Functional Finishes On Technical Textiles

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Abstract

Textiles that are primarily used for their performance or functional properties and not for their appearance or aesthetics are known as technical textiles. Industrial fabrics that are used for various industrial applications are also classified as technical textiles. It can also be defined as an umbrella term covering textile products that are produced keeping a specific functionality in mind. Unlike apparel and furnishing fabrics, function is the most important attribute of technical textiles. Another way of categorizing technical textiles is by application. A distinction is generally made between fabrics for automotive, construction, safety, medical, geological and agricultural applications. Technical textiles are used for a wide range of applications and are expected to meet very high quality standards and demand specifications for coloration and finishing. It is a new and diverse sector which is currently growing at a much faster rate than the conventional apparel and home textiles sectors. On the other hand, protective clothing and medical textiles would end up interacting intimately with the human body and may actually stay in contact for an extended period of time. Not only a great variety of raw materials but a multitude of processes are employed for manufacturing technical textiles, including basic processes like weaving and knitting and more advanced processes from stitch bonding, chemical and thermal bonding to needle punching and many more. All these processes result in various products such as fibers, yarns and threads that are further used for making the finished textiles.

I. Introduction

Functional finishes on technical textiles is not just about surface finish on the substrate but meeting with all functions in terms of performance and end user requirements. Value addition in manufacturing is the sum of gross output less the value of intermediate inputs used in production. To make salable consumer products, the fiber, yarn, fabric or readymade garments have to go through various chemical-processing sequences such as preparatory, dyeing, printing and finishing. Among these the chemical finishing assumes considerable significance because the value addition is realized through functional finishing to impart the desirable properties. A textile fabric undergoes a series of wet processing operations to make it functional. Wet processing has been and will remain an important operation in the textile value chain. Specialty finishes in the form of functional finishes play a significant role in the value addition of technical textiles. Technical textiles today include textiles for automotive applications { car interiors, upholstery } medical textiles { e.g. wounds and dressings }, geo textiles, { reinforcement of embankments}, agro textiles{ textile for crop protection}and protective clothing{ heat and radiation protection for fire fighter clothing and bullet proof vests. Out of the aforementioned classes of technical textiles, geo textiles and agro textiles are pure industrial products not meant for consumption of individuals.

II. Birth of functional finishes- Some driving forces

The challenges facing the finishing industry has intensified in the last one decade, with finishers faced with the new task of striving to survive in this global and highly competitive market. Consumers demand more durability, more functionality from their clothing. The beginning of 1980s brought the conventional cationic softeners, polyethylene emulsions for open end yarn and short liquor dyeing machines. Since the beginning of 1990s, with more and softer flow machines, amino functional silicones and high quality fatty acid condensate products were applied on the fabrics. By the end of 1990, there has been a paradigm shift in the mindset of the consumers. Conventional softeners could not compensate such handle differences and had limitations. Multi-functional softeners with special effects have come in to the market place. Consumers insist for tailor made products, with more value added properties.

III. Drivers of functional finishes

1: Need for higher quality

2: Demand for more value added properties and value added finishes.

3: Discovery of new molecules

4: Specialty chemicals performing one or more functions.

Functional finishes represent value creation in the area of technical textiles making the textile materials act by themselves. Value addition on technical textiles can be in the form of functional finishes like protective finishes, UV Absorbers, Antimicrobials, Oil and water repellant finishes, flame retardant finishes, water proof finishes, Thermal finishes{ Hot and cool},micro encapsulated & aroma finishes, Insect Repellent finishes to mention a few. Technical textiles made of synthetic fibers like polyester, nylon, acrylic too demand functional finishes, but with the emergence of cotton, as the most popular fabric, newer finishing terminologies have given birth. Cotton is amazingly versatile, whether alone or blended. Cotton is popular because it is comfortable year around. In hot humid weather, cotton breathes, as the body perspires, cotton fibers absorb moisture and release it on the fabric, so it evaporates in cold weather. If the fabric remains dry, the fibers retain body heat especially napped fabric. Cotton absorbs up to 27 times its weight of water, has a comfortable soft hand, takes dye easily, conducts heat well, resists pilling etc. With all the advantageous properties, there are two main inherent weaknesses, namely, dirt and crease resistance. On the other hand, fabrics made with synthetic fibers, generally, have strong crease and dirt resistant, but they lack the comfort properties of cotton. With the recent advances in Nano technology, it is possible to develop next generation cotton based fabrics that can complement the advantages of cotton and man-made fibers. Such advanced fabrics can be produced either by blending cotton with special Nano fibers or by treating the yarn or fabrics with various design/material modification at Nano scale. Nanotech deals with the science and technology at dimension of roughly 1to 100 nanometers. {One billion Nano meter = one meter}. The technology can be used in engineering desired textile attributes such as softness, durability, breathability and in developing advanced performance characteristics, namely water repellency, fire retardancy, anti-microbial resistance, UV absorbers in fibers, yarns and fabrics.

Functionality	***Application***
Oil, stain or water repellent	Table cloth, curtains, furniture, car, bus, train. Aircraft seats
Flame retardant	Textile interiors, fire dresses.
Anti-microbial	Bedding, medical textiles, socks
UV- protection	Roofs, tents, awnings, blinds, curtains
Insect repellent	Tents, nets
Aroma &Cool finish	Children clothing, thermal wear

IV. Oil. Stain and water repellant finishes

Water/stain repellent finishes can provide durable liquid repellent (water and oil) without compromising the natural feel of cotton. With proper chemical treatment and selection of fabric construction, fabrics / garments that provide a host of benefits to the wearer, such as staying clean longer, faster drying, and protection from rain. The development of these finishes has taken place in response to the consumers need for easy care fabrics. Technical textiles with water/stain repellent can be used for a variety of end uses such as outerwear, where the focus is on a high degree of water repellency, and general wearing apparel such as casual pants, where the focus is more on stain resistance. Other common end uses for fluoro chemical repellents include upholstery, rugs, and carpet.

V. Flame retardant finishes

There has been a great deal of interest in providing effective flame retardants for normally flammable substrates. Interest in the development of flame retardant finish on polyester, nylon, polypropylene etc., without disturbing the desirable physical characteristics of the fibers are increasing with changing market requirements. Technical textiles consist of highly ignitable materials and are the primary source of ignition. They contribute to rapid fire spread; however, reduction of ignitability can be obtained by through chemical treatment with flame retardant finishes. With new fibers /blends rapidly changing the economic situation, today's manufacturer needs to be fully aware of new regulations and the products and processes that will meet them. Companies that adopt the latest technology will have the edge in providing superior products with the best balance of properties at the lowest possible price Synthetic polymers have largely replaced the use of wood, Glass and other metallic materials in our homes, offices, automobiles and other public areas. These synthetic materials are often petroleum based plastics that easily ignite, spread flames quickly and release toxicants when burned. Fire safety is a significant cause of property damage and of death. Standards are therefore set for electrical appliances, textiles upholstery and many other materials to minimize these losses. To meet fire safety standards, products made of synthetic materials are

modified with flame retardant chemicals that inhibit the ignition and spread of flames. Recently, there has been a great deal of interest in providing effective flame retardants for normally flammable substrates.

VI. Anti-microbial finishes

Anti-microbial finishes have increased its importance in the recent years for several reasons. They serve the consumer by offering protection from the harmful effects (such as infectious diseases) of certain microbes. More commonly, the finish is designed to inhibit odors that may have been generated by the body, soils, contaminants, or personal care products. Some of these finishes are designed to reduce the deterioration of the fabric from biological activity. The use of synthetic fibers and blends in items such as shirts, hosiery, blouses, and underwear has accelerated the need for bacteriostatic finishes on clothing. The moisture transport characteristics of such blends tend to cause a greater degree of "perspiration wetness "than occurs with fibers of wholly natural fibers.

VII. Insect repellant finish

Insect repellant finish on textiles is one of the revolutionary ways to advance the textile field by providing the much-needed features of driving away mosquitoes, especially in the tropical areas. It protects the human beings from the bite of mosquitoes and thereby promising safety from the mosquito-borne diseases, such as malaria, dengue fever (DF), Nile fever, dengue hemorrhagic fever (DHF), and filariasis, which are serious public health problems in tropical regions like Africa and Asia. Insect repellant finishes on textiles remain effective for up to a week when applied on textiles. A repellent applied to textile normally retains its effect longer than on skin. Generally, cotton and nylon fabrics are treated with mosquito repellents since cotton is widely used as bed-sheets where nylon as mosquito nets. Both the untreated cotton fabric and treated fabric is placed inside the mosquito cage containing insects for 2 hours. The effectiveness of the finish is evaluated by the presence of insects on the samples and the bites.

VIII. UV Finishes

Protection of the skin against the action of solar radiation is a relatively new objective of textile finishing, since the textile does not always guarantee adequate protection. Specific protective functions of textiles against the most diverse influences are attracting more and more attention. A notable objective of increasing interest in this area, is the protection against UV radiation. Sun protection involves a combination of sun avoidance and the use of protective garments and accessories. Reducing the exposure time to sunlight, using sunscreens and protective clothes are the three ways of protection against the deleterious effects of UV radiation.. The fabric is rated according to an Ultraviolet Protection Factor ("UPF"). UPF is like SPF except UPF rates protection against both UVA and UVB. A technical textile with a UPF of 50 only allows $1/50^{th}$ of the UV radiation falling on the surface of the substrate to pass through it. In other words, it blocks 98% of the UV radiation. Sun protection clothing is an easy and reliable form of UV protection and so is becoming more and more popular. Textiles are tested according to AATCC test method 183. UV protection textiles include technical textiles, various apparels, accessories, such as hats, shoes, and shade structures such as umbrellas.

IX. Aroma & cool finishes

Aroma finishes on textiles are possible through micro encapsulation of active matter. When temperature rises, we tend to sweat. This is a natural reaction of our body to maintain the temperature around 97°F. The sweat when evaporates, takes along with it heat equivalent to heat of evaporation of water, thereby maintaining the temperature of the body. The cool finish technology works in three different ways. The snocool finish uses the moisture management route i.e. it will enhance the natural phenomenon of sweat evaporation. This finish absorbs and dissipates sweat evenly throughout and thus gives a cool feeling to the wearer. Snocool finish when applied to the fabric, reflects light and produces the cooling effect. This finish uses the moisture management route i.e. it will enhance the natural phenomenon of sweat evaporation.

X. Conclusion

The scope of textile fiber science is very broad. Innovative products will be able to open up new markets and new horizons for the technical textiles. Development of new products and novel finishes are making a dent in the field of innovative technical textile market. The technological evolution which transversally integrates human science, materials and information technology allow to foresee positive perspectives in the approach towards development of new products and applications. Value addition by way of functional finishes can strengthen the product lines and diversify into new unchartered areas.

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