

Technical Textiles: Current global trends and prospects in Pakistan

The excerpts of the presentation by Dr. Tahir Shah from University of Bolton, UK are given here for the interest of our readers. This report is compiled and edited by Dr. H.R. Sheikh, Professor Emeritus, Textile Institute of Pakistan.

Dr. Tahir Shah from Institute for Materials Research and Innovation (IMRI) University of Bolton, UK emphasized importance of Technical Textiles in Pakistan and said that it is an opportunity for diversification of the production pattern into new areas of textile manufacturing. End-uses of these materials depend on the functional and not on the aesthetic properties.

In view of the problems faced by the conventional textile industry in Pakistan, textile industry should shift towards knowledge based products. We have a tremendous opportunity for diversification into technical textiles and make a real contribution to the development of the country – both in term of the economy and infrastructure. Government as well as the textile industry must look closely into the developments in technical textiles and knowledge-based products very seriously.

Main raw-materials used for the manufacture of Technical Textiles are Polyester, Glass, Polypropylene (PP), Nylon, Metal yarn, Natural Fibres and also Composite materials.

Value-added textiles

The Value-Added Textiles are the traditional textile products to which novel advanced technological characteristics have been added. They are mainly used in conventional markets for the purposes of meeting new needs of end users. Technical Textiles are value-added textiles manufactured by the application of fibre, yarn, film, wovens, knitted, braided, nonwovens, Composites and Hybrid Technologies.

Technological innovations supporting advances in technical textile

Some examples of technological innovations include nano textiles, intelligent and smart clothing, plasma technology, etc

Nanotechnology

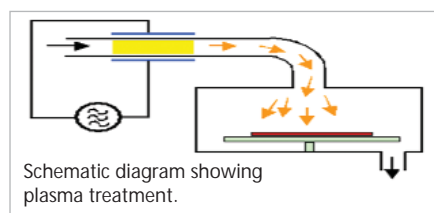
Nano-Technology is basically employed for a surface treatment through carbon or clay nano particles or metal oxide nano particles. For finishing treatment, nanotechnology is used through nano-sized emulsions and other applications include nanocoating of self-cleaning polymer films, nanoparticles (transparent) and Nanofibres. In 2007, the market for nano technology amounted to US \$13.6 billion, and in 2012 it is estimated to US \$115 billion.

Nonwoven, Composite and Hybrid Technologies

The integration of several components, or a combination of processes, for example, nonwovens combined with warp-knitted fabrics is also gaining acceptance as hybrid technologies. The stitch-bonded-hydroentangled composites are also considered in this context. The spunlace, combined with spunbonded, carded, meltblown or airlaid applications for medical, hygiene, wipes, industrial products, clothing, protective materials are few examples.

Plasma treatment

Plasma is the ionized state of a gas, whereas the gas reacts rapidly with textile surfaces. It is a cost effective finishing technology for producing water repellent, oil proof and stain resistant fabrics.



Intelligent Technologies

The word Intelligent represents textiles, which are responsive to requirements. Multiple applications include elements integrated into knitted fabric, fabric or nonwovens for applications in the medical, protection, safety and sport fields, etc. Intelligent Textiles can be programmed to produce the required response and provide protection and comfort to the user.



Global technical textiles and clothing

The global textiles and clothing sector trade has grown to reach US\$ 530 billion in 2007. Global technical textiles reached US\$126 billion in 2007, but are still growing four times faster than conventional textiles. In 2010 market valued at 22 million tonnes, representing a world market share of US\$140 billion. Asia is the hub of technical textiles. Market in India has increased from US\$ 0.5 to US\$ 12 billion and in China from US\$ 14.2 to US\$ 200 billion.

Major countries producing technical textiles are Germany, France, U.K, U.S.A., Japan, Korea, India, Turkey and China. In UK textiles and clothing sector was worth £10.2 billion in 2006 with £3.5 billion coming from technical textiles. In 2008 nearly 40% of total textile market belonged to Technical Textiles.

Prospects of technical textiles in Pakistan

Textile industry is extremely important for the economy of Pakistan, because it contributes to 46% of total manufacturing, 45% of total employment, 8.5% of total GDP and 31% of total investment.

Technical textiles growth by product classification

Type of Product	Value (US\$ millions)		Annual Growth Rate, 2005-2010
	2005	2010	
Nonwovens	19,394	24,958	5.2%
Knitted fabrics	4,143	4,927	3.5%
Woven fabrics	64,570	74,820	3.0%
Coated and laminated products	51,010	58,946	2.9%
Other fabrics	2,046	2,493	4.0%

World Technical Textiles Consumption by Region

Region	Year / (000Tons)			
	1995	2000	2005	2010
Americas	4,288	5,031	5,777	6,821
Europe	3,494	4,162	4,773	5,577
Asia	5,716	6,963	8,504	10,645
Rest of the World	473	558	628	730
Total	13,971	16,971	19,683	23,774

Technical Textiles: Global Consumption (000Tons)

Application Areas	Year			
	1995	2000	2005	2010
Agriculture	1173	1381	1615	1958
Building	1261	1648	2033	2591
Clothing	1072	1238	1413	1656
Geotextiles	196	255	319	413
Hometextile	1864	2186	2499	2853
Industrial uses	1846	2205	2624	3257
Medical	1228	1543	1928	2380
Automotive	2117	2479	2828	3338
Packaging	2189	2552	2990	3606
Protective	184	238	279	340
Sports	841	989	1153	1382
Total	13971	16714	19638	23774

Target growth areas for Pakistan include geo textiles, medical textiles, construction, agriculture textiles and other nonwovens products. In particular, building and construction industry offers a major opportunity for Pakistan's textile industry. It has huge areas of applications in the construction of dams, bridges, ports, etc.; it can also be utilized in the construction of stadiums, sports arenas, outdoor shelters, roofs etc.

Products include architectural membranes, roofing & waterproofing membranes & breathable liners, thermal and sound insulation, sewer and pipe linings, reinforcement of walls, facades, reinforcement and pre-stressing of concrete, awning, canopies, marquees, inflatable buildings, etc.

In agriculture, the industry can develop products for crop production, such as Crop protection fabrics against sun, wind, rain, frost, birds, insect, etc. Other product application include forestry (artificial mulch & insulating ground covers), Horticulture (balers & horticulture twines), animal & poultry (tarpaulins & other covers), fish farming (Fishing lines, nets, ropes, twines) and other novel application such as capillary nonwovens & seed/ nutrient/ moisture carriers.

Geo Textiles are used in the construction of embankments, cuttings, dykes, sub-sea coastal engineering and they offer lower cycle of construction, low maintenance costs as well as durability and optimal use of arid of land, etc.

Other important application area is reinforcement material for strengthening soil, slopes, walls and stabilization products for distribution of load to prevent erosion, cracking of roads, surfaces, The separation materials to prevent intermingling, sinking with filtration and drainage products to allow flow of liquids and retention of solids.

Fabric Architecture

Fabric Architecture is relatively new form of architecture, also known as tensile membrane architecture or fabric membrane structure architecture. The technological progress has increased the popularity of these structures due low weight, easier and cheaper construction.

Masjid-e-Nabvi, Madina, Saudi Arabia

PTFE coated fibre glass fabrics are being used in the mosque of Holy Prophet Muhammed (PBUH) and at the Haj Terminal in Jeddah. The fabric roof covers 430,000 sq.m. of plan area and is considered as the largest roof structure in the world. The roof reflects most of the heat and it consist of 10 modules of 320 m by 138 m fabric, whereas each module consists of 21 tent-like units. The structure is supported by steel pylons leaving the space under the units' wide open.



Masjid-e-Nabvi, Madina, Saudi Arabia.



The Millennium Dome, London, UK.

Millenium Dome, London, UK

Similarly, this PTFE coated fibre glass fabric can also be seen at the Millenium Dome in U.K. Two layer structure at Millenium Dome provides a degree of insulation and reduces the risk of condensation. The outer layer is a medium-weight PTFE/glass fabric and the inner lining is made of lightweight glass fibre fabric with an open mesh weave and a minimal coating of PTFE.

Among the most widely used materials are polyesters laminated or coated with polyvinyl chloride (PVC), woven fiber glass coated with polytetrafluoroethylene (PTFE fabrics). Typically, the fabric is coated and laminated with synthetic materials for increased strength, durability and environment resistance. ♦

Concrete Cloth

Concrete Cloth was invented by Imperial College London and Royal College of Arts. It is a flexible, cement impregnated fabric that hardens, when hydrated to form a thin, durable, water and fire proof concrete structure, which allows the concrete construction without the need for plant or mixing equipment.

Concrete cloth has a great potential for uses in Pakistan. Basically it is an impregnated fabric specially suited for earthquake affected areas also used for slope protection, coating for water pipeline protection, ditch or tank lining and in sand bag defence applications in the form of prefabricated structure or concrete canvas or rapidly deployable shelters. Dr. Shah provided details of specific product range and huge applications of concrete cloth. Dr. Shah also discussed 'Road Map' for Technical Textiles and opportunities for future.



Concrete Cloth: Can be rapidly unrolled to form ditch or tank lining.

Medical Textiles: A case study and its prospects in Pakistan

Muhammad Kamran Iqbal, Senior Research Assistant at Textile Research and Innovation Centre (TRIC), Textile Institute of Pakistan delivered a lecture on case study conducted on the prospects of medical textiles in Pakistan. The excerpts of the presentation are as follows. HRS.

All textiles and nonwoven products used in the operative and post-operative tasks in and around the patient by medical practitioners are termed as Medical Textiles. Research work on Medical Textiles is being carried out at the TRIC and its objectives are medical research and conducting survey of hospitals to evaluate demand and supply scenarios with the aim of providing insight into the specific medical, surgical and health care materials.

Muhammad Kamran Iqbal said over 1.5 million tonnes of textile materials, with a value of US\$5.4 billion, were consumed worldwide in the manufacture of medical and hygiene products in 2000. This is predicted to increase in volume terms by 4.5% per annum to 2010 to reach 2.4 million tonnes with a value of US\$ 8.2 billion. (Source: David Rigby Associates).

There are three main application areas in medical textiles, Implantable, Non-Implantable Materials and Healthcare and Hygiene Products.

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. Surgical collar is used to provide neck support to patients.

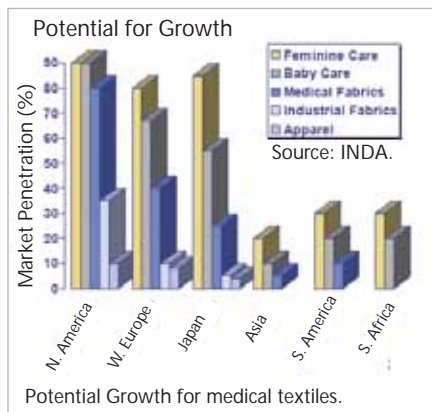
The Non-Implantable materials include compression stockings, long tight socks, automatic cushion bandages for patients suffer-



Healthcare/Hygiene Products.



Non-implantable materials.



ing from ulcer, thrombosis or immobile patients. The results of survey of hospitals are listed below:

Case study

The total number of beds in hospitals in Pakistan is 103285 according to Federal Bureau of Statistics. For the purpose of the research four hospitals were selected as per following criteria.

- ❖ Hospital 1: General hospital with 600 bed capacity.
- ❖ Hospital 2: Heart specialist hospital with 120 Bed capacity.
- ❖ Hospital 3: Kidney specialist with 100 bed capacity.
- ❖ Hospital 4: Urology and Transplantation specialist with 500 bed capacity.

Use of Disposable Textiles is preferred because it saves cost of laundering and later sterilisation, whereas urology and

transplantation based hospitals with 500 beds capacity consume 49% of imported materials. The results show that hospital 3 and 4 consume more conventional textiles than disposable products.

Hospital Acquired Infection (HAI)

According to CDC, about 1.7 million infections impact hospital patients each year, costing hospitals an estimated US \$ 4.5 billion in additional medical costs.

Surgical site infection, one form of an HAI, affects more than 370,000 patients in the U.S each year. In U.S, hospital infections kill 60,000 – 80,000 people a year. In Pakistan, one of the leading causes of death is respiratory infections.

The medical textiles used for protective, health care and hygiene applications serve as barriers between infection source and clinical workers e.g., surgical gowns, caps, face masks and surgical covers to cover the patients are some of the end uses at the hospitals.

The survey of hospitals also revealed that the cost of medical textiles imported in Pakistan was Rs 69 million. The total cost of these materials consumed annually was Rs 100 million. The share of the locally manufactured medical textiles was Rs 31 million per annum. Thus, significant potential and opportunity exists for the textile Industry of Pakistan to replace the Rs 69 million annual consumption of imported medical textiles by locally produced products. ♦

Total Consumption per annum				
Disposables				
Product	Total value of annual consumption			
	Hospital 1	Hospital 2	Hospital 3	Hospital 4
Surgical Gown	3187080	8400000	18240	---
Caps	341291	96000	33600	14400
Masks	607200	42000	90000	14400
Patient Gown	3163570	---	---	---
OT Towels	5261500	---	---	---
Apron	1695400	28800	---	---
Surgical Kit	2420000	3300000	---	---
Adult Diapers	3840000	144000	---	72000
Dignity Sheets	5183360	60000	108000	---
Drape	---	222000	---	---
Shoe Cover	---	72000	72000	---
Total	Rs. 25699401	Rs. 1249980	Rs. 328410	Rs. 100800

Role of nonwovens materials in combating nosocomial infections

Professor Stephen J. Russell, Director, Nonwovens Research Group, University of Leeds, UK wrote a paper on Role of Nonwoven Materials in Combating Nosocomial Infections. The paper was presented by Dr. Tahir Shah. Ed HRS.

The infections that occur during hospitalization but are neither present nor incubating upon hospital admission are called Nosocomial infections. Also called 'Hospital Acquired Infections' (HAI).

Nosocomial infections delay discharge from hospitals, patients suffer additional cost, emotional strain and extra work is done by the staff of the hospital increasing healthcare and pharmaceutical budget.

Common types of these infections are Endogenous flora infections which amount to 50%, whereas 35% infections are transferred from staff and other patients, whereas, Exogenous flora infections amount to 15% of the total infections.

Common causes of HAI are MSRA, E-Coli, Clostridium (c.) Difficile, Norovirus, Mycobacterium T.B, Acinetobacter Baumannii, Salmonella, etc. In order to control HAI, target delivery of disinfectants on contaminated surfaces is required.

Functions of nonwoven materials in controlling HAI

Nonwovens materials are better than woven materials, because the latter cannot be disinfected. It is essential to select

most suitable disinfectant for wipe lotion. Wet cleaning and dry cleaning mechanisms and Dirt Removal capacity (DRC) of wipes is important. In this context nonwovens wipe structure influences particle removal. Hydroentangled and Hydrospace fabrics manufactured from 100% viscose rayon are mostly used in this application. Disinfectant delivery rate and Jet pressure must be controlled. Forming and filling of internal channels with in Hydrospace fabrics must be achieved as per the requirement of the end users.

According to EDANA, new standard EN 13795 recently introduced in Europe to ensure performance of surgical drapes, gowns and PPE will encourage the production and development of nonwovens, as conventional linen drapes and gowns will not meet this standard. Furthermore, single use nonwoven materials do meet the standard and are required to be certified by manufacturer.

To safeguard public health, nosocomial infection rates need to be reduced – these are subject to significant variation between countries. Besides, certain organisms do not respond to antibiotics and protective measure and prevention of these



Single use nonwovens will be preferred as new infection control standards come into force.

infection is much better alternative. Single-use nonwovens play a major role in decontamination, sterilisation, disinfection, clean air provision and personal protection as well as acting as barriers to HAI transmission. The Research and development in nonwoven materials seeks to improve the efficacy of products to reduce the incidence of HAI's.

Two important areas of development are targeted delivery of disinfectants onto contaminated surfaces and self-cleaning surfaces to prevent HAI transmission in hospital & healthcare establishments. ♦

Development of electronic yarns for medical textiles

Dr. Zubair Bandukda, Textile Consultant and Educationist from U.K, former President of the Textile Institute of Pakistan (TIP) presented a paper on research done by ENTELL FIBRES on electronic yarn application for medical textiles.

Electronic yarns for medical textiles are manufactured by ENTELL FIBRES which represent latest innovation in fibre technology. Dr. Tilak Dias, Head of WLIC has been granted patent for this invention - new company called ENTELL FIBRES was floated in May, 2008 for business development and commercialisation of Electronic yarns. These yarns can be considered as the building blocks for the next the generation of Smart Textiles. The vision entails the fabrication of electronically active and sensor fibres which will be the basic building blocks of the next generation 'SMART' fibrous materials.

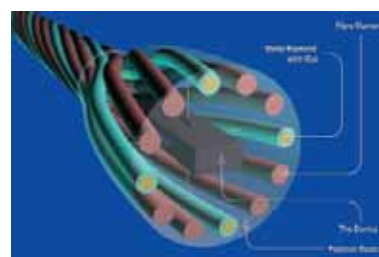
Dr. Zubair Bandukda discussed the integration of electronic with apparel and interface of apparel manufacturing process. He also explained the WLIC development involving use of "Technology Platform Feed System," (TPFS). Furthermore, research work on Micro-device Encapsulation Technology, is also in progress at the laboratory stage. Micro-devices are classified as electromagnetic chips, magnetic devices, optical devices and thermal devices.

Positioning of the μ -devices along the length of the fibres is accomplished by means of 'Resin Injection, UV curing and finishing as shown in the schematic diagram. The end-uses of

Electronic yarns are in apparel, footwear, leather goods and Medical Textiles.

Radio Frequency Identification (RFID) Technique has also been developed for future plans of work of sensing fibres, Yarns and for Temperature Mapping Systems.

The RFID sewing threads in Apparel and leather products ensures brand protection against counterfeit goods (clothing and footwear). According to World RFID Markets a Retailer Perspective, Frost & Sullivan (2007), revenue losses of US\$10 billion (Europe) and US\$250 billion (US) are reported every year due to counterfeiting in clothing and footwear industries. Another advantage of RFID sewing thread early integration of this technology in garment manufacturing process and supply chain transparency directives, which are expected to amount as US\$11 billion industry by 2016. The RFID tracking system has shown to improve logistics, increase productivity and reduce cost. ♦



Micro-device encapsulation technology

Geo textiles in Pakistan – The way Forward

Prof. S Anbhan Ariadurai, Textile Research & Innovation Centre, Textile Institute of Pakistan delivered a comprehensive lecture on "Geo-Textiles in Pakistan – The way forward."

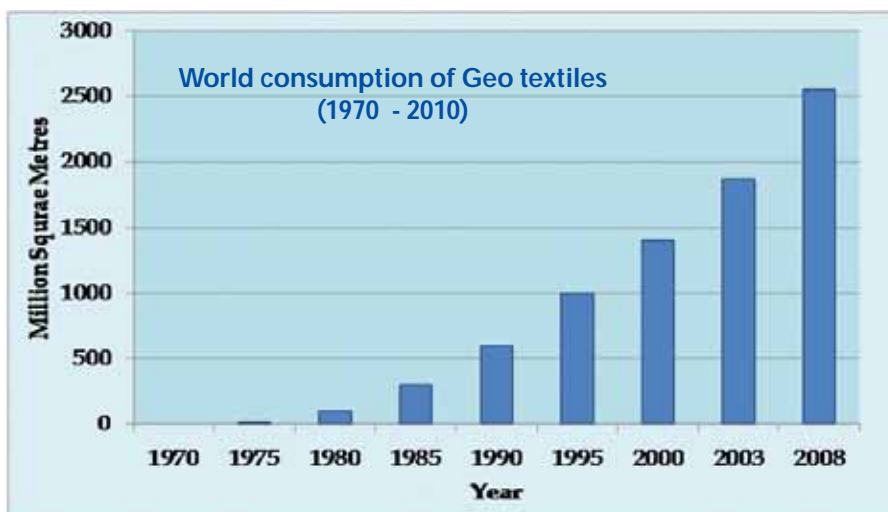
Geo-Textiles have proven to be versatile and cost-effective ground modification materials. Their use expanded rapidly into nearly all areas of civil engineering, geo technical, environmental, coastal and hydraulic engineering. According to David Rigby Associates, Geo-Textiles is forecasted to achieve the highest growth rates among the twelve technical textile application areas.

The rate of 4.6% per annum between 2000 and 2005 is set to increase to 5.3% per annum during 2005 to 2010. The world demand for Geo-Textiles is projected at about 4715 million square metres by 2014 mostly from China and India.

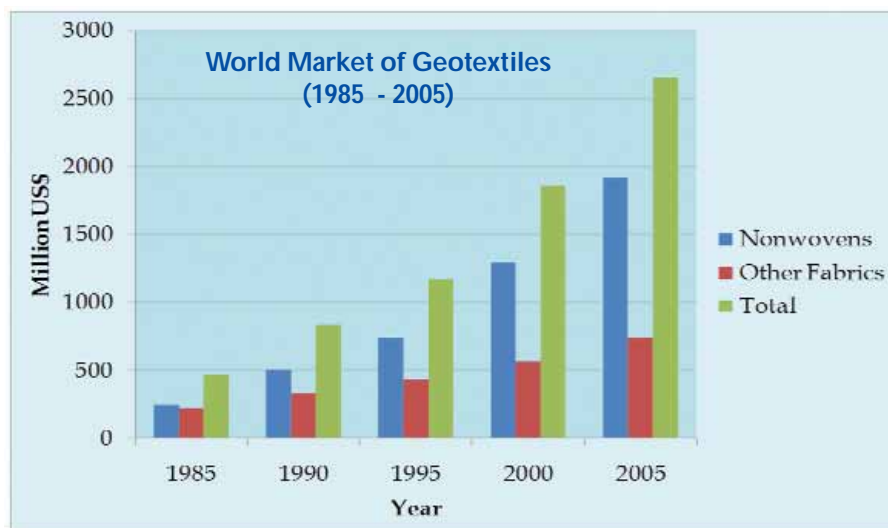
The main growth sectors for Geo-Tex are construction of roads and buildings in which drainage layer is protected by Geo-Textiles as use of geosynthetics make roads more durable, improve drainage and prevent erosion.

Another important area is the Landfill market, even though there is a high cost of geo-membranes in landfills, this market will advance at a below-average pace due to increased interest in recycling and reducing wastes, and the durable nature of geosynthetics used in landfills.

Other markets of niche opportunities include agriculture and mining, due to increase awareness and interest in increasing crop yields to make bio-fuels and in sustained expansion in the US mining industry.



Source: Geosynthetics – David Cook (2003), Freedonia Group (2009)



Sources: David Rigby Associates.

Demand growth for Geotextiles		
Technical Textile Type	2000 – 2005 (%)	2005 – 2010 (%)
Geotextiles	4.6	5.3
Building Textiles	4.3	5.0
Medical Textiles	4.6	4.3
Industrial Textiles	3.5	4.4
Protective Textiles	3.3	4.0
Agriculture Textiles	3.2	3.9
Packing Textiles	3.2	3.8
Sports Textiles	3.1	3.7
Automobile Textiles	2.7	3.4
Clothing Textiles	2.7	3.2
Hometextiles	2.7	2.7
Total	3.3	3.8

Source: David Rigby Associates.

Textile Trade Indicators

Textile Trade Indicators between India, China and Pakistan pertaining to 2008 is reported as follows:

- ❖ Export Growth: India 10%, China 18%, Pakistan 4%.
- ❖ Share in National Exports: India 6% China 5%, Pakistan 60%
- ❖ Competitiveness Rank: India 30, China 22, Pakistan 49 (Source: International Trade Centre).

The requirements of way forward for Pakistan are as follows.

- ❖ Continue to create awareness among all stakeholders.
- ❖ Include in the curriculum of the universities.
- ❖ Establish research and advisory centers with testing and standardization. ♦



Areas of applications

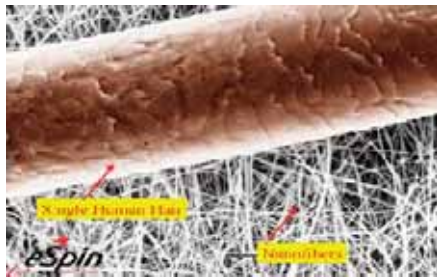


Electro-Spinning for Technical Textiles

Mr. Nadeem Shukat, Assistant Professor at Fabric Manufacturing Department, National Textile University, Faisalabad presented his paper on, "Electro-Spinning for Technical Textiles – Special Application to Medical Textiles."

The process of Electro-Spinning has been known for almost 70 years. The first patent for this process was obtained by Formhals in 1934. Larrondo & Manley performed a similar work on polymer melts in 1981 followed by research by Reneker and Chun, who have shown the possibility to electrospin a wide range of polymer solutions in 1996. From last two decades Ramakrishna, Zhang, Yoshimoto, Dalton, Kim and so many others are working on different aspects of electro-spinning.

The conventional fibre spinning techniques for the manufacture of filaments yarns and man-made fibers are Wet Spinning, Dry Spinning, Melt Spinning and



Human hair versus nano fibers.

Gel-Spinning. These technologies are capable of producing polymer fibers with diameters down from "mm" (10^{-3} m) to (μ m) micro meter 10^{-6} m Range.

Electrospinning or electrostatic spinning is a process capable for producing polymer fibers in nano meter (10^{-9}) diameter range.

Variables of Electro – Spinning

The variables of Electro spinning which must be controlled effectively and accurately are listed below:

- ❖ Polymer solution variables such as molecular weight and its distribution as well as architecture (branched, linear). Furthermore the solution properties such as viscosity, conductivity, surface tension and volatility (evaporation) are important parameters.
- ❖ Process variables for Electro-Spinning of Nano-Fibers include electrical potential, flow rate of Polymer, distance between capillary & target and ambient parameters of chamber (such as temperature, humidity, air velocity).

Benefits of Geo-Textile Reinforcement in Soft Soils

Paper on "Benefits of Geo-Textiles Reinforcement in Soft Soils" was presented by Syeda Madiha Zaidi, Assistant Professor at Department of Urban and Infrastructure Engineering, NED University of Engineering and Technology.

In order to encourage the use of geo textiles in road construction – a joint Research Project between NEDUET and TIP was initiated with an aim to explore the following two aspects.

- ❖ the degree by which the life of a pavement over soft soils can be enhanced by the use of geotextiles.
- ❖ cost savings involved, both at the time of construction and in terms of overall life cycle of the pavement (maintenance cost).

Soft soil is not suitable for construction because of the problems of high compressibility, low shear strength, low permeability, low bearing capacity and excessive settlement. Therefore, under cyclic loading, soft clayey and silts subgrades exhibit large deformation and thus leading the fine grain subgrade into graded base course.

Usual methods of soft soil stabilization are based on use of stone piles, hydrated lime, cement or cement kiln dust, lime and

coal fly ash (CFA) treatment and at times are not effective in the long run. The better option for soil stabilization in road and dam construction is geo textiles. In road construction, geo textiles act as reinforcement element with in a soil mass or in combination with soil to produce a composite with the benefits of stabilization, separation, filtration and compaction. The major functions of Geo textile are stabilization, separation, reinforcement, filtration, drainage and acting as liquid barrier.

The objective of the research work being carried out at the NED University is to highlight soft soil areas in Sindh and promote the use of Geo-Textiles as reinforcement in Soft Soils. The presentation will focus on flexible pavement Construction method, problem in soft soil construction and methods of stabilization before construction in soft soil.

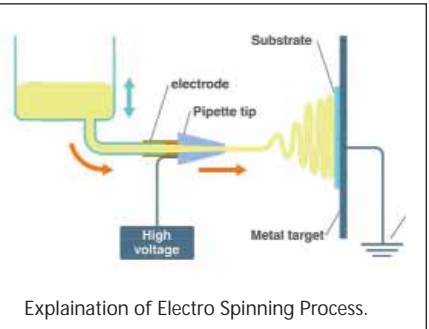
The soft area is 11.4% of the total land area of Pakistan (90,400 hecstres).

According to the data of soft soil, two major highways of Pakistan (N-5 and N-55) traverse through this area, N-5 connects Karachi-Lahore-Peshawar and N-55 (Indus Highway) connects Kotri-Shikarpur-D.G.Khan-D.I.Khan-Kohat-Peshawar.

The National Highway Authority (NHA) has planned to improve and widen the road to international standards i.e, 7.3m carriage-way with 1.3 m shoulders on either side. The 61-km long Lakhi-Naudero-Larkana section has recently been finalized for construction.

Condition of the parts of the roads which lie in soft soil areas are investigated and experimental work on Triaxial samples using Triaxial Apparatus is being organized.

Pressure will be applied on samples, with vertical and horizontal stresses acting on the samples will be determined as both woven and nonwovens samples of Geo-Textiles will be part of the experiment. The work in progress is to determine how Geo-Textiles can enhance stability of roads.◆



Explanation of Electro Spinning Process.

End-Uses of Nano-Fibers

Some of the end uses are self cleaning cosmetic skin masks, skin therapy with medicine, protective clothing for military personnel for anti-bio chemical gases and efficient aerosol trapping and filter media for liquid and gas filtration.

Industrial application includes photo-voltaic devices such as nano solar cells, micro and nano electronic devices, LCD devices and other application in electromagnetic interference shielding. In medical textiles, the nano technology is used for tissue engineering scaffolding. Examples include porous membrane for skin grafting, tubular shapes for blood vessels and nerve regeneration and also 3 D scaffolds for bone and cartilage regeneration.

Another very interesting facet of nano technology is application in thermal sensors, piezo electronic sensors, biochemical sensors and fluorescence optical chemical sensors. ◆

Geo-fabrics for roads

Ms. Syeda Faiza Jamil, Research Assistant at Textile Research and Innovation Centre, Textile Institute of Pakistan presented her paper on, "Geo-Fabrics for Roads" which is briefly reported as follows: Ed.

Geo-Textile fabrics are permeable textile materials used with foundation, soil, rock, earth etc which is an integral part of a constructed project, structure or system. Advantage of using Geo-Fabrics is to extend the life of roads, improve stability and reduce cost. Research work being carried out at the TRIC is based on a 3-pronged strategy (demand, supply and research) based on sustainable growth of geo textiles in Pakistan.

Mechanical properties of Geo-Textiles are strength, elongation, puncture resistance, tear strength and creep. The hydraulic properties are permeability, whereas in terms of endurance UV resistance is desirable property. Products suitable for use as reinforcement in roads are identified on the basis of the following consideration:

Raw-materials

Geo-Textiles are generally made from 90% Polypropylene fibre the remaining component can be polyester or polyamide fibre. Polypropylene and Polyester fibers are most suitable, due to their stress-strain characteristics, initial modulus, capacity to resist initial stress and deformation under load applied over a period of time. The ideal raw material for reinforcement of roadbed is Polyester, because it is durable and has superior initial modulus and creep characteristics.

Yarn type

Fine, high-tenacity multi filament yarn with high strength, stability and high capacity of interlocking with soil particles are required for the manufacture of Geo-Textiles.

Fabric type and construction

Both knitted, woven and nonwoven fabrics can be used for Geo-Textiles. The fabric construction parameters should give high strength characteristics with permeability. Fabrics must also have the properties of resistance to damage and abrasion. The weight per square meter of the fabrics should be sufficient to give maximum reinforcement to the roads. The usual range of weights of fabrics for use as Geo-Textiles is from 180 gsm to 400 gsm. The woven construction made up of high tenacity multifilament polyester yarn is the most suitable geotextile for reinforcement.

Local manufacturers and users

Some of the local manufacturers of Geo-Textiles are Ibrahim Fibers, Dewan Salman Fibers, Rupali and I.C.I. The local users of Geo-



Geotextiles can extend the life of the road and decrease its immediate and life time cost.

Textiles are Pakistan Navy, Irrigation Department of Baluchistan, Civil Aviation Authority, Sui Southern Gas Company Limited, Pakistan Petroleum Limited, Defense Housing Authority, Karachi Port Authority and Hub Pak Salt Refinery. In conclu-

sion it is stated that for the promotion of the manufacture and use of Geo-Textiles, government support, standardization, technical education and research facilities are prerequisites for further development.

Geo-Textiles can be placed on top of asphalt layer with binder. It can also be placed between soil and asphalt for prevention of soil erosion but mostly it is used for road reinforcement.

Firstly high tenacity polyester yarns can be used for Geo-Textiles and secondly either natural fibers or a hybrid of natural and synthetic fibers or other cheap materials made from reprocessing waste can also be used.

About 50% of the water is lost in seepage in Pakistan which can be saved by using Geo-Membranes in canals and water courses. ♦

VEC Composite Technology launches new site promoting its benefits

VEC Composite Technology, a fully integrated composite solutions company, has launched a new and updated website featuring the benefits of its leading edge composite manufacturing process. The updated website is located at VECTechnology.com and features information on VEC Composite Technology, applications, production process and more.

VEC Composite Technology is a patented, state-of-the-art, computer-controlled manufacturing process that guarantees that every composite part built with VEC is made to the most exacting standards of fit and finish, resulting in composite parts that have superior and unparalleled precision and unprecedented quality.

VEC Composite Technology uses advanced thermosetting and thermoforming techniques to dramatically reduce the capital and time needed to make composite prod-

ucts as well as ensure that VEC parts are superior in quality, appearance and strength when compared to traditional manufacturing methods.

"VEC Composite Technology has been producing products of the highest quality and most exacting precision for many years," said John Wirt, President of VEC Technology. "We have proven that VEC Composite Technology saves time and money through our production of thousands of boats, storage containers, recreational vehicles, transportation equipment and more. We are currently working on revolutionizing the production of wind turbine blades for the Wind Energy industry. The deficiencies of traditional wind blades include poor bonding between sections, delaminations and voids, all of which can lead to blade failure and ultimately to blade replacement. With the proven precision and reliability of the VEC Composite process, we are going to change

the industry's expectations of wind blade performance and durability."

Perhaps VEC's greatest significance is that the process is so environmentally friendly. VEC Composite Technology computers control a myriad of complex variables that reduce styrene emissions by over 90 percent. In fact, the VEC process is so environmentally friendly that it was awarded the prestigious and highly coveted "Clean Air Excellence Award" from the Environmental Protection Agency (EPA), recognizing VEC for its outstanding achievements.

Additionally, VEC Composite Technology has earned the Design & Engineering Award from Popular Mechanics. Time magazine also referred to the VEC Technology as "The Revolution in a Box."

For additional information regarding VEC Technology and to view the updated website, visit VECTechnology.com. ♦