

## Technical and Smart Textiles and their Applications

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### ABSTRACT

Technical textiles have been idealized to be one of the most active energetic and promising areas for the textile industry. The advancement of polymer, fibers, yarns, chemical technology and fabric technology are there driving forces for the development of technical textiles. The industry is coming into view because people are now ready to spend the money on achieving comfort in their tough life. Technical textiles can satisfy those needs that cannot be fulfilled by traditional textiles. Textiles with nano materials and much more with textiles it will be possible to offer innovative solutions for global problems such as pollution, health issues transport protection communication.. Smart textiles are the most exciting innovation in the field of textile engineering. The development of smart textiles reaches for beyond imaginations some storage maybe scene science fiction. The economic value and impact of smart textiles are gigantic. The advent of smart textiles makes it possible to be the traditional textile sector to a level of a high technological industry. Moreover it appears that this is only possible by intense cooperation between people from various backgrounds and disciplines such as microelectronics, computer science, material science, polymer science, biotechnology.

Keywords :- Smart Textiles, Technical Textiles

## I. INTRODUCTION

Textile products manufactured primarily for its performance and functional properties rather than aesthetic or decorative characteristics. The primary function of textile is to shield humans but with advancement in technology. Textile industry is rapidly developing with varied special features in addition to its primary function. The demand to smart materials and intelligent textiles grows increasingly all over the world. In other words, technology has also taken control of textile industry. Smart textiles have superior performance and functionalities

for the applications ranging from simple to more complicated uses such as military, healthcare, sportswear, etc. Smart or intelligent textiles can also be called as the next-generation textiles.

Smart Textiles are the textile materials that have the ability to sense and hence react to external stimulus with the help of electronic sensors incorporated. Along with its application in different fields like sports, military, fashion/lifestyle etc, it has applications in health care for continuous monitoring of patients. A smart textile are materials and structures that sense and react to environmental conditions or stimuli, such as those from mechanical, thermal, chemical, electrical, magnetic or other sources. They are systems composed of different apparatuses and materials such as sensors, actuators and electronic devices together.

Technical textiles are defined as textile materials and products used primarily for their technical performance and functional properties rather than their aesthetic or decorative characteristics. This is one of the fastest-growing sectors of the Textile Industry, which is manufacturing high-tech, high-performance fabric designed not just to look attractive, but to present a significant added value in terms of functionality. The textile coating process is widely used in the manufacturing of technical textiles. Technical textiles are functional fabrics that have applications across various industries including automobiles, civil engineering and construction agriculture, health care, industrial safety, personal protection etc. The technological evaluation which transversally integrates human science, materials and information technology, does allow to four screen four seeing positive perspective in the approach toward the development of new products and applications.

## II. Materials for technical textiles

Regular/Generic fibers...Natural fibers: Cotton, silk, wool, jute, hemp, ramie, flax

Regenerated fibers: Viscose, Lyocell. Synthetic fibers: Nylon, PET, PP, Acrylic.

Specialty variants of regular/generic fibers....Flame retardant, Super absorbent, Anti micro bacterial Ultra fine fibers etc.

High tech/high performance fibers....High chemical- and combustion-resistant organic fibres: Nomex, Kevlar.

High performance inorganic fibres....Glass, Asbestos, Carbonic

Classification of technical textile:

### 1. Agro Tech (Agro-textiles):

Textiles used in Agriculture are termed agro textiles. The agro tech products include shade nets, crop covers, mulch mats, anti-hail nets, bird's protection nets, and fishing nets agriculture, horticulture, forestry and Aquaculture textiles Polypropylene, polyester, polyethylene etc.

Given the increasing awareness of the environment and the specific knowledge of the various interdisciplinary technologies, special attention has been paid to unconventional technical applications, such as the use of textile structures in the agriculture and horticulture sectors to increase the quality and efficiency of agriculture and food products in terms of ensuring a healthy environment, social-economic equity, and a profitable economy.

### 2. Build Tech (Construction Textiles):

Textiles have in the past been predominantly confined to the interior decoration; they are now increasingly becoming part of these constructions themselves.

Textiles used in construction – concrete reinforcement, façade foundation systems, interior construction, insulations, proofing materials, air conditioning, noise prevention, visual protection, protection against the sun, building safety, architectural membranes, floor & wall coverings, scaffolding nets, awnings & canopies, HDPE tarpaulins and others.

### 3. Cloth Tech (Clothing Textiles):

In the textile and apparel industry, clothing components include fibre and textiles which are used as a technical component during Apparel manufacturing. Those clothing components are swing traits, wedding and interlacing and insulations.

### 4. Geo Tech (geo textile and soil engineering):

These are used in the reinforcement of embankments or construction of bridges, dams roads and pavements, railways and paths as well as embarrasments, cutting, dikes, rail- track bed stabilization, landfills and waste management and sub-sea coastal engineering projects.

The fabrics in geo textiles are permeable fabrics and are used with soils having the ability to separate, filter, protect or drain. The fabric used in it must have good strength, durability, low moisture absorption and thickness. Mostly nonwoven and woven fabrics are used in it.

Synthetic fibers like glass, polypropylene and acrylic fibers are used to prevent cracking of concrete, plastic and other building materials. Polypropylene and polyester are used in geo textiles and dry/liquid filtration due to their compatibility.

### 5. Home tech (Domestic Textiles):

Textiles used in a domestic environment – interior decoration and furniture, carpeting, protection against the sun, cushion materials, fireproofing, floor and wall coverings, textile reinforced structures/fittings, furniture fabrics, fiberfill, stuffed toys, blinds, mattress and pillow components, carpet backing cloth, mosquito nets, vacuum cleaner filters, and others.

### 6. Indu Tech (Industrial Textiles):

These technical textiles products are used for industrial purposes. The industrial purposes include industrial processes, incorporation of textiles into industrial products, reinforcements for printed circuit boards, seals and the gaskets and other industrial equipment. The indu tech products include conveyor belts, cigarette filter rods, drive belts, bloating cloth, AGM glass battery separators, decatising cloth, abrasives, ropes and cordages, composites, computer printer ribbon, printed circuit boards, paper making fabrics, filtration products, and industrial brushes.

### 7. Medi-Tech (Medical textiles):

These are commonly used in bandages and sutures (stitching the wounds), surgical dressings, contact lenses, artificial implants, baby diapers, incontinence diapers, sanitary napkins, surgical sutures, surgical disposables, and others. Medical textiles also cover surgical gowns and drapes. . Polyester, Cotton, polypropylene, silk and their use is best on several typical basic textile properties like softness and lightness, flexibility, absorption,

filtering etc. Traditional applications include wounds care products, diapers braces, prostheses and outhouses', wipes, breathing mask, bedding, and covers, ropes, and belts etc

#### 8. Mobi Tech (Textiles used in transport):

Technical textiles used in automobiles, aircraft, railways, and ship building, such as nylon wire cord fabrics, seat cover fabric/upholstery, seat belts, cabin filters, tufted carpet, helmets, insulation felts, automotive interior carpets, sun visors / sunblind's, headliners, airbags, seat belt webbing, car body covers, airline disposables, aircraft webbings and others. The automotive sector has been improving its existing market share and creating innovative products through new developments, consequently increasing the demand for technical textiles.

#### 9. Oeko Tech (Environmentally friendly textiles):

These types of technical textiles are used for the protection of the environment and ecology. Do this type of technical textile overlaps with several other areas such as industrial textiles, geo textiles and agricultural textiles it's not a well defined segment yet.

#### 10. Patch tech (Packaging textiles):

There are some key uses of technical textiles as packaging and containment such as manufacturing of sacks and bags, traditionally from cotton, flex, and jute but increasingly from polypropylene and glass fibers. In the modern packaging market especially in the food industry, lighter weight nonwovens and knitted structures for a variety of working and protection applications. On the other hand tea and coffee bags used wet-laid nonwovens.

Besides these vegetables meals and fruits are now frequently packed with a nonwoven insert to absorb liquids, whereas fruits and vegetable products are supplied in knit or knitted net.

#### 11. Pro tech (Protective textiles):

Protection against heat and radiation for firefighter clothing, against molten metal's for welders, for bulletproof jackets etc, all these things are obtained by usage of technical textiles with high-performance fibers high altitude clothing, ballistic protective clothing, fire retardant apparel, high visibility clothing, industrial gloves, and others.

#### 12. Sports Tech (Sports textiles):

The various products used in sports application are included in it such as playing turf of hockey, etc. Ground, net used in various games like football, tennis, table tennis, basketball, hockey etc. The sports tech also includes the different types of protective materials used in various games such as gloves, helmets, safety pads etc. Also, the playing equipment such as Tents, swimwear, footwear components, sports nets, sleeping bags, hot air balloons, parachute fabrics, artificial turf, sports composites, and rackets, balls of various games like football, tennis, cricket, volleyball etc Polyester, nylon, spandex, glass fibers are used for Sport and leisure

#### Uses of Technical Textile:

Pidilite products are extensively used across many industries in a wide range of technical textile companies in India. These include technical textile uses in segments like Homotech, Packtech, Indutech, Geotech, Sportech,

Medtech and Protech etc. Applications consist of apparel, protective textiles, transportation fabrics, home furnishings, window treatments, soft luggage and a range of other technical textile applications for woven, non-woven and knit fabrics. Our portfolio of water-based, multi-functional coatings improves a broad range of functional and aesthetic properties, including flame retardance, abrasion and wash durability, water repellence, chemical resistance, thermal regulation and stretch resistance.

#### A Smart Textiles:

A smart textile are materials and structures that sense and react to environmental conditions or stimuli, such as those from mechanical, thermal, chemical, electrical, magnetic or other sources. They are systems composed of different apparatuses and materials such as sensors, actuators and electronic devices together. Textile science today stands on a novel unexplored and a fantasy-filled horizon.

#### Classification of smart textiles:

Passive smart textiles:- The first generations of smart textiles, they are only able to sales the environment user, based on sensors.

Active smart textiles:- The second generation have both actuators and sensors. Textiles which adopt their functionality to changing environment automatically are active smart textiles. Active smart textiles are shape memory, chameleonic, water resistant and vapor permeable, hate storage thermo regulated vapor absorbing and heat evolving fabric and electrically heated suits.

Ultra smart textiles:- Very smart textiles are the third generation of smart textiles, which can sense, react and adopt themselves to environmental conditions or stimuli.

#### Functions of smart textiles:-

Five functions can be distinguished in the intelligent suit namely sensor, data processing actuators, storage and communication. They all have a clear roll, although not all intelligent suits will contain all functions. The functions may be quite apparent or maybe an intrinsic property of the material or structure. They all require appropriate materials and structures and they must be compatible with the function of clothing. Comfortable, durable, resistant to regular process and so on.

#### Sensors:-

The basis of the sensor is that it transforms a single signal into another signal that can be read and understood by predefined readers which can be a real device or a person. As for real devices ultimately most signals are being transformed into electric ones. Textile materials cover a large surface area of the body. Consequently, they are an excellent measuring tool.

#### Data processing:-

Data processing is one of the components that are required only when active processing is necessary. The main bottle neck at present is the interpretation of the data. Textile sensors could provide a huge number of data, but what do they mean? Problems are large variations of signals between patients complex analysis of stationery and time dependency signals lack of objective standard values lack of understanding of complex inter relationship between parameters. Apart from this, the textile material in itself does not have any computing power at all.

#### Actuators:-

Actuators respond to an impulse resulting from the sensor function, possibly after data processing. Actuators make things move, they release substances, make noise, and many others. Shape memory materials are the best-known examples in this area. Shape memory alloys exist in the form of threads. Because of its ability to react to a temperature change, a shape memory material can be used as an actuator and link up perfectly with the requirements imposed on smart textiles.

#### Storage:-

The smart suit offer needs some storage capacity. Storage of data or energy is most common, sensing, data processing, actuation, communication; they usually need energy, mostly electrical power. Efficient energy management will consist of an appropriate combination of energy supply and energy storage capacity.

#### Communication:-

For intelligence textiles, communication has many faces; communication may be required within one element of the suit, between the individual elements within the suit, from the wearer to the suit to pass instructions, from the suit to the wearer or his environment to pass information.

#### Application of smart textiles... Health...

The development of wearable monitoring systems is already having an effect on healthcare in the form of "Telemedicine". Representative examples are Wireless-enabled garment with embedded textile sensors for simultaneous acquisition and continuous Monitoring of ECG, respiration, EMG, and physical activity. The "smart Cloth" embeds a strain fabric sensor based on piezoresistive yarn and fabric electrodes realized with metal based yarns. Sensitize vest including fully woven textile sensor for ECG and respiratory frequency detection and a portable electronic board for motion assessment, signal pre- processing, and Bluetooth for connection of data transmission. The wearable sen garment that measures human sitized garment that measures human heart rhythm and respiration using a three-lead ECG shirt. The conductive fibre grid and sensors are fully integrated (knitted) in the garment (smart shirt).

#### Life belt:-

Life belt plays a significant role in medical sector. It's a valuable decision support tool.

Basically life belt is a trans-abdominal wearable device. To avoid the frequent visit of additional patients the remote health monitoring provided by this. It is also time consuming to take individual care of every patients. So it becomes easier when hospitals use Life Belt which improves significantly patient's living and health conditions.

#### Phase change materials:-

Nowadays, face change materials are highly applied in the field of textiles for different kinds of products such as apparel, underwear, socks, shoes , bedding accessories and sleeping bags. For multifunctional products also are applicable in the specialty items like anti- ballistic vests, automotive, medical or for other industrial applications.

### III. CONCLUSIONS

The textile industry is not only experiencing clothing application but also continuing a major outlook towards the non-clothing application of textiles known as Technical textiles.

The distinctiveness and confrontation of technical textiles lie in the need to understand and apply the principles of textile science and technology to give solutions, in the main leading technological problems but also often to engineering problems as well.

The fabrics of the future will be entirely re-conceptualized; researchers all over the world have been quizzed about the products that will be appearing on the market over the coming decades, and their belief is that there will be materials capable of repairing themselves when damaged, fabrics with built-in digital devices, smart textiles with nano materials and much more. With textiles it will be possible offer innovative solutions for global problems, such as pollution, health issues, transports, protection, communication, and so on. Smart textile is so much useful for human being. So we should have proper knowledge in this field. It should have high strength, high chemical and combustion-resistant organic fiber, high modulus organic fiber, It can be Ultra-fine fiber and novelty fiber, and high performance inorganic fiber

### IV. REFERENCE

- [1]. Smart fibres, fabrics and clothing; Xiaoming Tao, Wood Head publishing. Synthetic fibre materials; H.Brody, polymer science and technology series.
- [2]. New fibres; second Edition, tatsuya Hongu [www.textiles.edu](http://www.textiles.edu)
- [3]. <http://academia.edu>
- [4]. [www.textilesinfo.com](http://www.textilesinfo.com)
- [5]. <https://www.technicaltextile.net/articles/technical-textiles-and-their-applications->

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