

Needlepunched Nonwovens

Part four in a five-part series on nonwoven manufacturing technologies

Jürg Rupp, Executive Editor

Basically, five technologies are applied to form nonwovens. In this context, needlepunched nonwovens - also called needle felts - are still the most important technology for transforming fibers into a fabric. The estimated global share of needlepunched nonwovens is 30 percent. Needle punching is a very traditional method of forming nonwovens and is especially suitable in terms of flexibility, quality and product diversity.

Bonding using needling requires no water and consumes little energy. It is a high-performance technology realizing high throughput speeds exceeding 150 meters per minute, allowing universal applications, a high degree of automation and a high production efficiency with low personnel requirements. The biggest textile machines in the world are needle looms for needling paper machine felts. Their working widths are up to 16 meters, and their total weight is about 750 tons. Needle punching is an ecologically friendly technology, as it permits the use of recycled material including that from polyethylene terephthalate bottles and regenerated fibers from apparel, as well as natural fibers. It also offers great savings potential and has a bright future.



Needlepunch technology permits the use of recycled material, as in these needle felts.
Flexible Technology

Today, there are numerous designs for needling machines. Machines having just one needle board and a low needle density needle the web from one side only, either from the bottom or the top. The production speed increases in direct relation to the number in use. Depending on the end product, a production line can be equipped with a series of different types of machines with alternating needling directions. A complete punching line is equipped with different machine sections, preneedling, intermediate needling and finish-needling.

Fiber Selection Essential

As mentioned in recent issues of *Textile World*, there are two basic methods to form a nonwoven: dry and wet. Needle felts use a dry method, just like spunbonds. No water is required to form a batt made from natural or man-made fibers, or even from glass fibers. It is very significant that reclaimed fibers from any kind of recycled material can be used for the products. Of course, the selected fibers to be processed have a direct impact on the overall quality and properties of the end product. These fibers may vary from short to long fibers to continuous fibers, as in spunbond. All fiber finenesses ranging from 1 to 200 decitex, and all weights from 30 to 3,000 grams per square meter (g/m²) may be processed, which makes needlepunching a very universal and flexible production technology.

The basic work to form a needlepunched nonwoven occurs in its initial stages similar to spinning. After opening and mixing, the fibers are cleaned and carded. Here is the separation: the web is processed into either a yarn or a nonwoven. However, the web formation can be executed either aerodynamically

or mechanically. With aerodynamic technology, only random-laid webs are possible. Mechanical formation is much more flexible, and the webs can be laid randomly, crosslaid or parallel. The web formation process determines the characteristics and performance of the finished nonwoven. Web bonding can be executed in three different ways: chemically, thermally or mechanically. Needle punching is a mechanical technology.

The first patents were given in the 1880s. In 1829, it already was possible to process fibers like jute, sisal and animal hair. Over the years, technology has improved constantly, and today, two of the major players in the field of needlepunched nonwovens are Germany-based Dilo Group and France-based NSC nonwoven (Asselin-Thibeau).

NSC nonwoven

NSC nonwoven is another leading supplier of needlepunch technologies. According to company literature, it offers "an alternative to the nonwovens industry where different economies of scale can enable opportunities to markets where capacities of scale relative to their investment enable growth." The range of technologies includes needlepunched nonwovens and direct web markets, which includes hydroentanglement, thermal, chemical and laminated nonwovens.

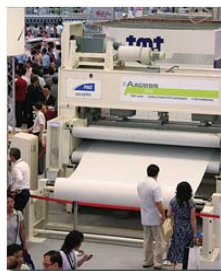
Needle Types And Web Bonding

During mechanical bonding methods, fibers are transported with felting needles and interlocked in the nonwoven structure. This procedure increases the friction between the fibers, which reinforces the nonwoven. A very large number of needles are inserted in the needle board of the needling machine. Germany-based Groz-Beckert KG is a major manufacturer of needles for the nonwovens industry and supplies two groups of needles - felting and structuring needles. Felting needles are used to mechanically compact nonwovens. There are different types of needles used with varying shapes, length distribution and barb characteristics - the most important functional elements. The correct needle is selected according to the fiber and the required properties and performances of the end product.

NSC nonwoven's Axxess Line

NSC nonwoven recently introduced Axxess, a new range of needlepunch machinery engineered for medium-capacity markets while maintaining the engineering quality standards of its high-capacity Excelle nonwoven lines. The technologies include web-forming carding systems, batt-forming crosslapping with profile capability, batt drafting and felt drafters, needle looms and winding systems. The engineering of the Axxess range of machinery is based on proven technologies of Asselin-Thibeau. It is said to offer an alternative for customers who do not require the capacities available with the Excelle production lines, and also in situations where lower production capacities and lower capital investment costs are better suited to a company's corporate strategies.

It also is designed for alternative bonding technologies in which direct web manufacturing lines enable the production of different nonwoven fabrics such as spunlace wipes using France-based Rieter Perfojet's Avantage technology, or with other bonding technologies such as thermal, chemical or laminating for composite nonwoven applications.



NSC nonwoven's Axxess needlepunch machinery for medium-capacity markets offers the same engineering quality standards of the company's high-capacity Excelle lines.

MD:CD Ratio

If requested, a drafting unit can be integrated in the production line after the first needling machine. Drafting is one method of achieving a well-balanced tear/strength ratio. Top priority of every nonwoven producer is to reach an even or isotropic machine direction to cross direction (MD:CD) of the product. Isotropy refers to a product with the same physical properties in all directions. The ideal nonwoven has a MD:CD ratio of 1:1. This ratio plays a prominent role in determining the quality of a nonwoven.

Monitoring

For years, the great challenge for nonwovens producers was to achieve an isotropic MD:CD ratio. For this, it is important to produce batts and webs with great uniformity. In the first stages of production, web formation plays an important part. The fibers should be laid evenly to form an even fabric weight over the entire width of the web. Today, the big suppliers are providing instruments to monitor and adjust the MD:CD ratio.

NSC's Excelle series includes technologies such as the ProDyn® + Qua!sys® web/batt shaping system to optimize weight uniformity in the finished felt with an optimized uniformity while reducing fiber costs. The company's IsoProDyn is said to offer a competitive advantage.

Needlepunched Nonwoven Applications	
Traditional	Industrial
Apparel	Medical/hygiene
Home textiles	Secondary carpet backings (recycled fibers)
Cleaning wipes	Geotextiles
Blankets	Drainage, separation, etc.
Floor and wall coverings (needle felts)	Automotive
Decoration felts	Insulations/composites
Paddings	Protective apparel
Interlinings	Industrial felts
Shoulder pads	Roofing material (substrates)
Artificial leather	Filters
	Paper machine felts

Table 1

Products

The list of products made using needlepunch technologies is seemingly endless. Needlepunched products are applicable in many sectors. Either domestic or industrial textiles can be produced. Possible application areas are floor coverings, automotive linings, geotextiles, filter media, synthetic leather or natural fiber felts for upholstery and bedding. Needle felts are an everyday product and are applied in countless end-uses (See Table 1).

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