TEXTILE topics

Spring 2001

International Textile Center   Texas Tech University   Lubbock, Texas USA

Sharing current research information and trends in the cotton and textile industries.

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MATERIALS EVALUATION LAB UNDERGOES RENOVATION

Renovation of the Materials Evaluation Lab is complete. It includes: improvements in air handling equipment; new sensors to monitor and control ambient conditions; improved layout of instruments, machinery and equipment; new delivery and outlets for electricity and compressed air; new paint and décor; and a new observation window that provides touring visitors a vista of the laboratory from the hallway.

SPECIAL EVENTS AT THE ITC

- The Seventh Annual Cotton Fiber Properties Seminar was held at the International Textile Center on April 3 - 4. Twenty-five were in attendance.
- The Texas Tech Chapter of Achievement Rewards for College Scientists had a tour and lunch, April 12.
- The 19th session of Texas International Cotton School was conducted May 14-25 at ITC. Eighteen students from nine countries attended the two-week overview of the U.S. cotton and textile industries.
- COTMAN workshop for Texas Agricultural Extension Service was hosted by the ITC, May 30.

ITC TRAVEL

- Texas Independent Ginners Association, Austin, March 7, presentation, Dean Ethridge
- NC-170 Committee/Protective Clothing & Textiles, St. Augustine, FL; Central Leather Institute, Anna Univ., India; South India Textile Research Institute, PSG College of Technology, Kumaraguru College of Technology, Coimbatore, India; Textile Institute meeting in Melbourne, Australia, CSIRO, School of Engineering & Technology, Deakin Univ., Geelong, March 18-April 11; SS Ramkumar
- Texas Commissioner of Agriculture, Cotton Advisory Committee, Austin, March 13, Dean Ethridge
- CCQM (Committee for Cotton Quality Measurement) Meeting, Memphis, March 15-16, Dean Ethridge
- USDA Gin School, Lubbock, April 3, presentation, Dean Ethridge
- Texas Cotton Association, S. Padre Island, April 18-20, Dean Ethridge
- SBCCOM countermeasures consortium meeting, presentation, April 26-27, University of South Florida, Tampa, FL, SS Ramkumar
- RA-89 AATCC research committee meeting, presentation, Research Triangle Park, NC, May 2, SS Ramkumar
- Engineered Fiber Selection, Cotton Incorporated, Greenville, SC, June 11-13, Dean Ethridge, Eric Hequet, Pam Alspaugh

NONWOVENS RESEARCH: A NEW INITIATIVE AT THE ITC

S. S. Ramkumar, Ph. D.

INTRODUCTION

The nonwoven textile industry has grown consistently and rapidly, about 10% annually during the last two decades. Two basic reasons for the increase are production cost advantages and expanding end-use applications of nonwovens. Nonwoven machinery manufacturers are progressively refining machine designs in order to increase flexibility, productivity and efficiency of the processes. Advancements in nonwoven machine designs have enabled the production of nonwoven products with improved properties and applications. Developments have taken place both in the conventional process, such as needle-punching, and new technologies, such as spunbonded and spunlaced processes.

A nonwovens research program has recently been initiated at the International Textile Center. This was made possible by the support of the Soldier and Biological Chemical Command (SBCCOM) of the US Department of Defense, in the form of a research contract to Dr. Seshadri Ramkumar of the ITC. The main objective of the research program is to develop protective fabrics for use against hazardous agents. A Fehrer H1 technology needle loom has been purchased, along with a William Tatham feeding line. The nonwovens laboratory at the ITC will be the first facility in the USA to house the state-of-the-art H1 technology needle loom.

H1 TECHNOLOGY NEEDLE LOOM

The H1 needle loom is a patented invention of Dr. Ernst Fehrer of Fehrer, AG, Austria. The technology has been aimed at enhancing the quality and expanding the variety of nonwoven webs produced. Results to date reveal that the distinctive contoured needle zone of these machines enhances the characteristics of the nonwoven web (Öllinger). According to Fehrer, advantages offered by the contoured profile include the following:

1) The longer needle path results in better fiber orientation and fiber entanglement than the conventional needle machine.
2) Superior web properties can be obtained with fewer needle penetrations.
3) It greatly enhances the construction of composite and hybrid products.
4) It delivers increased productivity versus conventional needle-punch looms.

Figure 1 shows the needling zone of the H1 technology machine; clearly visible is the oblique angled needle zone. The contoured profile makes it possible to obtain a better integrated, stronger needle web than with conventional needle-punch looms.
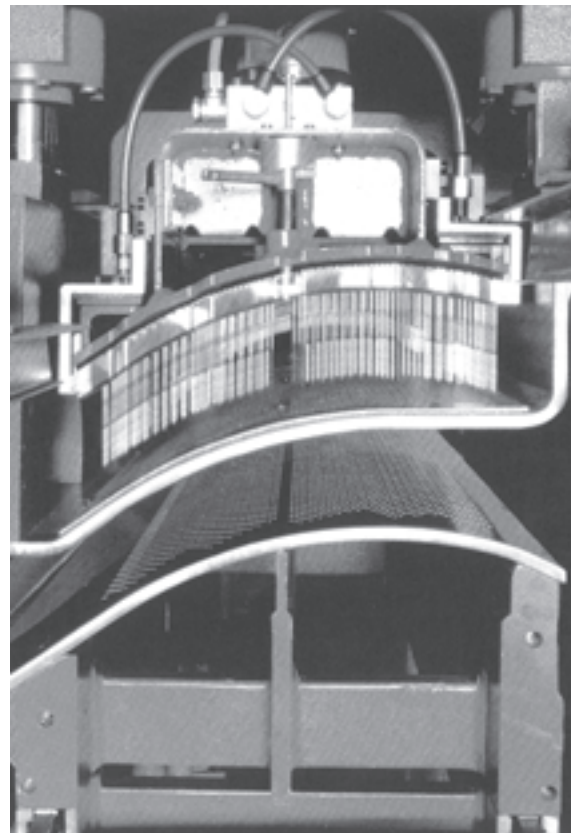
**Figure 1. H1 needling zone
(Source: Fehrer, AG)**

Figures 2a and 2b show the macroscopic structural images of both the conventional and H1 technology needle webs. The structure of the H1 technology web is more highly integrated and more coherent than the conventional technology needle-punched web.
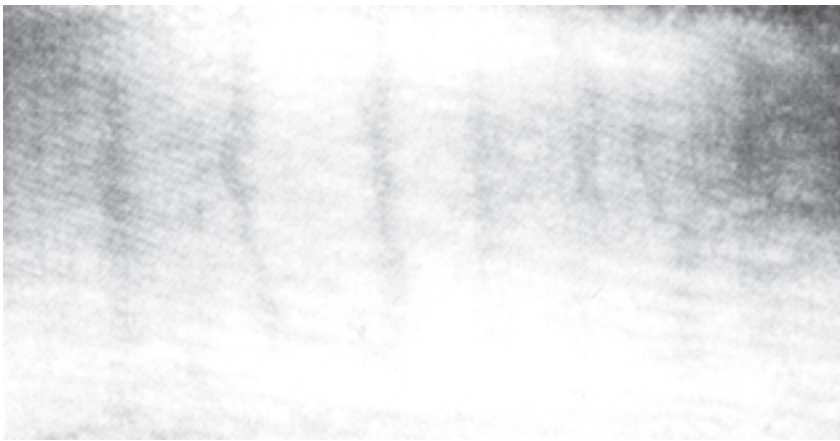

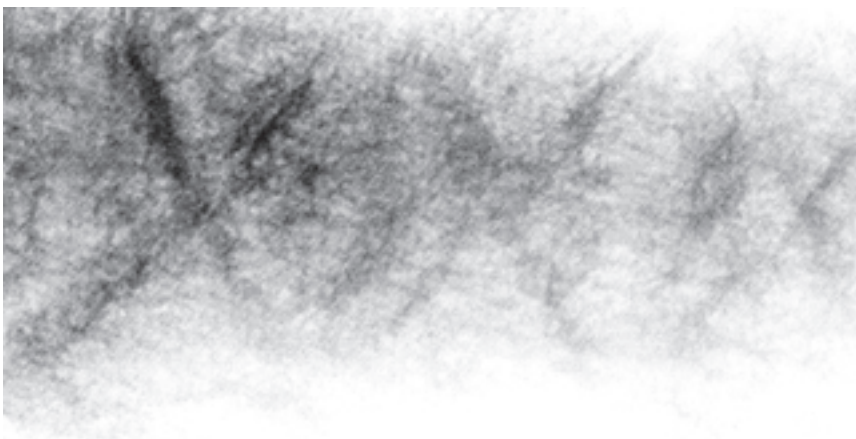**Figure 2a. Conventional needle web (Source: Fehrer, AG)**

Figure 2b. H1 technology needle web (Source: Fehrer, AG)

PROCESSING OF COTTON AND OTHER NATURAL FIBERS

Cost is a major issue concerning the use of cotton in the manufacture of nonwoven products that have specialty applications. The majority of nonwoven cotton products find applications in the medical field; e.g., medical wipes, bandages, cushion pads for lymphedema, wound wrappers, diapers, etc. The special care required during processing increases the production costs associated with these products. Higher throughputs with the H1 technology help to lower production costs. In addition, the manufacturers claim that the amount of needling required to produce a web of superior quality and performance is less compared to conventional needle looms, further reducing production costs. In a similar vein, the increase in productivity will also enhance the use of animal fibers such as wool and mohair for developing carpets, floor and wall coverings, etc. In addition to the productivity aspect, the arrangement of fibers in the web and their structural integrity is also important for applications in carpet and medical textiles.

CLEANING AND FEEDING REQUIREMENTS

The feeding and other preparatory requirements for the H1 technology machine are similar to those of conventional needle looms. There have been some improvements in the feeding devices in the recent past. These have been mainly to enhance the precision and the uniformity of the feed and control of the feed material to the needle loom. One such example is the micro control feed monitoring systems installed in feed units.

William Tatham, Ltd., England, has most recently introduced a feed monitoring system known as Microfeed 2000 for monitoring and controlling the delivery of fibers to the card. This system is similar to the autolevelers in drawframes that are used for maintaining uniformity in feed and delivery. The company claims that the micro weigh/feed system improves the quality of webs produced on the needle looms, making them more useful in the manufacture of hybrid and composite products. Figure 3 shows the micro feed unit in conjunction with the feed unit to the card.

CONCLUSIONS

The advantages of the new H1 technology needle loom make it quite suitable for the production of nonwoven products with advanced applications. The unique design of the needle zone improves the structural features of nonwoven webs. Furthermore, the amount of needling necessary in H1 technology needle looms is less compared to those of conven-

tional needle looms. Most importantly for current purposes at the ITC, the H1 is the best technology available for use in the development of composite needlewebs, which can be used as protective clothing substrates and shields.

REFERENCES

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Ramkumar, S. S. (2001) *Development of Nonwoven Protective Clothing: A New Initiative*, Proc. of the 81st World Conference of the Textile Institute.

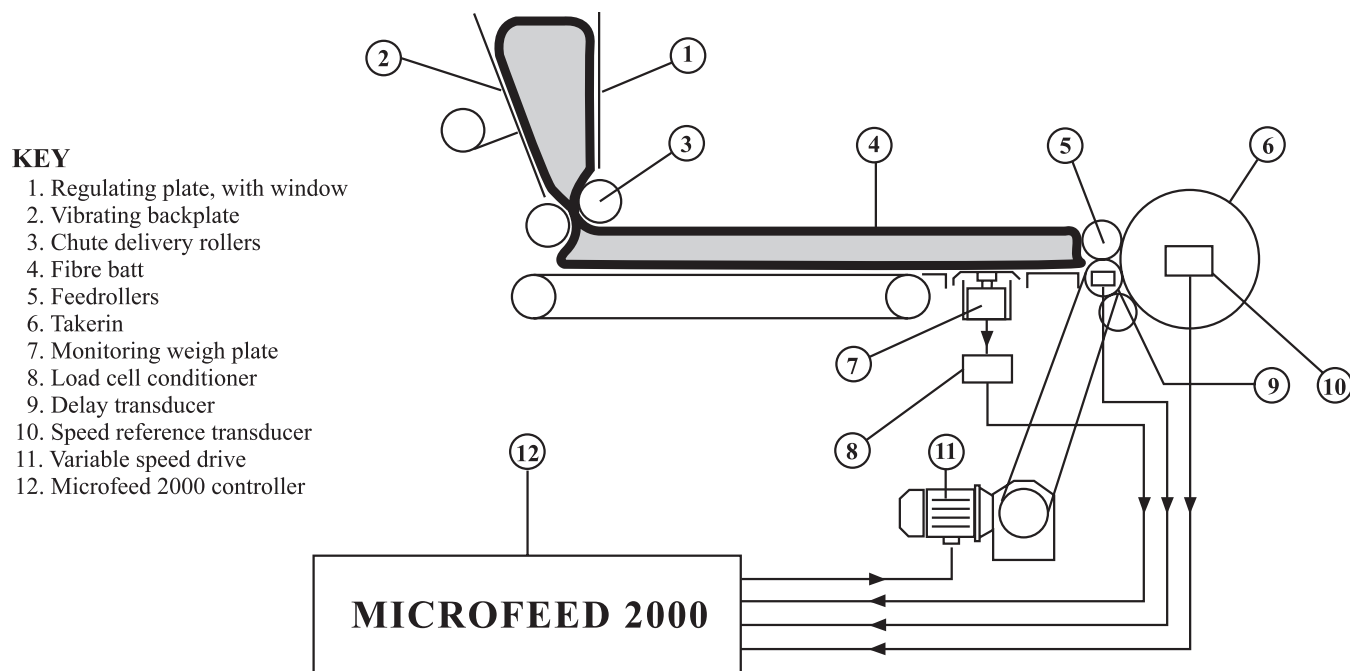William Tatham, Ltd., *Microfeed 2000*, Product Brochure.

KEY
1. Regulating plate, with window
2. Vibrating backplate
3. Chute delivery rollers
4. Fibre batt
5. Feedrollers
6. Takerin
7. Monitoring weigh plate
8. Load cell conditioner
9. Delay transducer
10. Speed reference transducer
11. Variable speed drive
12. Microfeed 2000 controller

MICROFEED 2000

Figure 3. Micro feed unit (Source: William Tatham, Ltd.)

EVALUATION OF DYED COTTON YARN FOR MEASURING WHITE SPECKS

James L. Simonton, Textile Engineer

INTRODUCTION

According to the American Society for Testing and Materials, the general definition of a fiber nep is "a tightly tangled, knot-like mass of unorganized fibers" (ASTM D-123-96 1996). In most cases, fiber neps are made up of at least five or more fibers with the average number being sixteen or more. Immature or dead fibers are finer in structure, due to their lack of secondary wall development, and have a higher propensity to form neps than do more mature fibers, (Hebert et. al, 1988). In an un-dyed state, entangled fiber clusters could be generically classified as neps. It is only after the application of dye, when some of the neps remain un-dyed, that the more specific classification of "white speck" is used. This propensity to form neps, in combination with the lack of dye retention and high reflectivity, gives the white speck its characteristic light shinny appearance on the surface of dyed cloth or yarn.

Commercial instruments are available to measure the neps contained in both fibers and yarns. However, measurements of white specks are currently done by making sample fabrics (usually knitted), dyeing them with a selected dye (usually a direct blue dye), and manually counting the "white specks" that result from the dead or immature fibers. It has been estimated that even in fabric with severe white speck contamination the percentage of white speck fibers (by weight) is most likely less than 0.1% of the total fibers, (Watson, 1989). This makes the detection and measurement of white specks difficult in raw cotton fibers.

The detection and measurement of white specks would be less onerous if the material used could be changed from dyed fabric samples to dyed yarn samples. In order to explore the feasibility of doing this, a preliminary investigation was done to (1) evaluate the operator counting variability with dyed yarns versus dyed knit cloth made from the same yarns, (2) compare the counting variability within each sample for white speck counts in yarns and fabrics, and (3) investigate the existence of direct relationships between yarn white speck counts and fabric white speck counts.

PROCEDURES

Fifteen yarns were selected from an inventory of commercially spun 30/1 Ne, 100% cotton, ring-spun yarns. Selection was based on white speck levels derived from the International Textile Center's screening test for dyed, single-knit jersey fabric (ITC Test #402.01).

The yarns were dyed with Direct Blue 80 dye, which the ITC has used for fabrics over the years and which has been shown to be sensitive to dead or immature fibers (Smith, 1991). The dyed yarns were then wound onto 7-by-11-inch black yarn boards. The Alfred Sutter Yarn Board Winder was electronically set to place 16 equally spaced wraps per inch on each board for a horizontal distance of 5.75 inches. With this setup each board had 28.11 linear yards of dyed yarn per board viewing side, for a total of 56.22 linear viewing yards per yarn board.

A MacBeth BBS-562 Lablite, with both "Horizon" and "Daylight" settings activated, was used by the technician when counting the white specks on both the yarns and fabrics. The floor of the Lablite viewing box was equipped with a stationary alignment stop, which was used to ensure accurate repetitive placement of samples and set for the operator to achieve the best visual differentiation between the white specks and the adjacent yarn or knit, (Boynton, 2000).

The operator counted the white specks on the yarns using a technique of "reading" from left to right, then right to left, while moving from top to bottom. A pointed probe was used to help the operator maintain focus while counting. Counts were made first on side "A" and then on side "B" of the yarn board. This procedure was repeated in a blind-test fashion on three separate occasions, in order to check operator variability reading to reading.

Knit tubes (from FAK sample knitting machine) were sub-divided into four sides as follows: Side A was the outside front, side B the outside back, side C the inside front, and side D the inside back.

This procedure eliminated double counting of the fabric surfaces. For taking the "readings," a 4-by-9-inch template was made from 3/16-inch black foam board and was placed inside of each knit tube before viewing. Therefore, each side viewed consisted of 36 square inches, resulting in a total of 144 square inches for all four sides. The same counting technique used for the yarn was used for the fabrics and the procedure was also repeated in a blind-test fashion on three separate occasions.

RESULTS

Of primary importance is the correlation between white speck counts for yarns versus fabrics. Exhibit 1 shows a graph of the actual results for the 15 samples tested. While the counts for yarns versus fabrics are not exactly the same, they do exhibit a strong tendency to move together. The correlation coefficient between them is 88.8%, which is highly significant (α = 0.001). This indicates that decision rules based on yarn results may be equally valid as those based on fabric results.

The relative stability of measurements made from yarns versus fabrics provides and indication of which measurement is more practical for guiding textile manufacturing decisions. Using the coefficient of variation (CV%) among the three replications of each measurement to indicate stability, Exhibit 2 summarizes the results. The average CV% of white speck counts from the yarns was 2.89%, with a range of 1.32% to 6.55%. The average of white speck counts from the fabric was 5.72%, with a range of 3.01% to 9.20%. Therefore, the measurement of white specks from yarns may actually be more reliable than measurements made from fabrics.

CONCLUSIONS

It is to be expected that the relationship between yarn white specks and their appearance in the finished product may be not only product-specific, but also mill-specific. Factors such as knit or weave construc-tion, dyes, knitting machines or looms, and machinery conditions will likely determine at which point yarn white speck levels become problematic in finished products. The use of yarns for detection of white specks offers the prospect of deriving procedures to allow for these fabric construction variables, thus providing a tool that will meet specific needs of the textile product being manufactured.

While this preliminary study is quite limited in scope (one yarn count, one fabric construction, one dye, etc), it indicates that dyed yarn offers a more stable measurement of white specks than does dyed fabric. These results should be expanded to include multiple yarn counts, multiple cottons, multiple dyes, etc. Eventually, results from the yarns may be determined by computerized image analysis techniques and incorporated into algorithms that convert the results into predictions of the fabric appearance.

REFERENCES

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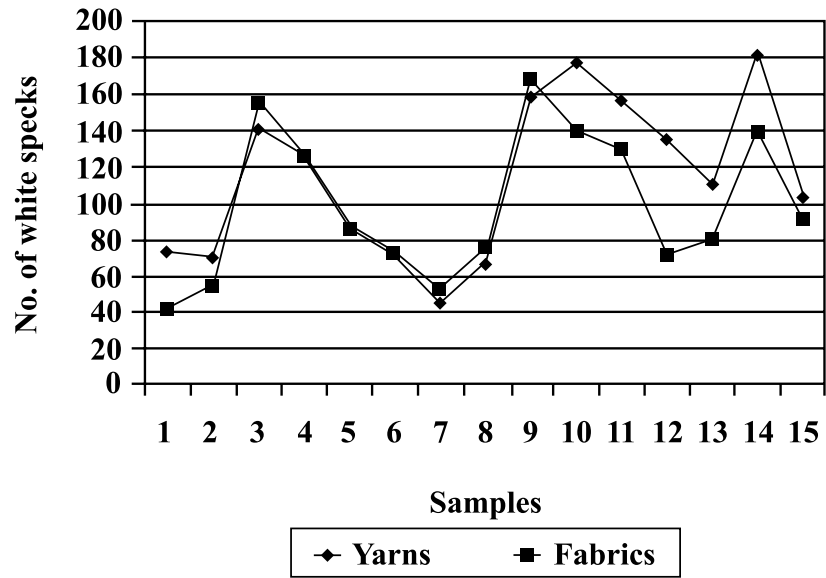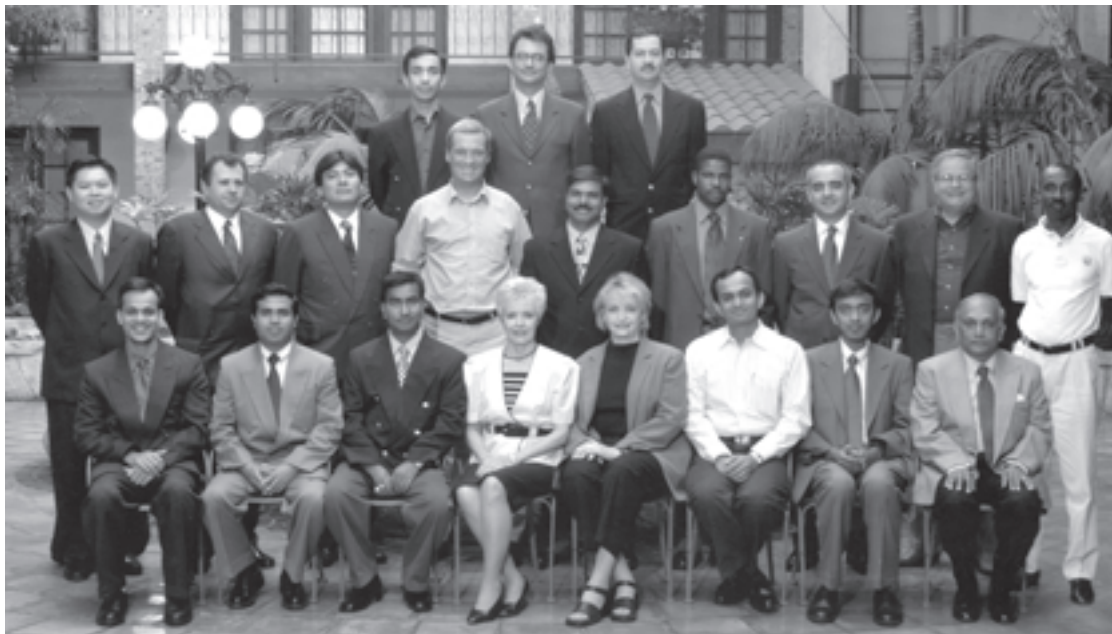
Exhibit 1. Yarns Versus Fabrics: Average Number of White Specks

	Yarns	Fabrics
Average CV%	2.89%	5.72%
Range of CV%	1.32% −6.55%	3.01 −9.20%

Exhibit 2. Yarns Versus Fabrics: Repeatability of White-Speck Counts

TEXAS INTERNATIONAL COTTON SCHOOL - CLASS OF MAY 2001

FRONT ROW : Muhammad Asghar, Crops Diseases Research Institute, Pakistan; Md. Majibur Rahman Khan, Shinshu University, Japan; Sayed Mohammed Atiqur Rahman, Ibrahim Cotton Mills Ltd., Bangladesh; Liz Phillips, TICS Assistant Coordinator, Texas; Mandy Howell, TICS Executive Coordinator, Texas; Annush Ramasamy, The Kadri Mills (Cbe) Ltd., India; Niranjan Sankar, Sree Ayyanar Mills, India; Arunachalam Veerappan Veeyanthena, Sree Umayambigai Textile Mills Ltd., India.

SECOND ROW : Kitti Loserevanich, Numton Textile Co., Ltd., Thailand; Oscar Castro, Creditex, Peru; Omar Perez, Creditex, Peru; Pascal Beelprez, The Cotton Group, Belgium; Abdul Rouf, Crescent Cotton Products, Pakistan; Jhon Gerson Mayo, Coltejer, Colombia; Bekir Gures, Gap Paz. A.S., Turkey; Tom Walker, New York Board of Trade; George Ekukole, Agroconsult 2000, Senegal.

BACK ROW : Ahmed Shafi, The Crescent Textile Mills Ltd., Pakistan; German Serrano, Fabricat Tejicondor, Colombia; Jose Ivan Charry, Coltejer, Colombia.

MEL RENOVATION

Looking through the new viewing window to Materials Evaluation Laboratory.