

2nd International Technical Textiles Conference

by Dr. H.R. Shaikh, Professor Emeritus Textile Institute of Pakistan.

The Textile Institute of Pakistan (TIP) organized 2nd International Technical Textiles conference in collaboration with Pegasus Consultancy (Pvt) Ltd. at the Karachi Expo Centre during 2009 concurrent with the MEGATEX Pakistan 2009 exhibition.

Textile Research and innovation Centre (TRIC) established in August 2007 at the Textile Institute of Pakistan. TRIC works in collaboration with the textile industry to develop value-added products and provide a competitive edge in the changing global market. The research centre fosters genuine research, linking the industry and other institutions within Pakistan and abroad.

Mr. Farooq Sumar while addressing the 2nd International Technical Textiles conference said that the textile industry of Pakistan became aware of technical textiles in the early 1970's when production was started in U.S.A. and Europe. About forty years later TIP established TRIC and started research on technical textiles. Although it was late yet encouraging step in the right direction and some of the aspirations and expectations have been achieved, but a lot of more work has to be accomplished to catch up with the latest trends. Knowledge never becomes stale. It is necessary for us to learn about technical textiles and start production in these value-added areas, concluded Mr. Sumar.

Smart/Intelligent Textiles

Dr. Tahir H. Shah from TIP presented an overview of the developments in United Kingdom, which has the largest concentration of firms producing Technical Textiles. These firms are leading the way in smart fabrics and interactive textiles for wearable electronics, according to a new report from Textiles Intelligence. For instance some of the British companies have designed textiles to interface with software from Microsoft and iPod music players from Apple. Many are being sold under well known names with wide consumer appeal. Brands such as Levi's, Nike, O'Neill, Quiksilver, Reusch, Ribcap, Rohan, Schoeffel, Spyder, The North Face and Tommy Hilfiger are all using smart fabrics and interactive textiles supplied by UK firms.

Dr. Shah also presented a paper on Smart/intelligent textiles and explained that application of nonwovens as Technical Textiles. The word 'Smart' means wearable e-textiles and the word 'Intelligent' represents textiles which are responsive to requirements. These textiles will have tremendous effect on the treatment techniques adopted by the Medics

especially the ageing population. The demand for textiles with potential for cure will increase. The availability of the requisite technology and knowledge has made it possible to develop 'Smart and Intelligent' textiles. The concept of the adoption of stimuli offers a wide choice for the production of Smart/Intelligent Textiles, some of these textiles are designed to sense temperature and keep the body of the user cool or warm as required. Furthermore, intelligent textiles can be programmed to produce the required response, e.g. can be programmed to repel water or absorb moisture with wicking properties.

Intelligent Textiles sense stimuli, actuate and initiate action. These textiles are manufactured from high performance material and consequently are durable, provide protection and comfort to the user. These products possess a wide range of desirable properties in order to meet a various requirements. In order to achieve these objectives following types of materials are being used.

- ❖ Conductive and thermally sensitive materials.
- ❖ Shape memory materials.

Nano and Micro-Technology as well as neuro network are increasingly being used for integrating processes involving use of electronics. The main functions of Smart/Intelligent Textiles are:

- ❖ Sensing for which existing sensors are modified or miniaturized as required by specific applications.
- ❖ Sensing properties can be incorporated in the textile fabrics themselves.
- ❖ Surface body temperature is monitored. It is difficult to monitor core body temperature.
- ❖ Smart Jackets, for example, smart shirts can produce Electrocardiograms.

These textiles are very useful for ageing population. Whole range of chemicals used can be sensed by monitoring the patient at his own home. Blood pressure monitors are also being integrated with textiles.

Temperature and blood pressure monitoring devices must be timely tuned. A whole range of 'Actuators' is also available for use. For example "Super - Gels" can release material at controlled rates and 'Phase Change Materials' can provide thermal comfort.

Systems are available to convert body temperature to electricity which can be stored in batteries.

Finally communication function of wireless enabled textiles, for which 'Antennas' can be developed and incorporated into textiles with global positioning devices and other systems for the search and rescue missions are some of the future applications.

The current focus of the 'Smart / Intelligent Textiles' is in the following applications: Armors; Biochemical hazard protection; Physiological status and Location, embedded connections and communications.

The Centre for Materials Research and Innovation of the University of Bolton in U.K. is conducting research work on following applications.

- ❖ Auxetic Textiles: These textiles become thicker when pulled.
- ❖ Protective clothing.
- ❖ Energy Harvesting Textiles.
- ❖ Thermo physiological comfort fabrics.
- ❖ Health Monitoring Textile Structures.
- ❖ Smart Bra to prevent breast cancer, as there are over one million breast cancer patients in U.K. and its incidence is projected to increase in future.
- ❖ Breast Cancer Diagnostic Method for Breast Cancer detection.
- ❖ Microwave Radiometry Technology (MRT)
- ❖ Developing conductive textiles for above-mentioned applications which must be light, sensitive, flexible, comfortable, breathable etc.
- ❖ Developing wearable textiles with integrated 'Antennas' equipped with micro-electronics and power supply for use as early warning system and the ultimate goal is to develop 'Smart Bra' for preventing breast cancer and afterwards for prevention of heart attack.

Geo synthetics

Dr. Tahir H Shah also spoke about "Geosynthetics" which is closer to Pakistan's requirements, as more than 500 types of Geosynthetic products are being marketed world-wide. Geosynthetic products world market is worth multi-billion dollars and growing in some areas at the rate of 10% to 25% annually.

Geo means soil or Earth and Synthetics mean manmade materials. Some of the functions of Geosynthetics are separation, reinforcement, filtration, drainage and water preservation. Geosynthetics are generally sub-divided into six classes given as under:

1. **Geo-Textiles** are generally made from 90% polypropylene fibre and remaining component can be polyester, polyamide fibres. Geo-Textiles are basically utilized in road and dam construction. Very porous structures both woven and nonwovens can be made for filtration applications. Heaviest Geo-Textile manufactured to date weighed 3000 gms/ square metre.
2. **Geo-Grace** have open structure and are used for reinforcement of foundations and walls.
3. **Geo-Bits** are utilized in plain kind of applications protected by Geo-Textiles on one side or both sides.
4. **Geo-Membranes** are products made from high density Polypropylene as well as flexible PP depending upon the end-use requirements. An important property of Geo-Membranes is extensibility and rapid recovery to original dimensions. Geo-Membranes have applications in lakes, canals for preservation of water.
5. **Geo-Liners** are used wherever water or liquid is to be contained. The usual composite structures are Geo-Textiles and Geo-Nets. Geo-Pipes and Geo-Foams.
6. **Geo-Composites** can perform any function tailored to that particular application. Due to its customized nature, specific research work is in progress for enlarging applications of Geo-composites.

The applications include:

- ❖ Stabilization of soil and slopes to prevent land slides.
- ❖ Landfill applications for waste disposal by municipalities.
- ❖ For lining of canals and dams to prevent water leakage by using Geo-Membrane clay liners. Seepage of water from canals is a major problem and upto 20% water is reported as lost in Pakistan.
- ❖ Floating covers for water reservoirs in Pakistan to prevent evaporation of water.
- ❖ Water transport utilizing Geo-Membranes.
- ❖ Improvement in the use of water in agriculture in Pakistan involving the use of Geo-Membranes.

Dr. Shah suggested that Pakistanis should start learning to use Geo-synthetics and textile industry of Pakistan should

manufacture genuine good quality products for applications in agriculture, irrigation, civil engineering, construction of dams, roads, new infra-structure. Geo-synthetics can prolong the life of new infrastructure.

Geo textiles in Pakistan

Syeda Faiza Jamil, Research Assistant at the TRIC presented her paper on "Geo-Textiles, with special emphasis on Geo-Textiles used in the form of layers for lining of lakes, ponds, water reservoirs. Any material that can be used with soil for the functions separation, drainage, filtration, Stabilization of reinforcement, erosion control, protection of weaker Geo-membranes, separation of soil compounds, such as graphite, gravel, natural ground can be included in this category .

Geo-Textiles can be inserted between the two or more layers of soil to introduce stability, where water molecules can pass through the textiles, leaving the soil particles in place.

Geo-Textiles can be used for reinforcement and strengthening of roads. The use of Geo-Textiles can increase the road life by 10 to 15 years and reduce cost. TRIC is conducting a study to assess how much cost could have been saved, if roads in Karachi were built with Geo-Textiles reinforcement. Analysis of the weaknesses and threats in the use of Geo-Textiles carried out by TRIC shows that major threat is the resistance to change to innovative technologies and our weaknesses are lack of human expertise and absence of legislative protection.

Agro Textiles application in Pakistan

Mr. Aasim Ahmed Research Assistant at TRIC presented his paper on Agro textiles. Pakistan's textile industry contributes about 60% of total exports. It consumes about 80% of cotton in its textile and clothing products. Cotton is an agricultural crop and therefore Agro Textiles can play an impotent role in yield increase, effective use of water, reduction of fertilizers and pesticides.

The application include:

- ❖ **Weed protection:** Weeds erode trees and plants. Agro Textiles are used to control erosion.
- ❖ **Wind protection:** Fabrics made from polyethylene, polypropylene, polyolefins can be used to provide protection from wind to plants and trees. Warp knitted fabrics are used for hail protection. It is possible increase the yield of plants by providing wind and hail protection.

Red chillies

Red chillies are grown, harvested, crushed into powder and sold. The export of 'Red Chillies' from Pakistan in 2003 was about Rs 1.10 million. However, during the process of drying, the chillies are damaged by 'Aprotxin' produced by fungus. For controlling damage by Aprotxin, chillies should be dried by spreading on Agro Textiles and not on soil. Furthermore, the duration of period should be minimized. Aprotxin is an air borne infection and the chillies should be covered.

Research at Gadap farm

In order to prevent fall down of the plants, metallic ropes were used instead of ordinary ropes. This resulted in the increase of yield. Gadap farmers were advised to use tunnels for high temperature, high yields and early season crops. Polyethylene sheets covering tunnels were frequently ripped by fast flowing wind. These were replaced by warp-knitted fabrics. Engro Chemicals & Polymer Ltd and Dr. Narain of Chilli Farms, Kunri were the partners for this research project.

Medical textiles

Mr. Danish Ahmed, Research Assistant at the TRIC presented his paper on, "Medical Textiles" with the aim of providing insight into the specific medical, surgical and health care materials. These materials can be divided into two main categories non-implantable materials and implantable materials

The non-implantable materials include compression stockings, long tight socks, automatic cushion bandages for patients suffering from ulcer, thrombosis or immobile patients. These materials are manufactured from elastomeric fibres such as lycra or spandex. The bandages apply external pressure to the affected part of the patient body and produce blood flow. Surgical collar is used for providing neck support to the patients. These materials are also used for protective, health care and hygiene applications to serve as barriers between infection source and clinical workers e.g., surgical gowns, caps and face masks. Surgical covers are also used to cover the patients or the working area around the patients.

Implantable materials have applications in the effective repairs of the body parts, soft tissues, bones, etc. Medical Textiles are extensively used for replacement of damaged or blocked arteries in the form of Vascular Grafts and for the treatment of swollen heart.

Survey of hospitals has revealed that medical textiles costing more than Rs 100 million are being used in Pakistan per

annum. The cost of foreign materials imported from USA, U.K, China and Turkey is about Rs 69 million. The share of local medical textiles made in Pakistan is therefore Rs 31 million, i.e. about 31%. Thus, opportunities exist for the textiles industry of Pakistan to tap the 69% portion of the requirement of hospitals for medical textiles.

Coating - special finishing effects on technical textiles

Mr. Abu Yonus, Head of Finishing Department of Clariant Pakistan Limited presented his paper on Coating – Special Finishing Effects on technical textiles. Globally Clariant manages 85 working sites engaged in the manufacture of dyes and chemicals for textile, leather paper industries. The unit installed at Jamshoro is the second biggest unit in Pakistan and manufactures all kinds of chemicals, dyes, etc. About 1800 patented products of Clariant are being marketed globally. The global sales are about 200 million Swiss Francs. Clariant (Pakistan) Limited maintains a full – fledged research laboratory headed by Dr. Billa. The laboratory coordinates its research work with industry and provides R & D services.

Types of coating

Properties of textiles can be improved by coating with polymers, for example home textiles require fine coating, which renders different value added properties to the end fabrics. Coated fabrics should be fast to dry cleaning and shrink proof. For field and out door textiles high viscosity coating is necessary so that such textiles become fast to light, heat and are shower proof e.g. tarpaulins and umbrellas etc.

In order to achieve these objectives knife coating, air knife coating techniques are used. Rotary coating is commonly used in Pakistan. For example, Zimmer is well-known for manufacture and marketing of coating equipment. They supply Magno Roller, Triplex and Vario Processes for knife coating and transfer coating.

Nonwovens Technologies

Dr. Anbaban Ariadurai visiting Professor and head of TRIC of the TIP delivered lecture on ‘Nonwovens Technologies’ presently available in the market. Examples include sheets and web structures bonded by entangling fibres or filament, all of those are classified as nonwovens.

1. Web formation (sheet structure) is carried out by ‘wet laying process’ water is drained out, web is consolidated and taken up – the web can be used for medical packs, gowns, etc.

2. Air Laying Process is used to form a highly absorbent and cost competitive webs.
3. In carding process web is also formed, and the main advantage of web formation by the carding process is that different fibers can be blended and relatively strong webs can be formed for hygienic applications.
4. Spunlace (Spun Bonded) process is used to form webs at lower cost as compared to other technologies.
5. Melt Blowing process forms webs which are highly suitable for filter media. Melt Blowing is followed by thermal, mechanical or chemical bonding. Hot air is blown, fibers or powder melt and fabric is formed. Web is then drawn between heated cylinders for calendaring.
6. In Hydro-entangling process, fibers are curled by hydro jets. The fabric formed has good, sustainable properties.
7. Needle punching process is also used to form webs. In this process design of the needle is very important to get different qualities.
8. In Stitch Bonding method continuous filament yarns of many types are used, however, this method is not considered as part of the nonwovens technology.

Fibers commonly used for production of Nonwovens fabrics by the above mentioned technologies are polypropylene, polyester, viscose rayon and acrylic, aramide, cotton, etc.

Application of nonwovens

Mr. Kamran Iqbal presented his paper on the ‘Application of Non-woven in Technical Textiles’ which is briefly reported as follows. Technical Textiles are manufactured primarily for their performance and end-uses. Scope of nonwovens is very large because of their characteristics of durability, permeability, breathability and conductivity. Main areas of ‘Technical Textiles are:

- ❖ **Agrotech:** Is aimed at agriculture and farming. The products possess weather and micro organism resistance and reduce pesticide requirements, Polyester and P.P. fibers are mainly used for Agrotech products and applications.
- ❖ **Buildtech:** Covers manufacture of membranes for construction of light weight structures.
- ❖ **Oekotech:** Stands for concepts in environmental protection, waste disposal and recycling.
- ❖ **Meditech:** Includes complete range of medical and hygiene products. Some of these products have infection bar-

rier properties to protect surgeons from infection from patients. Cotton is a major fiber used in Meditech.

- ❖ **Indutech:** Products provide solutions for mechanical engineering, chemical and electrical industries.
- ❖ **Geotech:** Stands for concepts and products in civil engineering, i.e. roads, dams and waste site construction. Polyester and polyolefine are the main fibers for Geotech.
- ❖ **Protech:** Deals with latest ideas in the manufacture of protective clothing.
- ❖ **Packtech:** Includes products utilized in packaging, covering and transportation.
- ❖ **Homotech:** Represents innovative developments in furniture, upholstery, floor coverings and carpet manufacturing.
- ❖ **Clottech:** Shoe and clothing manufacture.
- ❖ **Mobiltech:** Latest developments in ship and aircraft constructions, automobile, railway and space travel.
- ❖ **Sporttech:** Includes products and ideas from the world of sports, leisure and outdoor equipments.

Market for ‘Technical Textiles’ in Asia is growing at the rate of 9.6% per annum. In China growth in the rate of investment is about 30% per annum. India is also expected to be one of the largest producer and consumer of ‘Technical Textiles’. In Pakistan cheaper raw-materials are available for production of nonwovens. In conclusion it may be stated that ‘non-woven’ is a strong and growing technology all over the world. Lot of waste material is available in Pakistan which can be utilized to make nonwovens for weather proof houses in the northern areas. High strength Auxetic Textiles can be produced from Polypropylene fiber, as there are many areas of applications of ‘Auxetic Textiles’. For example smart dressings, smart filters and smart bandages can be produced.

Syntech Fibers (Pvt) Ltd. is producing climate control sports wear ‘Duradry’ which keeps the wearer comfortable by wicking moisture away from the skin to the outer layer where it can evaporate. **Master Textiles** are producing spun – bonded materials. Companies like **IHSAN SONS** as well as **S. Fazalilahi & Sons** produce nonwovens for medical and hygiene applications.

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