality of fibers are not bonded by thermal or chemical means for retention of textile drape for apparel use.

4. The nonwoven fabric of claim 1, wherein the reduction in tear strength of said fabric is less than 40% after 25 home launderings when tested per ASTM D-5734.

5. A field durable, repeatedly launderable nonwoven fabric comprising:
   a plurality of fire resistant fibers formed into a cross-lapped and needle punched nonwoven fabric, said fabric being bonded together by entangling said plurality of fire resistant fibers with hydroentanglement,
   said fabric capable of being laundered at least 25 times per AATCC 135 standard testing method using a home laundering machine with substantially no fabric damage and pilling.

6. The nonwoven fabric of claim 5, wherein said plurality of fire resistant fibers are inherently fire resistant without chemical treatment.

7. The nonwoven fabric of claim 5, wherein said plurality of fire resistant fibers are not bonded by thermal or chemical means for retention of textile drape for apparel use.

8. The nonwoven fabric of claim 5, wherein the reduction in tear strength of said fabric is less than 40% after 25 home launderings when tested per ASTM D-5734.

9. A process for preparing a field durable, repeatedly launderable nonwoven fabric comprising:
   carding a plurality of fibers to form a series of fibrous webs; cross-lapping said series of fibrous webs; needle punching said series of cross-lapped fibrous webs; and
   bonding together said plurality of fibers with hydroentanglement to form a nonwoven fabric, wherein said fabric is capable of being laundered at least 25 times per AATCC 135 standard testing method using a home laundering machine with substantially no fabric damage and pilling.

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