2004 BELTWIDE COTTON CONFERENCES, SAN ANTONIO, TX – JANUARY 5-9

# REVIEW OF NONWOVENS AND OTHER INTERESTING TECHNOLOGIES FROM ITMA 2003

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## Abstract

Nonwovens and technical textiles are essential components of modern everyday living. This presentation highlights the interesting techniques and new developments in the manufacturing of nonwovens observed at ITMA 2003.

## Introduction

Initially, there was concern that the ITMA show would not be held – with terrorism, SARS and the poor textile economy in the US and Europe. A number of companies were on the fence about whether to exhibit, and a few did not show up.

Most all exhibitors who did come agreed that ITMA 2003 was better than they had expected, but then added that their expectations had been very low. There were almost 60 exhibitors from the US but US attendees were less apparent and, according to the official count, made up less than 3% of the 125,000 visitors. (The results are reported as 15,000 visitors per day so, one cannot be sure that the 125,000 did not include duplicates; however, 24000 were pre-registered.) Italian machinery occupied 25% of the exhibition floor space. The Italian Textile Machinery Association reported that the 2002 exports of textile machinery were 70% of total production and that 40% of the exports were to Asia. Most exhibitors agreed that most of the "buyers" at the show were from Asia. The Turkish presence among exhibitors was as large as that from the US (61 exhibitors), and the combined total of exhibitors from China (PRC) and Taiwan was about 75. China exports the expected yarn and fabric machinery, but in addition, you could purchase a turnkey fiber production facility.

A number of exhibitors complained about the lack of organization in planning the show and the high cost of exhibiting. Some unrelated exhibitors had joined together in a single large booth to share and save expenses. Several exhibitors questioned their future exhibitions in Europe; the market is moving. India, for example, was promoting its own version of ITME in Mumbai in December 2004.

The following are among the more interesting new developments seen by the author in the areas of nonwovens, testing and fiber production.

### Nonwovens

Fleissner showed their new patterning capabilities for their Aquajet® hydroentanglement unit. By controlling the geometry of the support screen, they are able to produce a relief pattern on the fabric surface (Figures 1,2). The hydroentanglement unit is also being promoted to bond three layer composite nonwovens with a center layer of pulp from their air lay pulp heads. Fleissner also exhibited a carpet dye liquor applicator head that allows rapid color changes and minimizes carpet and dye waste during the color changeover.

Fehrer exhibited a needle punch machine with two independently operating needling sections. A section can be engaged intermittently to produce an end border on structured nonwoven carpet in a single pass through the machine (Figure 3). The also exhibited an improved version of their DREF® friction spinning machine (model 3000). A "Yarn Puncher" was introduced for binding yarn to flat surfaces or for improving the entanglement between sheath and cores in composite yarns.

Wise (Kings Mountain, NC) was exhibiting the Struto® vertical laid nonwovens technology. The structure is corrugated similar to the inner layer of a shipping box except with longer folds and an almost vertical arrangement. The structure offers better resilience than crosslapped or airlaid products and is finding applications in various padding applications and in automobile panels (Figure 4).

Hills Inc of Melbourne Florida is a bright spot in U.S textile machinery technology. John Hagewood was busy demonstrating their bicomponent spinning (extrusion) technology. They can produce extremely fine fibers using "islands in the sea" technology. The "sea" is dissolved away, leaving islands approaching nanofiber dimensions. They also have segmented pie fibers and hollow segmented fibers with either splitable or with dissolvable segments. The hydroentanglement of the splitable bi-components provides both splitting and bonding, with remarkable dimensional stability and strength for a nonwoven. Hills Inc provides complete spinning lines for normal as well as bicomponent and hollow fiber. They also provide bicomponent technology to other extrusion engineering companies including Barmag, Reiffinhauser and Fleissner

Laroche SA (France), long known for its recycling and bast fiber processing equipment is being successful in providing complete nonwovens lines. An air lay line capable of handling relatively short fibers, and a compact line for moldable felts were highlights of their exhibit. Paul Whitaker (Allertex of America, the US Representative) made the point that with mature industry, the ability to integrate the known technologies to produce new products is a key to success. Allertex also represents Technoplants (Italy) who exhibited cutting stacking and wrapping equipment for nonwoven products.

The Santex Group (Switzerland) was promoting their large variety of heating and bonding equipment for nonwovens (Cavitec affiliate), and their Wave Maker®, which competes with the Struto technology.

Autefa, along with its sister companies Spinbau and Dilo, exhibited an improved nonwovens line with faster speed, better control of crosslapping and more versatility in needling. The crosslapper (Topliner® CL 4006) can handle webs at up to 200 m/min and with precise digital control of speeds (WebMAX®) can vary the infeed web weight to eliminate the normal increase in thickness in the folds at the edge of the web. Autefa also provides slitting and transverse cutting and perforation machinery which can be set for cut widths and lengths via automatic controls, rather than manually. Temafa showed a new nonwoven carding system with up to four webs doffed from the main cylinder, and two doffing layers during transfer between the opening cylinder and the main cylinder. This arrangement allows for better blending of fibers and for versatility in the addition of randomizer rolls. It also allows higher production rates and thicker webs from a single card system. Dilo was again exhibiting their Hyperpunch® needling machine with elliptical needle path for faster speeds and lower stress on the fabric and needles.

NSC nonwovens (which includes Thibeau ans Asselin) were offering increased speed and control on its card, crosslap and needlepunch machines. They also showed a new air-laid web forming system (Air-Web) that operates downstream from the card and provides low web directionality (1.3 – 1.9 MD/CD) over a wide range of batt weights beginning as low as 30g/sq meter. A scanning X-ray unit measures web uniformity for feedback control of process quality.

Automatex (Italy) offered improved side-to-side weight control in their crosslapper and better dust removal from their preneedler.

Both Groz Beckert (Germany) and Foster (ManitowocWI) were promoting their new entanglement needles. Groz-Beckert had new tin and chromium coatings to reduce wear and a tapered conical needle with high flexibility to minimize breakage. Foster touted improved precision in the crank and working areas of the needles as well as increased metal hardness for longer wear and reduced breakage.

Fibroline (Belgium) was promoting a “plasma” approach to the distribution of small particles in a nonwoven web. A high voltage alternating current is reported to improve the distribution of powders such as adhesives in the web and thereby minimize the powder waste. This may allow the production of powder-bonded fabrics in webs that previously required water or solvent based adhesives. The technology is being offered on Strahm Textile Systems AG (Switzerland) new nonwoven bonding ovens.

Mazios offered a line for web manufacture, and direct feeding to a multi-needle quilting machine (Figure 5), as well as a pillow vacuum (rather than blowing) line. The vacuum operates with less noise, fly and dust. They also exhibited a card with lateral motion to reduce the directionality in nonwoven webs.

Bematic (Italy) had a web-forming machine dubbed as a “no-air” air laid machine. The opened and centrifugally dispersed fibers land on an inclined apron and fall to the conveyor. Without the stream of high velocity air and a condensing screen or belt, short fibers and small particles are retained in the batting.

Nordson was promoting their new hot melt system for applying elastomeric yarns to disposable garments with minimum waste of glue material. The glue is applied directly to the elastomeric rather than to the nonwoven.

Europlasma (Belgium) was offering plasma units for surface treatment of nonwovens and films. The machines (unlike earlier plasma treatments) do not require high vacuum, but can operate at atmospheric pressure. The treatments include cleaning, and changing the polarity of the surface – more or less hydrophilic.

**Testing Equipment**

For all the talk of fewer exhibitors, there seemed to the author to be more companies exhibiting testing instruments, scattered throughout the exhibition. In addition to the usual manufacturers Zellweger Uster, Lawson Hemphill, Lenzing, Zweigle, Textechno, SDL etc there were newcomers from Italy, India, Taiwan, and P.R. China – all offering instruments similar to the others. That is not to say there was nothing new in testing. All of the instrument makers offered improved robotics to minimize the labor involved in testing.

Lawson Hemphill (Central Falls, RI) was offering their new testers for filament yarn shrinkage and drawing force. They also are representatives for another exhibiting company LineTech Industries (Brooklyn, NY) that was showing a new pilling tester (PillGrade®) and a color comparison device (PIXLColor®) for measuring color uniformity in a sample, or between samples. The device receives and analyzes spectral data from each pixel across the width of a sample, or a sample placed beside a standard (Figures 6,7).

Uster was present in high style and had a busy booth with their improved fiber and yarn testing instruments. They are also extending into the area of fabric quality measurement with fabric inspection equipment.

Shirley Developments Limited (SDL), Atlas Material Testing Technology, Raitech and Textile Innovators have all come together under the banner SDL-Atlas to offer a complete line of textile testing equipment.

Lenzing exhibited a single fiber crimp instrument. They load the fiber with an exceptionally low load and measure length. Then the instrument elongates the fiber by increasing the load from .01 to 1 cN/dtex (~ .001 g/den to 0.1 g/den) and then reverses to the initial tension to determine the crimp and crimp recovery.

Zweigle (Germany) has entered the optical evenness market.

Textechno (Represented in the US by Measured Solutions Inc., Greenville, SC) introduced an automated vibroscope/single fiber tester (Favimat®) that measures fiber crimp and can do an optical count as well. They were also testing the market for measurement of 3-D crimp with a new prototype instrument. The improved Dynafil ME® allows coupling with instruments to measure bulk and entanglement properties of BCF and textured yarn as well as uniformity (capacitance) denier (cut and weigh).

Mesdan (Italy) was there with testers for neps and trash in fibers, tensile testers for yarns and fabrics, a friction and a twist tester for yarn, and abrasion and lightfastness testers for fabric.

Woolmark Technology (UK) exhibited their laser measurement system for determination of fiber diameter in hair fibers. They advertise measurement of fiber diameters in mohair wool alpaca and cashmere. They also have a new version of the Almeter® and provide a fiber picking/aligning mechanism for preparing the samples.

Premier (India) had a large booth, and a number of fiber and yarn instruments similar to Uster. And Paramount, as well as Rossari Labtech (both from India) offered rather complete lines of typical textile testing equipment as well as general laboratory equipment like hot plates, water stills, pH meters, balances and ovens.

**Other Exhibits of Interest**

Cietex Chemnitzer Textilmachinenentwicklung exhibited machinery to make thick knitted and stitch bonded constructions using monofilament "spacers" in the Z direction. The vertical monofilaments provides cushioning and resilience for upholstery applications and the ability to change the thickness of the fabric during manufacture allows near net shapes for fabric up to 1.5 cm in thickness. Other suggested applications include coated inflatable articles, foam filled cushions, filtration products with pockets for absorbent media, and reinforcing textiles for the construction industry.

On September 4, 2003, DuPont Textiles and Interiors changed its name to Invista® and became a wholly owned corporate subsidiary of DuPont. The new company has sales of $6.3 billion, and employs 18,000 in 86 countries. And since the exhibition, DuPont announced the final sale of Invista to Koch Industries (a private corporation headquartered in Mexico). Invista and its construction partner, Chemtex International, are major players in the turnkey polyester polymerization and fiber spinning areas.

DuPont has also collaborated with Shaer Schweitzer Mettler AG (SSM), an extrusion technology company, to produce a continuous fiber spinning, stretch-break, twisting (air compaction – perhaps false twist) machine (Uniplex®) for producing staple yarns. The break length is rather long (perhaps as low as 8 inches according to William Corcoran from DuPont) so the fiber ends are not plentiful. However, it is a significant because it minimizes the number of discrete processes in producing a staple yarn. It is also claimed that a continuous filament core can be introduced in the yarn with the staple being wrapped around it. Advantages seen are lower air permeability, higher strength, rapid and flexible product changes, something approaching spun yarn aesthetics and rapid production rate that may translate into improved economics. A photomicrograph of a yarn sample appears in Figure 8.

Gilbos (Belgium) was exhibiting an air false-twist unit for combining yarn strands. The air-jet false twist provides alternate S and Z twist yarn segments and uses periodic air entanglement to prevent the adjacent segments from untwisting (Figure 9). Jack Gaches, the US representative, said that the advantage is a twist effect in plied yarn at higher production speeds than normal twisting machines can produce.

Sliver knitting is a fascinating process, allowing the production of synthetic textiles that resemble animal fur. Mayer Inc., (the Spartanburg, SC, based subsidiary of Mayer and Cie) produces sliver knit machines. Their new innovation on display at the exhibition was an air attachment that allows the machine to tuck the fiber ends back into the knitting mechanism to produce a knitted loop effect. The combination of areas with, or without fur and some of the fur areas being looped gives a wide variety of styling possibilities, particularly when combined with different colors of sliver.

Enka Technica was bought by Heberelein about three years ago and has now purchased Wetzel Micro Products in a consolidation of spinneret and spin-pack producers. They also offer a variety of products for downstream quality monitoring of yarn quality including filament migration detectors and entanglement counters.

Modra Technology Pty Ltd. (Australia) offered a unique carpet sample machine capable of producing variable gage, stitch length and stitch height in cut or loop pile and up to eight colors in the pattern. Samples are produced up to one meter in width and can be backed for display with a hot melt adhesive and a heated press.

Hollingsworth is now a part of Trutzschler, except in the US and offers card and clothing service from the same manufacturer. Hollingsworth on Wheels will still operate out of Greenville in the US.

Karl Mayer has moved into the yarn preparation area with a prototype draw-warping/texturizing unit. In an extension of their draw warping process they exhibited a machine that integrates texturing into draw warping. If commercially successful, they would prepare a beam of air-textured yarn directly from undrawn (or POY) polyester or nylon fiber. They also demonstrated a sample warping machine to prepare short warps from a limited number of packages, avoiding the large creel needed for conventional warping.

In addition to its improvements in color measurement equipment stability, which reduces the need for frequent sampling, Datacolor (Lawerenceville, NJ) featured foam generator/applicator systems for nonwovens manufacture. They have also partnered with several dyeing equipment manufacturers for better control of mill dyeing processes, and showed an improved, IR heated, beaker dyeing sample machine.

Laser Systems Technology (Quebec, Canada) offered a laser “engraving” system for “imprinting” designs on fabric. It was exhibited with a denim that was selectively faded in a pattern to produce a design (Figure 10).

Another Canadian company, Intstrumar, exhibited a denier/finish/interlace monitor for online measurements during extrusion. Their relatively unique business model is that they will install their system in the plant and the plant pays for the information, not the system. The system uses RF technology with a miniature RF applicator and determines denier from the magnitude of the absorption and the finish from the direction (phase) of the absorption vector.

Several companies were exhibiting antimicrobial finishes. Among the suppliers were Clariant, (Sanitized) and Rycobel (HealthGuard).

Figure 1. Fleissner Aquajet hydroentanglement unit and Don Gillespie, Vice President.

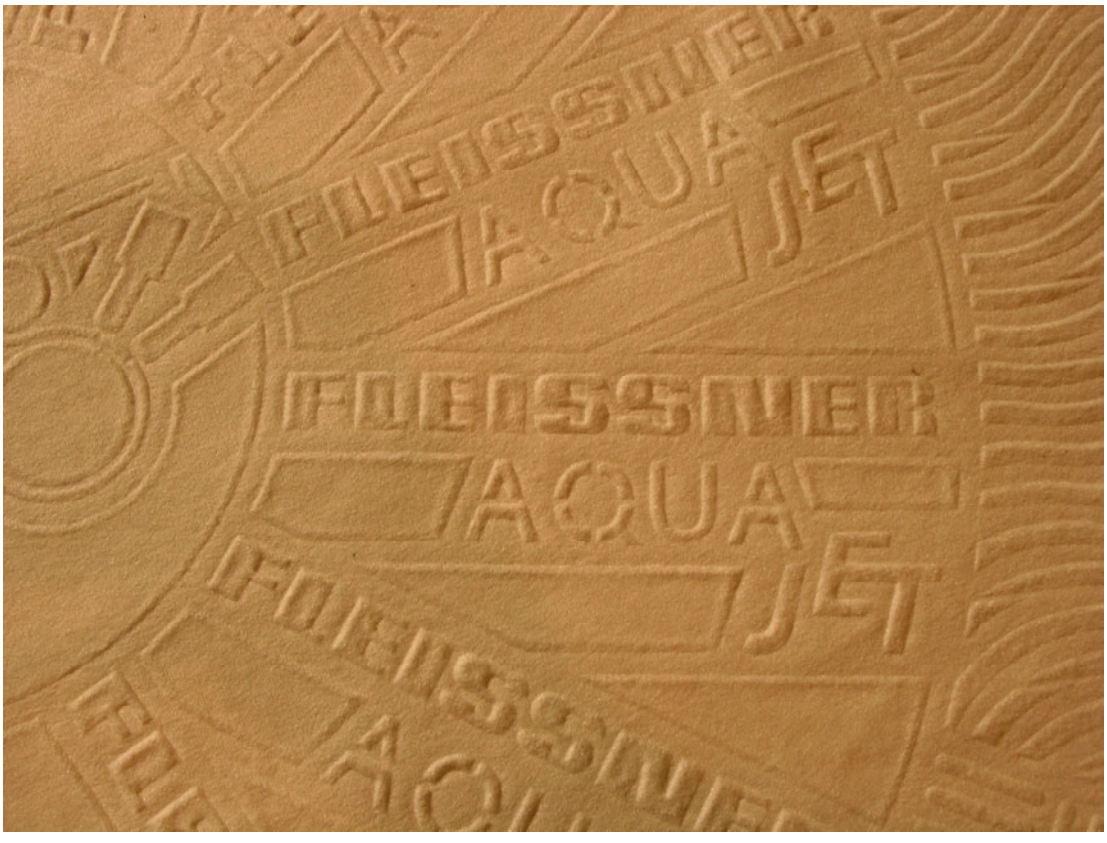


Figure 2. Tablecloth with a design imparted by the Aquajet.

Figure 3. Fehrer end-bordered nonwoven carpet.

Figure 4. Struto vertical laid nonwovens.

Figure 5. Mazios continuous bat forming/quilting.

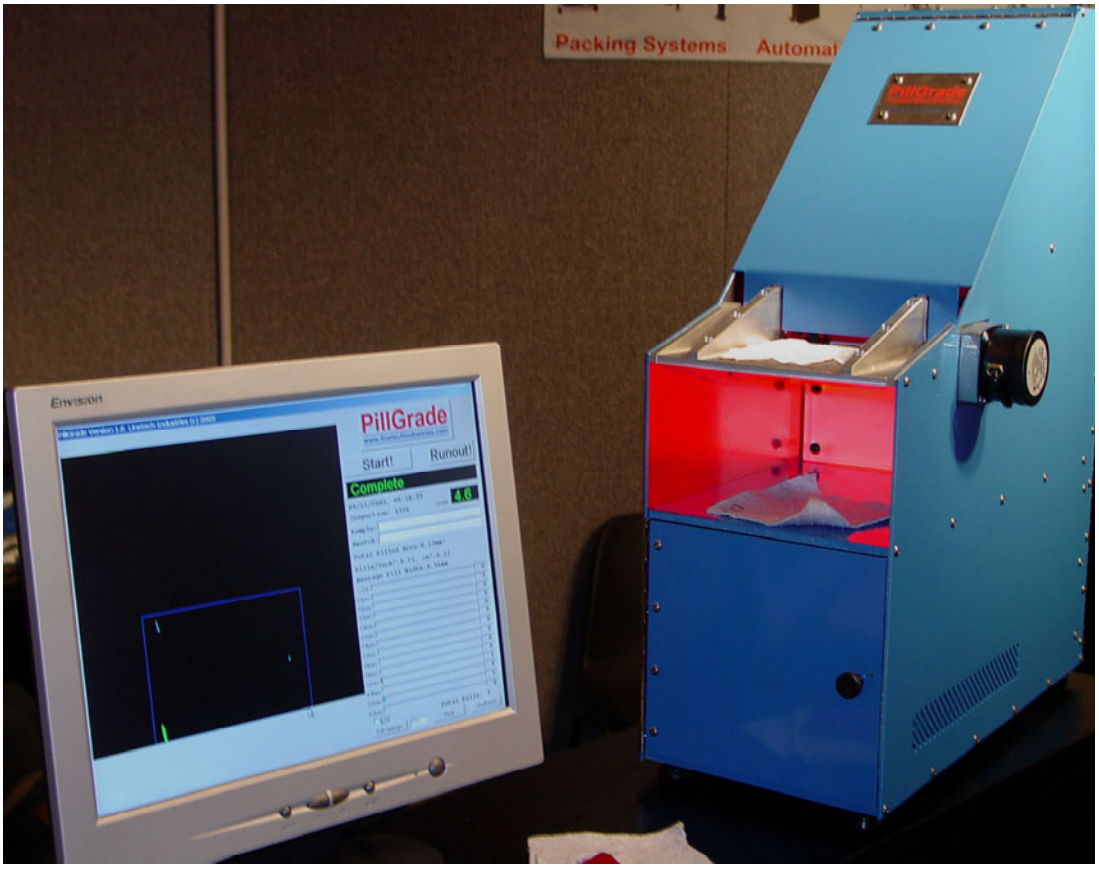


Figure 6. LineTech PilGrade.


Figure 7. LineTech PIXLColor.

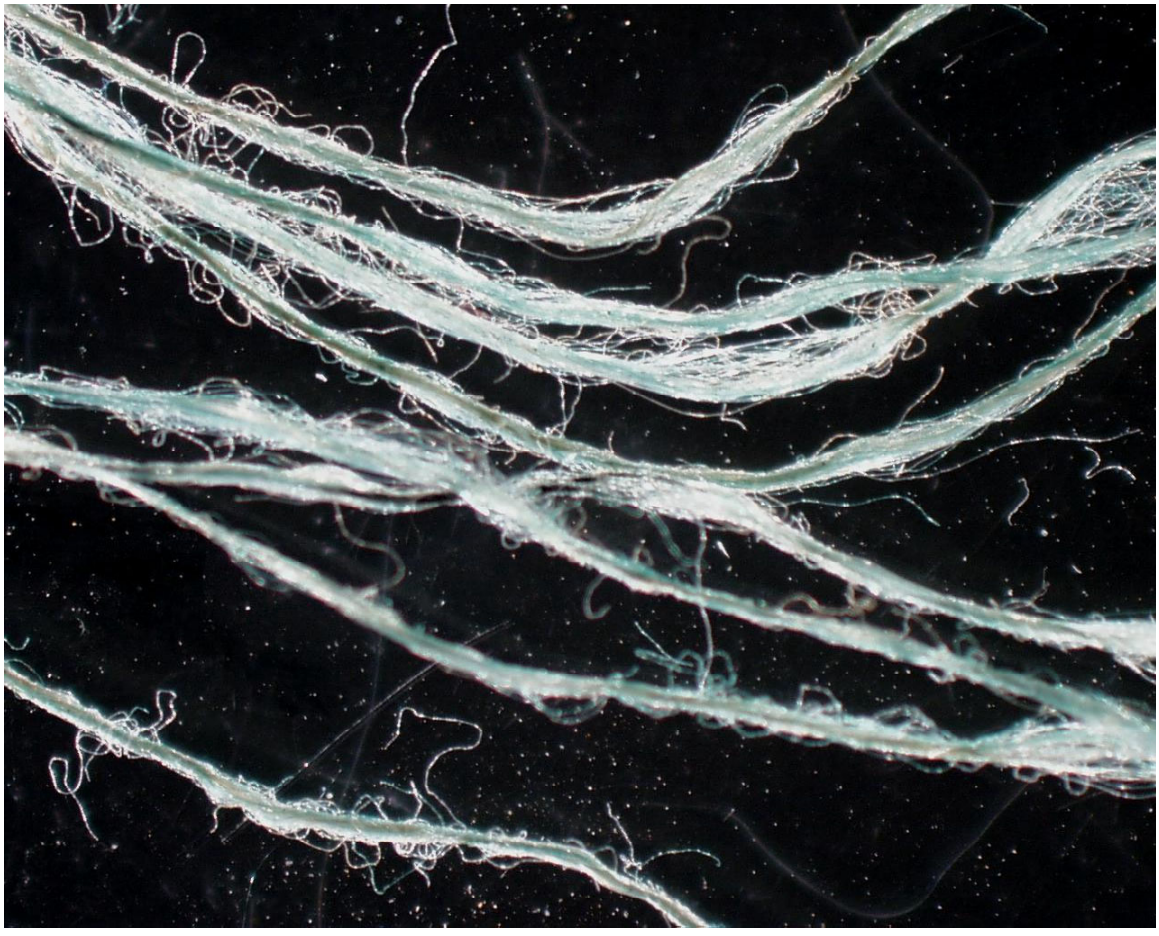

Figure 8. Yarn micrograph from Uniplex process.

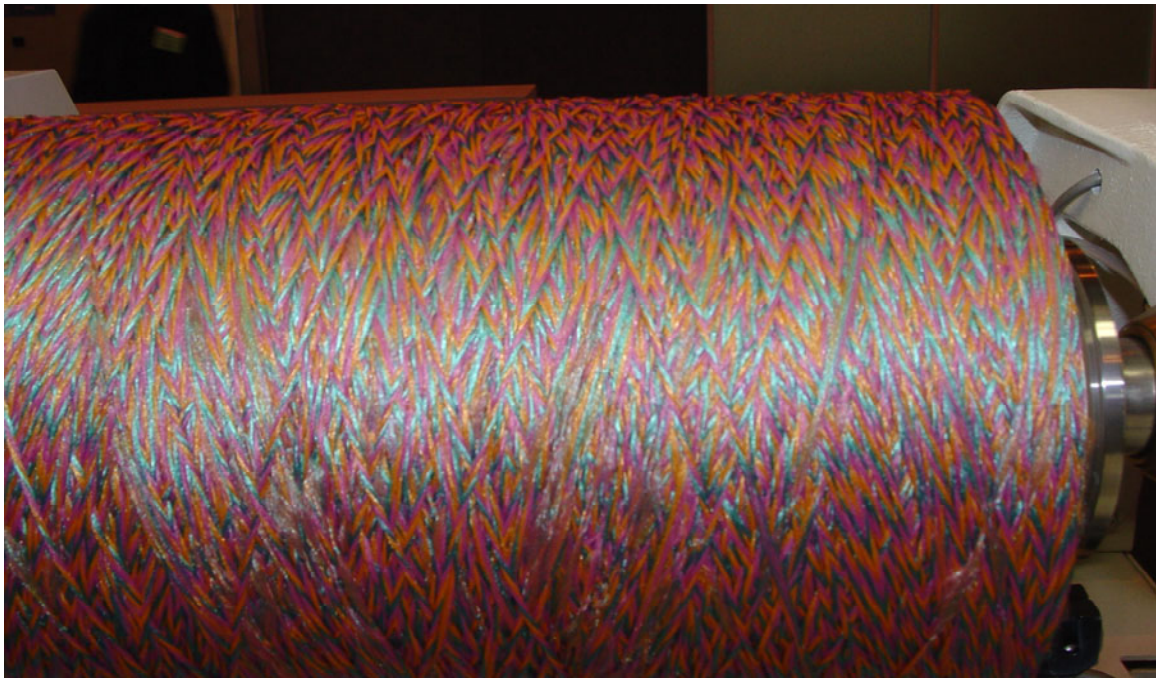

Figure 9. Air twisted yarn from Gilbos.


Figure 10. Laser “engraved” fabric from Laser Systems Technology.