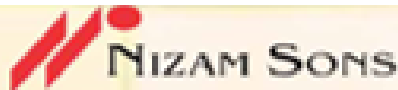


5th International Conference on Value Addition & Innovation in Textiles 2019

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National Textile University Faisalabad



**5th International Conference on Value Addition &
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BOOK OF ABSTRACT

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1. Toward better collaboration between university and industry

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Abstract

It is well known the mission of universities around the world where same, generally classified into four classes, teaching, research, extension of knowledge and consultancies. On the other hand, the mission of industry to provide commodities and services satisfying the consumers. However, both entities contributed positively toward economic and well fair of the nation. Actually the relation and link between university and industry at least in developing country are not satisfactory, this paper was designed to explored the area of collaboration to strengthening tied and closed relation already existed and to overcome weakness. As we know design and implementing of curriculum depend mainly on staff members, facilities and beneficial but the right now in may developing county the curriculum was set in the absence of beneficial so these trend hinder the graduates to find vacancies after graduation or in some cases required extra training to fit in. This problem can be solved if the beneficial participated in curriculum design from the beginning. Research also required to be emphasized and strategic plan should be formulated in present of beneficial to direct research toward problem facing the industry but unfortunately this trend was not applicable of course these case cannot be generalized. Therefore, the gap between research conducted at university and problems facing the industry should be bridge by direct contact between university and industry. The research outcome which called extension of knowledge should have paid attention the collaboration between university and industry particularly in this field are not pleasant, the reason behind this may be due to lack of communication between university and industry or may be the industry are not recognized the outcome of the research at the tool of improvement and promotion. The fourth mission of university which called consultancies considered as the least priority really on given a proper weight although it is influential factor. However, the complementary and integrity between university and industry should be adhered and collaboration should be encouraging to achieved sustainable development.

Keywords: *commodities and services, curriculum design*

2. Design and applications of antifouling functional polymeric materials for industry and environment

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Abstract

Designing functional materials especially polymers with antifouling and antimicrobial properties has an important route to solve industrial challenges, such as infections and fouling, in healthcare, environment, energy, and water. Recently, there has been considerable interest in developing tailor made polymers because of their distinct properties including their sizes, length scale, ease of process-ability, relatively lower cost, tunable properties as well as others diverse functionalities. Considering above, this presentation will focus to elaborate the polymer systems developed as antifouling and antimicrobial materials termed respectively as bio-passive and bioactive polymers. Recent state of the art involving various types of bioactive and bio-passive polymeric systems and their applications will be presented from the perspective of industrial challenges and applications including advanced antifouling textiles.

Keywords: *antimicrobial, bioactive polymers*

3. The challenge to lead in the changing dynamics of textile industry

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Abstract

Textile industry is facing new challenges with push from legislators and pull from brands and consumers, demanding new complete approaches to manufacturers and application of colorants. The \$2.5 trillion fashion industry supports more than 60 million workers throughout the value chain, and is a significant engine for global development. It is the second biggest consumer of water, according to the UN. Textile dyeing is the second-largest polluter of clean water globally. Polyester micro-fibers add to ever-growing volumes of plastic in the environment. Most garments are not biodegradable, and present serious threats to our oceans and wastelands. Growing cotton increases the impact of toxic chemical use in agriculture. The role of sustainability issues has not historically been front and center of business strategy but now companies are increasingly connecting the dots between risk management and corporate sustainability. That, in turn, is making sustainability issues more prominent on company agendas. To develop sustainable solutions & Innovations without compromising overall performance require taking into account the influences emerging from outside the boundaries of the conventional textile industry. These 'external' influences ranging from agricultural practices to international energy policies, passing through consumption patterns and levels of ecological notions of society could have a great influence on the sustainability of the sector as a whole.

Keywords: *micro fibers, biodegradable, toxic chemicals, sustainability*

4. Improving weaving efficiency: Non-stop tying-in process II

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Abstract

The weaving process is the slowest process in the woven fabric manufacturing pipeline, and this is due both to the nature of the weaving process, and the inherent limitations in the yarns' tensile and abrasion properties, which can result in yarn breakages during weaving. In an attempt to offset these limitations, a weaving machine must run at its highest speed and efficiency. To overcome the inherent limitations of the weaving process, weavers made major advances in improving the quality of yarns by preparing them to withstand the rigor of weaving, which led to the reduction of short-term stops. Parallel efforts have been conducted by machinery manufacturers that led to the development of high-speed machines. The improvements in yarn preparation and weaving machine speed have reached the limit and other revolutionary ways to improve efficiency of the process are sorely needed. Two long-term stops in weaving remained unchallenged: Style change, which is conducted when a warp beam runs out and new fabric with different specifications is required; and tying-in, which is performed when the warp beam runs out and the same fabric needs to be continued. A recent time studies showed that about three hours is required to conduct tying-in for about 3,000 end warp, including the preparation time prior to tying-in, knotting by tying-in machine, loom beam change, and passing the knots after tying-in. During that time the weaving machine was idle. The time to conduct tying-in depends on warp width, warp density, yarn type, and tying-in machine type. This sort of long-term stop significantly reduces the efficiency of high-speed weaving machines. While the production lost due to tying-in is well-known for long time and causes 2%-7% loss of weaving efficiency, the practice of tying-in remained unchanged. We developed patented process that encompasses new equipment and procedures to keep the weaving machine running while performing tying-in procedures.

Keywords: *weaving, efficiency, tying-in, knotting*

5. Bangladesh's textile industry: A model of export lead industry

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Abstract

For nearly last four decades Textile and Garments industry in Bangladesh plays pivotal role in its economic development. Although the foreign market of Bangladeshi garments products has increased significantly, but the country is facing several challenges and some major challenges are sustainability issues like working environment, safety, societal etc. At the present time of industrialization manufacturing environment friendly products in a sustainable way is the most important and emerging issue. The main focus comprises not only to the products quality sustainability but also it focuses on the manufacturing processes including raw material resources from cradle to grave. Nowadays, many companies and organizations focus on the environment friendly way of production. Sustainability of the garments industry is also a burning issue and needed to address and adopt cleaner, greener approach and also improved technology and management for better environment. The key-note paper emphasizes main factors of sustainability, present practices, challenges, and implementation and suggests initiatives towards sustainable Textile and Garments Factories of Bangladesh.

Keywords: *sustainability, textile and garment industry, environment friendly*

6. The design and application of the high-distance warp-knitted spacer fabric

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Abstract

High-distance warp-knitted spacer fabric, manufactured by the double bar Rachel machine with high-distance, is a three-dimensional knitted fabric. The unique three-dimensional structure, flexible gauge and excellent performances conclude that it will have a big development space in the future. This paper mainly introduces the definition, forming technology and weaving methods of the high-distance warp-knitted spacer fabric, compares with the traditional warp-knitted spacer fabric to highlight its industrial advantages, and states its superiorities and applications in the fields of medical aid, sports & entertainment and military affairs and national defense according to the development prospect of warp-knitted spacer fabric

Keywords: *High-distance warp-knitted spacer fabric, technology, manufacturing, application*

7. Fully biodegradable fibers and their applications in polymer composites

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Abstract

Increasing environmental concerns and awareness has gravitated in high interest on the use of environmentally friendly materials such as natural fibers. Natural fibers have traditionally been used in the textile industry for the production of yarns and fabrics but in the last few decades research and development has resulted in value addition in these fibers to produce natural fiber composites. The key driving force to the increased research and interest in natural fibers is their well-known attributes that include low cost, low density, high mechanical properties, wide availability and environmental friendliness. Natural fibers such as flax, hemp, jute and kenaf have been utilized to replace traditional synthetic fiber reinforcements in composite products. The development of natural fiber composites based on thermoplastic and thermoset polymers has been fairly successful, with new innovative products constantly being introduced into the market. Exploitation of these fibers has however faced challenges due to their inherent drawbacks such as moisture absorption and poor compatibility with polymer matrices. Research has yielded positive results and these shortcomings have been successfully addressed through interventions such as chemical treatments. This paper highlights the developments in the natural fiber composites industry, challenges and interventions and presents some innovative applications. It is found that the automotive industry will continue to be the highest consumer of natural fiber composites and new markets are expected to emerge as key players come under pressure from governments to utilize sustainable materials while consumers continually become aware of the many other positive attributes of natural fiber composites.

Keywords: *Natural fibers, natural fiber composites, applications, chemical treatments*

8. Novel dyes for a sustainable textile industry

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Abstract

There is little doubt that textile industry will exist as long as human society. However, textile industry, as it is, is unlikely to be sustainable. Indeed, major textile producing regions have seen increasing negative impacts of textile industry on both lives and environment, and there appear to be few practically feasible solutions in sight. Much of the challenges lie in the intrinsic inability of existing dye chemistry to meeting opposing requirements. Take existing reactive dyes as an example, an elevated reactivity with cotton fiber is often accompanied by a heightened rate of hydrolysis in the dye bath. This talk aims to share views on tangible routes to significantly alleviating the negative impacts of textile dyeing industry on environment and even fundamentally resolving the challenges that threaten the sustainability of textile dyeing industry. The focus will be placed on examples of research that is aimed at developing ground-breaking dyes, as well as dyeing technologies, that lend themselves to textile dyeing with significantly reducing negative impacts on lives and environment and thus will hopefully help sustain textile industry for many decades to come.

Keywords: *sustainable, reactivity, environment*

9. Clustering and effect on innovation: Applications in bursa for textile and composite sectors

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Abstract

Bursa is located in the Marmara region and is Turkey's fourth largest city. It is coastal to Marmara Sea and has a logistic location with land, rail, sea and air transportation. Bursa is the 4th biggest city and also one of the biggest industrial cities of Turkey, with 22 organized industrial zones and annual exports of over 15 billion dollars. It is also a very attractive city in terms of employment. There are over thousand large companies in Bursa. There are 65 R&D center of them. There are also two universities one technology development zone in the city. It has a very advantageous position as logistic. It is the logistic most advantageous city in terms of being on the İzmir-Istanbul highway, being very close to harbor, and having an airport and railway connections. The most important competitive elements of Bursa are the advanced industrial infrastructure. The main sectors in Bursa are automotive, textile, machinery-metal and plastic industry. These sectors have international competitiveness and are committed to raising the value added in production. Increasing value added in production and more production of high technology products are among the top priorities of Bursa. For this reason, in Bursa, there is a correct conversion of the higher value-added production in the main sectors. With their strong infrastructure, the companies are shifting from standard production to extremely high value-added products. For this purpose, clustering and establishment of common R & D centers in the main sectors are encouraged the conversion in Bursa. We will be talking about the work done especially in the name of clustering. There are 18 professional councils in total within the Bursa chamber of commerce. In this way, public sector support, known as the International Competitiveness Development Project (other name is shortly URGE, let's talk about it as URGE), was first applied for different sectors. The goal here is to create a semi-cluster with Urge support and then to make it a permanent cluster. The Bursa Chamber of Commerce has created a unit to manage these activities. This unit is responsible for the execution of all Urge, clustering and other sectoral projects. Two of these sectors are composite and textile. In these areas not only clustering, but also the establishment of excellence center has been realized.

Keywords: *logistic, clustering, composite*

10. The production and finishing of the prototypes of the international traditional narrow strip fabrics as the basis of motorizing the modified floor loom

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Abstract

There are many schools of thought about Nigeria's technological development. Some believe in constant importation of foreign technology since the nation is still developing, others want development from the grassroots level; and some want the adaptation of the foreign technology to suit the Nigerian situation. Development from the grassroots level is more adequate, what is important is for the present Nigeria textiles producers to translate the mechanics of the traditional looms to contemporary types. Traditional weaving has less attention being paid when it comes to adaptation to suit Nigerian market needs. Traditional weaving is still revered, preserving the old ways, which is culturally and historically important, but it has little to do with the economic development of the country, which needs improvement. The aim of this study is to conduct a post doctorate research in the production and finishing of the prototypes of the international fabrics as the basis of motorizing the modified floor loom. Nine different samples were woven before getting the exact prototypes of the traditional narrow strip fabrics. The samples were dyed through the traditional indigo dyeing methods and the finishing was done using the special traditional calendaring techniques. The main objectives of this study were successful, because the mechanized modified loom constructed can weave the prototypes and the traditional process of finishing of the fabrics were successful. The next objective is to motorize the modified floor loom. Through Research and Development (R&D) the modified manual floor loom of the researcher can be developed and improved in to an automatic weaving machine. The weaving process itself consists of three basic operations which form a continuous cycle whether in simple hand loom or in the most complex automatic machine. These primary motions are forming the shed, the picking process and the beating up of the weft yarn. In trying to automate the primary motions the Nigerian textile engineers, textile technologists and textile designers should come together under one textile institute and have a fully automated weaving loom. The inherent problem of the shuttle mechanism was discovered and this led to the latest shuttle-less technologies like rapiers, projectiles, and fluid jets. The newer weaving machineries are simpler in designs, motions are more reliable, and consume lesser energy and ultimately have lower maintenance costs. The modified loom would produce weave equivalent to the works of up to 42 traditional weavers at the same time. The modified traditional men's horizontal loom should not only be motorized, but should be computerized and be a foundation for textile machinery production, for proper industrial development. Nigerian textile technologists should design a Programme for textile machine design manufacture which will be strengthened by supporting a postgraduate Programme covering textile electronics and loom computer control systems.

Keywords: *traditional, prototypes, finishing, automatic, loom*

11.Engineering a family of disordered fiber networks via unified theory approach

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Abstract

Disordered fiber networks (DFNs) are ubiquitous materials present in the form of paper, nonwovens, bulk assemblies of one-dimensional (1D) carbon nanomaterials, electrospun mats to interconnected networks of filamentous proteins. This talk will focus on a unified theory approach to predict the geometrical, mechanical, electrical and wetting characteristics of DFNs. Specifically, the unified theory approach has been successfully applied to the nonwoven materials and assemblies of carbon nanotubes in the form of buckypaper. The unified theory has been developed by combining the first principles of stochastic and stereological approaches. Further, the research challenges involved in formulation of unified theory would also be discussed.

Keywords: *nonwoven, carbon nanotubes, wetting*

12. Cost of end breakages in ring spinning technique

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Abstract

Melt extrusion process is a well-known and widely acceptable process for development of different products and parts. Melt fiber extrusion is used to develop filament yarns of different types having different morphological structures, materials and geometrical shapes. Composite filaments are sort of structures developed with two or more different materials having distinct properties which maintain their surface integrity at microscopic level. A core sheath filament is a particular type of composite filament in which a material core is wrapped or covered with another material as sheath. These filaments find their application extensively in electronic textiles as electrically conductive filaments, sensors and actuators. In this study an extrusion die has been designed for the fabrication of core sheath composite filament fabrication. The extrusion die was composed of two parts, outer shell part of die and inner core part of die. The outer part was designed as hollow conical geometry at central axial position from top to bottom side. The inner part was designed as a conical tube extended up to the bottom level of spinneret with trilobal structure at its sides for support. The length of trilobal structure was shorter than total length of conical tube. The conical tube was extended to facilitate and guide the flow stream at exit. The flow channels were straight and convergent at diagonal position between the inside walls of outer part and outside walls of inner part. The walls of flow channels facilitate the convergent flow due to their conical geometrical shapes. The two parts were joined to develop the complete geometry of the whole spinneret. The flow channels were created between the free spaces created between the two parts.

Keywords: *extrusion die, composite filament, core sheath, spinning, spinneret*

13. Negative poisson ratio based on weft knitting fabric with different loop length

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Abstract

Auxetic textile materials have become a point of developed knitted structures produced using high performance yarns and showing strong auxetic effects. The Negative Poisson Ratio based on Weft knitting fabric have huge potential for applications, especially in personal protection materials like bullet proof vest, and many industries application such as airspace, automobile, and so on. The present work reports auxetic structures using polypropylene filament yarn through weft knitting technology. The polypropylene filament yarn was knitted on a 5-gauge flat knitting machine (Passap Deumatic 80), using a 2-cam system with a pattern based on a (rib knitting) structure on the face and back loops. Three types of different loop length with same structural (fisherman's rib) are used (3LL, 4LL, and 5LL). The effected of different Loop length on negative Poisson's ratio (NPR) was investigated in the loops and courses direction. The results shown that all knitted fabrics have the NPR effect, for the both direction (loop and course). It was observed that NPR improved strongly with the increase in loop length of knitted structures.

Keywords: *auxetic materials, poisons ratio, weft knitting*

14. Predictive modelling and optimization of printing properties of inkjet-printed cotton

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Abstract

Recent times have seen a rising interest in inkjet printing of textiles due to potential benefits it offers over conventional printing methods such as lean set-up costs and enabling cost effective short runs. The growing interest has made pretreatment of fabric to be the subject of much recent research. The aim of the study was to develop a model which can predict the color strength and ink penetration (%) of inkjet-printed cotton as a function of pre- and post-treatment process variables. The independent variables investigated were concentration of thickener, urea, and alkali and steaming time. The experimental plan was based on the full factorial design. Predictive models were constructed by modeling the values of the independent variables and their coefficient of regression. It can be concluded that most significant predictor affecting the color strength was concentration of urea followed by concentration of thickener; whereas, for ink penetration (%), the most influential predictor was concentration of thickener followed by concentration of urea and steaming time. The adequacy of predictive models was evaluated by analysis of variance, coefficient of determination (R^2) and residual analysis and found to be accurate at 95 % confidence level

Keywords: *ink-jet printing, steaming time, color strength*

15. The challenge to lead in the changing dynamics of textile industry

Dr. Arshad Mehmood

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Abstract

Textile industry is facing new challenges with push from legislators and pull from brands and consumers, demanding new complete approaches to manufacturers and application of colorants. The \$2.5 trillion fashion industry supports more than 60 million workers throughout the value chain, and is a significant engine for global development. It is the second biggest consumer of water, according to the UN. Textile dyeing is the second-largest polluter of clean water globally. Polyester micro-fibers add to ever-growing volumes of plastic in the environment. Most garments are not biodegradable, and present serious threats to our oceans and wastelands. Growing cotton increases the impact of toxic chemical use in agriculture. The role of sustainability issues has not historically been front and center of business strategy but now companies are increasingly connecting the dots between risk management and corporate sustainability. That, in turn, is making sustainability issues more prominent on company agendas. To develop sustainable solutions & Innovations without compromising overall performance require taking into account the influences emerging from outside the boundaries of the conventional textile industry. These 'external' influences ranging from agricultural practices to international energy policies, passing through consumption patterns and levels of ecological notions of society could have a great influence on the sustainability of the sector as a whole.

Keywords: *micro fibers, biodegradable, toxic chemicals, sustainability*

16. Integration of Pakistan's industry with Chinese special economic zones

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Abstract

The past few months have seen a decent uptick in Pakistan's merchandise exports. Domestic large scale manufacturing has also exhibited some buoyancy. Sectors which have posted positive growth include: iron and steel, automobiles, petroleum, food and beverages, electronics, non-metallic products, pharmaceuticals and textile. Several of the above-mentioned sectors are beneficiaries of the ongoing investments under China Pakistan Economic Corridor (CPEC) Programme. Not all sectors could benefit in the same manner. For example, some key sectors with export potential have seen falling productivity, including leather, engineering products, and chemical sectors, because of (among other reasons) lack of value chains which can bring economies of scale. Pakistan is putting a lot of confidence in CPEC's next phase which will include development of Special Economic Zones (SEZs). The success of these SEZs will critically depend upon how fast the country can be integrated into the Chinese value chains. One region which is envisaged to see benefits of economic integration with China is Faisalabad. We have already seen some Chinese companies who have invested in Faisalabad's economic zones. However already domestic and foreign investors have complained about lack of effective one-window operation which increases cost of doing business. The public sector continues to resort to very traditional fiscal incentives which are only one part of the package which private sector is looking for. Often the assessment from the public sector does not fully recognize the difficulties arising from domestic regulatory framework, labor, environmental and municipal laws. Chinese businessperson have usually been found to go where the above mentioned regulatory environment was certain and protected by law. Using an enterprise-level survey of Faisalabad firms we will try to answer some key deficits which are preventing integration with Chinese manufacturing sector. Second, using a qualitative approach we will also bring into our analysis perspectives from the public sector in Faisalabad and Islamabad. We expect that the findings of this paper will better guide the Government of Punjab and Board of Investment in Islamabad. Additionally we feel that key industries in Faisalabad which could benefit from these findings include: auto parts, engineering products, food processing and beverages, cement, electronics, furniture, plastic, wood and wood products, information and communication technologies, and medical services.

Keywords: *environment, pharmaceuticals, economic corridor*

17. Inducing antimicrobial activity during synthesis of acid-azo dyes and their application on wool and nylon-6 fabrics

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Abstract

The demand for comfort, hygiene, and active lifestyle is increasing nowadays. Hence various finishes such as antimicrobial, anti UV, water repellent, and fire resistant have been applied. Since dyeing, and finishing are two separate energy intensive processes, an approach to combine both processes in one step have been adopted, that would be economical, and environment friendly. In the present study, a series of antimicrobial acid-azo dyes have been synthesized by incorporating antimicrobial sulphonamide moiety into the dye molecules during synthesis. Structures of the resultant dyes have been confirmed using spectral techniques such as Mass spectrometry, ¹H-NMR spectroscopy, FTIR, and UV-Visible spectroscopy. The synthesized dyes were screened biologically resulting in considerable antibacterial activities. These dyes have been applied on wool, and nylon-6 fabrics. Their various fastness properties were examined using ISO standard methods, and results showed good to excellent fastness properties.

Keywords: *antimicrobial, anti UV, water repellent*

18. Development of melt extrusion die for composite filament fabrication: Part C

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Abstract

Melt extrusion process is a well-known and widely acceptable process for development of different products and parts. Melt fiber extrusion is used to develop filament yarns of different types having different morphological structures, materials and geometrical shapes. Composite filaments are sort of structures developed with two or more different materials having distinct properties which maintain their surface integrity at microscopic level. A core sheath filament is a particular type of composite filament in which a material core is wrapped or covered with another material as sheath. These filaments find their application extensively in electronic textiles as electrically conductive filaments, sensors and actuators. In this study an extrusion die has been designed for the fabrication of core sheath composite filament fabrication. The extrusion die was composed of two parts, outer shell part of die and inner core part of die. The outer part was designed as hollow conical geometry at central axial position from top to bottom side. The inner part was designed as a conical tube extended up to the bottom level of spinneret with trilobal structure at its sides for support. The length of trilobal structure was shorter than total length of conical tube. The conical tube was extended to facilitate and guide the flow stream at exit. The flow channels were straight and convergent at diagonal position between the inside walls of outer part and outside walls of inner part. The walls of flow channels facilitate the convergent flow due to their conical geometrical shapes. The two parts were joined to develop the complete geometry of the whole spinneret. The flow channels were created between the free spaces created between the two parts.

Keywords: *extrusion die, composite filament, core sheath, spinning, spinneret*

19. Textile based sensor to measure hydration level of human body

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Abstract

Water is one of the important essential nutrients that human body needs to survive. Water is so essential that it help functioning all cells of human body and allowing the overall human body to maintain proper level of hydration throughout the day. Usually hydration level of body is measured through invasive techniques by analyzing the samples of Blood, Urine and Saliva etc. Literature review has demonstrated that not much work has been done in order to measure the hydration level of human body through non-invasive technique. This study discusses the development of textile based electrodes (Bio-impedance sensor) system which can monitor the hydration level of human body through skin impedance principle on continuous basis. This would help the subjects/patients to be monitored on regular intervals without the need to appoint nurses for their care. BIA (bio-impedance analysis) is a low cost non-invasive technique normally used for body composition evaluation and assessment of health check. BIA is exploited to measure the hydration level of human body by relating the Skin impedance to the water content of the body. At the end, the results obtained through standard electrodes have been compared with the results of textile electrodes which concluded that the results of both electrodes (standard and textile) are almost similar without any significant variation

Keywords: *hydration level, bio-impedance level, non-invasive technique*

20. Investigation of rheological, thermal and mechanical properties of recycled poly (ethylene terephthalate) hyper branched polyester blended fibers

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Abstract

To investigate the effect of hyper branched polyester (HBPET) and concentration on the rheology, thermal and mechanical properties of recycled polyethylene terephthalate (RPET) fibers. Different amounts of hyper branched polyesters (HBPET), 0.5wt% and 1 wt % were added to the RPET. The influence of HBPET on the rheological, thermal and mechanical properties of produced fibers was investigated. Thermal stability and rheological behavior of the pure recycled PET (RPET-0) and RPET-0.5 and RPET-1 blend prepared by melt compounding were tested by Thermogravimetric analysis (TGA), Differential Scanning Calorimetry (DSC) and parallel-plate remoter. RPET-0.5 and RPET-1 blend were in a good agreement with improved rheological characteristics and led to significant enhancement in thermal stability. Decrease in the complex viscosity (η) of the blends was observed with increasing content of HBPET. On the other hand, it was found that mechanical properties of the (RPET-0.5 and RPET-1) fibers were improved with respect to pure recycled PET (PET-0) fibers. Moreover, the crystallinity of blended fibers was also increased with an increasing of (HBPET) content.

Keywords: *Complex viscosity, recycled PET, hyperbranched polyester, thermal and mechanical properties.*

21. Conceptual design, materials selection and characterization of natural fiber reinforced polymer composites

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Abstract

In this lecture a review of conceptual design, materials selection and characterization of natural fiber reinforced polymer composites will be presented. Malaysia is blessed with abundant resources of natural fibers such as oil palm, sugar palm, bananas stem, kenaf, pineapple leaf, sugarcane bagasse, coir and coconut shell, and rice husk and they are potentially used as reinforcements in polymer composites. Natural fiber composites are materials consisting of two or more constituent materials; mainly natural fibers and matrices, bonded together. As a result, better properties are achieved in the resultant natural fiber composites compared to the constituent materials. Among the advantages of natural fibers include biodegradability, environmentally friendly, sustainable and abundant resources, light weight, low cost and comparable specific stiffness and strength properties to synthetic fibers. They had been reported to be used in different industries such as automotive, furniture, aerospace, packaging and building construction. Conceptual design is an important activity in the modern design process. It should be emphasized that incorrect conceptual design might lead to expensive rework and other problems that might occur after the product is fabricated. Design of natural fiber composite product, especially during the early product development stage requires three major considerations, i.e. design, materials and manufacturing process to satisfy higher quality, lower cost and faster development time requirements to ensure successful product in the market. Materials selection is the process of selecting the best materials for a specific design and can be performed with help of various techniques and tools (such as VIKOR, Cambridge engineering selector (CES), analytical hierarchy process (AHP), fuzzy logics, neural network and expert system, weighted sum method (WSM), weighted product method (WPM), technique for the order of preference by similarity to the ideal solution (TOPSIS), and analytical hierarchy process (AHP)). These techniques have been used the materials selection of several natural fibers reinforced polymer composite products. Characterization of natural fiber composites is important in determining the sizes, structural/morphological, physical, mechanical and thermal properties and reinforcement effect of the materials. Natural fibers, in the form of woven, unidirectional, random chopped and particulates were used as reinforcements in synthetic and biopolymer composites.

Keywords: *biodegradable, environment friendly, sustainability*

22. Current status and opportunities for composite industry of Pakistan

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Abstract

Composites are one of the most value-added products of technical textile with applications in sports, medical, automotive, aerospace, and structural products. In Pakistan, 120 to 150 small and medium sized organizations related to composites are operating. The major portion of existing industry is currently focused on sports equipment (hockey sticks, rackets etc.), fibre glass products (sheds, door panels, tanks, low cost houses, brief cases etc.) and other low-end applications. The industry focusing on high-end applications i.e. defense and aerospace is very small. There is a great opportunity for the Pakistan composite industry in the field of aerospace and automotive, for the application of both low end and high-performance composite materials. The automotive industry of Pakistan is expanding with new manufacturers. According to the statistics of Pakistan Automotive Manufacturers Association, the total sales of passenger cars was 104,038 during the year 2018. Being focused on low cost, automobile industry of Pakistan uses very few composite parts as compared to international practices. So, it can be a major area to focus for the composite industry. The composite industry of Pakistan lags behind due to the unviability of trained human resource, limited knowledge of advance technologies, lack of R&D facilities and latest equipment for high performance applications. Majority of products are manufactured by hand layup, compression or simple infusion. Therefore, the parts fabricated are of low-end application. The availability of high-performance materials is also a constraint in the development of the composite industry in Pakistan. The National Center for Composite Materials (NCCM) was established to promote the composite materials industry in Pakistan by helping them to overcome their limitations.

Keywords: *fiber glass, composite materials, hand layup*

23. Structural health monitoring of GFRP laminates using graphene-based smart strain gauges

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Abstract

Graphene nanocomposites are constantly being explored for their applicability in the growing domain of strain monitoring (Jing et al. in Chin Phys B 22(5):057701, 2013) for real-time health and integrity assessment of structural parts. Strain gauges were manufactured by incorporating conductive graphene nanoplatelets (GNPs) in insulating polystyrene matrix by varying filler concentrations. Initial measurements showed that the resistance of these gauges decreases with increasing content of GNPs. For structural health monitoring (SHM) applications, these gauges were pasted on laminated glass fiber composite substrate. The specimens with integrated gauges were tested under monotonic tensile loading. The piezoresistive response of gauges was observed and registered as a means to detect strains in the composite specimens. The results presented in this paper demonstrate SHM capabilities of these smart strain gauges.

Keywords: *graphene, strain monitoring, piezo resistive*

24. Thermo-physiological comfort of clothing system worn in extreme environment

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Abstract

Clothing provides a portable environment maintaining human body comfort. Personal protective clothing, such as firefighting garments and encapsulated chemical suits, is used to protect its wearer from hazards in the workplace and must be worn regardless the environmental thermal conditions. Protective clothing covers the body and is usually bulky, resulting in rapid accumulation of body heat and moisture inside the clothing system during active activities. The body heat and moisture cannot be quickly moved away from the skin and dissipated into the environment, causing over-retention of internal body heat, thermal stress and thermo-physiological discomfort. When working under extreme environments, such as facing intensive heat, or flame, the wearer's performance and safety is jeopardized. Hence, thermal comfort is highly desirable for a clothing system like personal protective equipment in the environment where the risk for the wearer facing to high temperature is very high, and protection from extreme external heat and hazards cannot be compromised. It is therefore a great challenge to design the clothing system for both protection and comfort. This paper introduces examples of personal protection clothing systems, recent development of protective clothing design for thermal regulation and the methods for comfort evaluation. It focuses on firefighting garments, and chemical protective clothing. The fiber material design and new technology integration into the clothing system are also discussed for regulating body temperature and maintaining the wearer's thermal comfort. The design of a full body covering dress for Muslim women is briefly mentioned as another example. The information will be useful for the development of an effective clothing system for both protection and psychological and thermo-physiological comfort.

Keywords: *personal protective clothing, thermo-physiological comfort, manikin test, garment design, thermal regulation.*

25.Characterization of self-cleaning effectiveness of electrospun PVA/TiO₂ and PVA/ZnO nanofibers composites

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Abstract

Metallic oxides, specially ZnO & TiO₂, have the properties to remove the contaminants by hydroxyl groups (OH⁻¹), which degrades the contaminants into small molecules and finally into CO₂ and H₂O. In this study, polyvinyl alcohol/zinc oxide (PVA/ZnO) & polyvinyl alcohol/titanium dioxide (PVA/TiO₂) nanofibers were manufactured in three different concentrations of ZnO and TiO₂ nanoparticles for the application of self-cleaning properties and these composites were manufactured by electrospinning. The surface morphology of resultant nanofibers was characterized by scanning electron microscopy (SEM) & transmission electron microscopy (TEM), the chemical interactions by Fourier-transform infrared (FT-IR) spectroscopy, crystalline structure by X-ray diffraction (XRD) analysis, the water absorbency was evaluated by water contact angle, the self-cleaning property by solar simulator, and the thermal degradation was done by thermogravimetric analysis (TGA). On the basis of the characterization results it was concluded that these PVA/ZnO & PVA/TiO₂ nanofibers have self-cleaning properties, and it was also found that PVA/ZnO nanofibers have higher self-cleaning properties than PVA/TiO₂ nanofibers.

Keywords: *Self-cleaning, polyvinyl alcohol/zinc oxide, polyvinyl alcohol/titanium dioxide, nanofiber composites*

26.Sustainable coloration for cotton dye-houses

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Abstract

In recent two decades, pressures from brands and government on textile dye-houses in Pakistan have increased to adopt best practices and improve textile processing towards sustainability, especially for waste management and health and safety protocols. Ultimately, dye houses face many challenges to comply ecological, health and safety compliance. This keynote speech reviews all possible areas of sustainable approaches to dyeing for cotton dye-houses. The speech will include highlights on sustainability issues of textile colorants and coloration processes, greener colorants including re-emerging natural colorants, alternate dyeing techniques and modified processing formulations.

Keywords: *sustainability, safety compliance*

27. Coloration of electrospun nanofibers

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Abstract

Since its evolution, electrospun nanofibers emerged to have commercial success for various technical/industrial applications such as filtration, cold separation, bio-sensing, healing, and functional reinforcement in composites. In the start of 21st century, the electrospun nanofibers found their way for use in apparel and furnishing textiles where aesthetics play one of the basic roles. Therefore, coloration of electrospun nanofibers grabbed attention of scientists and experts. As a result, many studies have appeared on coloration of electrospun nano-fibrous mats over the recent decade. This article presents a review on the fundamentals and methods, reported so far, of making colored electrospun nanofibers of various polymers. The review focuses on the principle coloration techniques, i.e. conventional methods such as batch wise and pad dyeing, using ultrasonic energy (an emerging processing technology), dope dyeing and printing.

Keywords: *electrospun, nanofibers, batch wise*

28. Crystallization behaviors and performance of biodegradable fibers melt-spun by polyoxymethylene/poly lactide blends

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Abstract

Biodegradable polymeric fibers are a class of eco-friendly synthetic fibers for sustainable industrial development and have attracted a great deal of attention in recent years. Polyoxymethylene (POM)/poly lactide (PLA) blends were prepared by melt extrusion and their crystallization behaviors, rheological properties, thermal stability, mechanical performance and melt-spinning process ability were investigated. It was found that the incorporation of PLA not only could well maintain good mechanical strength for POM/PLA blends but also could express the crystallization rate and reduce their melt viscosity, which made the blends melt-spun to biodegradable fibers with accepted mechanical performance. The crystallization kinetic study indicated that the growth rate of POM spherulites decreased due to the extension of PLA spherulites during the annealing process. This may favor the melt-spinning process for the formation of primary fibers and follow-up cold drawing to achieve high-strength fibers. An investigation on thermal degradation kinetics of the blends suggested that the POM/PLA blends presented a typical two-stage degradation behavior, and the decomposition of PLA were independent with the degradation of POM, which only resulted in a slight decrease in thermal stability of the blends. A biodegradable experiment demonstrated that the bio catalytic decomposition of PLA could further promote the degradation of POM under the nature environment. The POM/PLA fibers developed by this work exhibit a good balance between the mechanical performance and biodegradability and can meet a requirement for broad industrial and domestic applications as ecologically friendly synthetic fibers.

Keywords: POM/PLA fibers, melt-spinning process, mechanical properties, biodegradable, crystallization behaviors

29. Effect of sanforizing on pilling resistance of bamboo and bamboo cotton fabric, using 24 factorial design

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Abstract

The effect of Sanforizing on 100% bamboo and 50:50 bamboo/cotton plain and satin fabrics have been studied in this research work using an experimental design technique (DOE). A 24 full factorial design was used to identify the significant factors and their interaction. The impact of individual factors and their interactions on tensile, tear strength, Berger whiteness and pilling resistance have been critically scrutinized using software Design Expert 8.0.1. The study showed significant interactions of four factors Weave, Blend Ratio, Pretreatment and Sanforizing on weft tensile, and warp tear strength. Fabric weave was found to be the main factor that has an effect on weft tensile, warp and weft tear strength, berger whiteness and pilling after sanforizing. The results showed that Sanforizing has very little impact on pilling resistance properties of bamboo and bamboo/cotton woven fabrics. The uncertainty analyses for measurements showed that the forecast values are in decent agreement with experimental data and are satisfactorily accurate.

Keywords: *sanforizing, bamboo, satin, tensile and tear strengths*

30. Subjective evaluation vs wearing comfort; a study of knitted fabrics

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Abstract

Sensory comfort is an important criterion in buying decision of garments. Consumers evaluate fabric subjectively through the sense of touch. This can be done either by touching, rubbing and squeezing a fabric (Fabric Hand) or by wearing a garment (Sensory Evaluation). The latter involves destructive sampling and requires more time. There are sophisticated equipment to replace these subjective techniques but subjective evaluation is still the most common method of evaluation from end user point of view. Many people have correlated the results of objective evaluation with subjective evaluation but no significant work has been done to study different subjective evaluation techniques. In this study, a detailed approach has been adopted to compare the results of 'fabric hand' with 'sensory analysis'. Cotton and polyester-cotton (PC) yarns were used to make two single jersey fabrics. Both yarns had same count ($N_e = 30S$) and fabrics were produced in 140 & 160 grams per square meter (GSM). One half of each of the four fabrics was bleached to white while the other was dyed in navy blue color. In addition, a part of each processed fabric was kept with normal finish while the second was applied with softener finish. A total of sixteen different fabrics were developed for this study. For fabric hand evaluation, a group of male and female volunteers was trained for 8 weeks (two hours per week) as per evaluation procedure # 05 of American Association of Textile Chemists and Colorists (AATCC). Five parameters namely smoothness, thickness, stiffness, roughness and tensile stretch were evaluated by the trained panelists on a scale from 0 to 5. For sensory evaluation through wearing trials, under garments were prepared after taking appropriate size specifications of the selected panelists. They were asked to wear the garments for day long and respond on the same scoring scale. The results from both subjective evaluation techniques were compared. It was concluded that overall fabric hand evaluation and sensory analysis had strong positive correlation. However, some weak correlations were found in the evaluation of fabric stiffness. Further analysis revealed that 'fabric hand' by female panelists had strong positive correlation with 'sensory analyses'. Fabric hand by male panelists, in case of roughness, stiffness and finished fabric smoothness, had very weak correlation with sensory evaluation.

Keywords: *sensory comfort, single jersey, bleached, stiffness, roughness, smoothness*

31. Evaluation of implementation of lean manufacturing in apparel industries

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Abstract

The lean Manufacturing system is an efficient method to eliminate waste, remove nonvalue-added activities and increase productivity using a variety of tools and techniques. Due to increased competition, the attention towards Lean approach eventually increased. Organizations tend to focus on the implementation of lean manufacturing techniques to reduce waste and to make the products according to customer's requirements more effectively. Extensive research is conducted in last two decades regarding lean manufacturing importance and its implementation. Most of the research focuses on the lean implementation in different industries like the automotive industry, car industry etc. However, the implementation of lean manufacturing in the textile and clothing industry needs great attention. This study aims to evaluate the implementation status of lean manufacturing in apparel industries. A questionnaire survey is used to explore the extent of lean manufacturing implementation. This research also examines barriers that influence the implementation of lean manufacturing and recommendations that can be used to implement lean successfully. The survey was performed on 150 Apparel Industries of Pakistani. The respondents were chosen from the departments who were directly involved with lean manufacturing practices such as industrial engineering, production, and quality. The survey was divided into four sections. The findings show that the 52% respondents belong to the denim industry, 22% to home textiles and 19.8% belong to knitwear and woven and the implementation status of lean manufacturing is 52.6%. The tools like 5s, Value Stream Mapping, Root Cause Analysis, Kaizen, Total Productive Maintenance, Kanban, and Overall Equipment Effectiveness are implemented the most. The findings revealed that the main barriers that are affecting the implementation of lean include the top management support, lack of awareness, no proper training and difficult to change employees' culture or mindset. Lean Implementation is not one person's responsibility, it's the responsibility of everyone working in the organization. Teams should be made for proper training for workers. The mindset of labor should be changed by introducing the concept of rewards and other incentives as well as facilities. There should be motivation in the form of rewards for employees to implement Lean techniques effectively. There should be full authority to apply Lean tools and there should not be any hurdles from the management.

Keywords: *lean manufacturing, value Stream mapping, kaizen, kanban*

32.Enhancing production efficiency of a garment manufacturing unit by using DMAIC methodology

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Abstract

Now a day, manufacturing industries want to overcome their problems by the applications of scientific tools and techniques. In this regard, lean manufacturing and six sigma are the most common choices for organizations to reduce the different types of wastes and control the variations associated with product or manufacturing process. However, there is a lack of evidence for the effective implementation of these scientific tools in the field of textile and garment industry. Thus the objective of this study is to enhance the production efficiency of garment manufacturing industry using six sigma methodology. In order to achieve the above mentioned aim, DMAIC methodology of six sigma has been selected. It is a data-driven strategy that has been implemented in different types of manufacturing and service industries to improve the process. In this study, all five steps of DMAIC, define, measure, analyze, improve, and control, have been applied simultaneously using different problem solving tools like fishbone diagram, pareto chart, and control chart. The initial efficiency was 69.07%, causing a drastic decrease in the turnover of the unit. By applying six sigma techniques as a quality tool, the losses were remarkably reduced. The major reasons identified for high cost per minute included loss times due to machine breakdown and material unavailability. Losses were analyzed using, fishbone diagram, Pareto charts and control charts to finalize the evaluation reports. The corrective actions were taken that includes counseling with the suppliers to make sure the quality of trims and material with on time delivery. Further corrective measures, as indicated by the DMAIC methodology, were taken. This study succeeded in minimizing the defects, increased the efficiency of the process up to 80%, and also helped to improve the quality of product with reduced production cost. The sigma yield was also increased from 3.14 to 3.95 defects per million after implementation of the DMAIC methodology. Such studies will motivate the manufacturing industries like garment manufacturing to implement the advance scientific tools and get their full benefits in terms of quality, cost, and efficiency.

Keywords: Six sigma, DMAIC method, fishbone diagram, control charts

33. Developing a smart vest for athletes monitoring

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Abstract

Textile materials or products capable of performing an unusual function are known as smart textiles. The research in smart textiles has gained pace in last few years. As people are getting more health conscious, the use of smart textiles for the physiological monitoring have rapidly grown. The major reason of the rapid growth of this domain is that people are in contact with the textile products almost 90% of the time during their lives. The current research revolves around the development of a smart vest for the physiological monitoring of athletes. There are products available in the market for the same purpose but they are extremely expensive have some limitations. For example, electric wires are used which may cause discomfort for the wearer. The aim of this study was to develop a smart vest for determining the breathing rate and muscle activity for an athlete without compromising the wearer's comfort. A sports vest and Textile based sensors were developed. The sensors were then embedded in the vest. Further, a PCB was designed to process the signals of the sensors and to send the processed data to a mobile device wirelessly. Finally, a mobile application was developed to receive and display the data to the user.

Keywords: *smart textiles, physiological monitoring, sports vest*

34. Auxetic woven laminated composite with enhanced mechanical properties for impact application

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Abstract

Auxetic materials are known for their negative Poisson's ratio (NPR) and are used in defense, aerospace, energy harvesting, anchors and smart morphing structures. Auxetic nature is imparted by special internal geometry and behavior of geometry under stress. Auxetic behavior can be imparted in a composite either *by* using auxetic polymer or by using auxetic reinforcements (such as auxetic fiber, Helical auxetic yarn, auxetic co-weave knit structures, braided, Non-woven, knitted and highly anisotropic stacking sequence of plies). Auxetic fibers show higher impact tolerance for their swelling and self-anchoring behavior thus giving a strong interface. Auxetic braided composites were made by orienting glass filament in auxetic geometry which expanded the structure in both directions for its high modulus than ground structure. Co-weave knit structures and corresponding soft (PU foam based) composite was tested for impact and energy absorption testing. Woven auxetic structures are developed till now for the limitation imposed by lack of flexibility in manufacturing process. All other methods used for manufacturing of auxetic composites lack in commercialization e.g. there is not a continuous process of manufacturing auxetic fibers, auxetic yarns cannot be weaved on mass scale and co-weave knit structures are made by hand. By using proper material combination and weave design, woven architecture for different auxetic composites applications is major area of our research. Novel auxetic woven architectures made using modified or conventional mechanism and associated auxetic composites for scalable production are presented in this work. Most of the woven structures are fabricated with natural fibers (flax, cotton and jute) while glass and carbon based auxetic composite are manufactured using highly anisotropic stacking sequences. Epoxy as thermosetting and Latex rubber as flexible resin were used in composite manufacturing. Furthermore, thermal stresses induced deformations in auxetic laminated composites was studied by using highly anisotropic stacking sequences. Deformations of L-shaped composite bracket parts and plates were studied to fabricate auxetic composite parts in complex shapes with accuracy.

Keywords: *woven auxetic structure, negative Poisson's ratio, shaped composites*

35. Numerical study of shape distortion in flat and angled composite parts

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Abstract

The stresses in composite parts are generated due to the mismatch of thermal expansion behaviour between the plies, resulting in shape distortion of the composite part. This study aims to investigate the shape distortion in flat and angled composite parts by numerical modelling. Laminated composite parts (flat plates and L shapes) with a thickness of 3 mm were considered for modelling. The constituents of these composites were unidirectional glass reinforcement and vinylester resin. Additionally, the study investigated the effect of silica particle addition on the shape distortion. After curing, it was found that the curvature was produced in both the plates. Furthermore, it was revealed that the warpage in thin plate was reduced by the addition of fillers (silica micro-particles) to the composite material. For numerical study, properties (modulus, thermal expansion coefficient) of the matrix (with and without fillers) were investigated experimentally. The properties of reinforcement were taken from literature and used as input to investigate the shape distortion. The numerical modelling was performed using COMSOL Multiphysics (v 5.4). The numerical results showed that the presence of silica fillers tends to reduce the shape distortion in both type of composite parts.

Keywords: *thin plates, L-shaped parts, shape distortion, COMSOL multiphysics*

36. Mechanical behavior of 3D woven spacer fabric reinforced composites

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Abstract

3D woven spacer fabric is a new concept in which two bi-directional woven fabric surfaces are mechanically connected with vertical woven piles. The 3D spacer fabric composites provide high skin-core debonding resistance and impact resistance, excellent durability and superior integrity, high stiffness, excellent thermal insulation and acoustic damping. Due to these properties 3D woven spacer composites have broad application prospects in automobile, Locomotives, aerospace, marine, windmills, building and other industries. The designs of structural parameters including the areal density, pile height and distribution density of the piles are flexible. In this work, the results on needle penetration, 3-point bending, drop weight impact and dynamic compression & recovery properties of 3D woven spacer fabric composites having three different thickness levels (4 mm, 10 mm and 20 mm) are reported. 3D woven spacer (E-glass/epoxy) composites were fabricated using spray and hand lay-up method. Stiffness was increased while bending length of 3D woven spacer fabric was decreased with the increase in pile height of the fabric. Whereas in 3D woven spacer fabric composites, 20 mm (Comp20) thick composite showed highest needle penetration resistant as compared to the 10 mm (Comp10) and 4 mm (Comp4) thick composites. Drop weight impact, 3-point bending and flat compression performance of the 3D woven spacer fabric composites were reduced with the increase in pile height ranging from 4 mm to 20 mm. Furthermore, 4 mm thick composite exhibited highest values of work done during cyclic compression loading-unloading testing, showing more toughness followed by 10 mm and 20 mm thick composites.

Keywords: *3D woven spacer fabric, composites, needle penetration, drop weight impact, flexural, static and dynamic compression*

37. Study of energy efficient wall materials for buildings

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Abstract

The construction industry needs to make a choice to ensure a better life for everyone now and for future generations, through the use of environment friendly materials that would reduce our dependence on non-renewable materials. Pakistan is South Asian country that experiences hot temperatures more than half a year and sometimes temperature exceeds more than 45°C in summer, which causes thermal discomfort inside buildings. The occurrence of heat waves and thermal extremes also enhances the thermal discomfort and energy consumption. Thermally insulated building keeps inside temperature consistent over weather changes and energy consumption by use of air conditioning systems becomes less. Hence, thermal insulation is a potential solution to reduce energy consumption. Many types of materials have been used for thermal insulation but they all are not sustainable and environment friendly. Textile can be one alternative for these materials. Most of the natural fibers are included in sustainable materials. Natural fibers have good thermal insulation properties and may be used in concrete to construct an energy efficient material. In present research, review will be done for the material already used for these purposes.

Keywords: *construction, thermal, sustainable, energy*

38. Effect of chemical treatments on mechanical and moisture properties of jute reinforced polyester composites

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Abstract

In fiber reinforced composites, the fibers are used to reinforce the polymeric matrix. The natural fiber reinforced composites are those composites in which natural fibers are used as reinforcement. This study focused to investigate the interdependence of moisture regain, hydrophobic treatment (hybrid-fluorocarbon) and mechanical properties of jute reinforced composites material. The jute fabric (reinforcement) was subjected to mercerization and hydrophobic treatment; and subsequently composites were fabricated. A significantly reduction in moisture regain was found for the hydrophobic treated reinforcement and corresponding composites. Treated reinforced composites (mercerized, hybrid fluorocarbon) exhibit improved mechanical properties like tensile strength and flexural strength over the untreated reinforced composite. The developed composites were immersed in water for four weeks to study the moisture uptake and ageing properties. From the results, it was concluded that treated reinforced (mercerized, hybrid fluorocarbon) composites retained their mechanical properties as compared to untreated reinforced composites when immersed in water due to better interfacial adhesion between matrix and reinforcement.

Keywords: *composites, mercerization, hydrophobic treatment, jute reinforcement, mechanical properties*

39. Antibacterial electrospun grafts

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Abstract

Electrospinning is a versatile and simple method to produce nanofibers of required material with desired sizes and shapes with high surface area. Due to their versatile properties nanofiberous structures have been used in many applications such as filtration, sensors, drug delivery, and bio-medical application. One most demanding application of electrospun nanofibers is in medical textile for tissue engineering. Vascular grafts have been employed in human being for medicating diseased and damaged vessels. But, there is a problem while implanting these vascular grafts. There is a constant threat of infection at the target site that leads to severe complications. So inhibition of infection on the vascular surgery site has become necessary. For this purpose, a common practice is the use of antibiotics that could reduce the risk of infection but still the problem of infection exists due to presence of bacteria at the infection site. Therefore, current trends support the aspect of complete infection free area to avoid any complication during vascular surgery. The aim of this study was to develop antibacterial grafts that showed their efficacy against Gram positive and Gram negative bacterial strains i.e. S.aureus and E.coli.

Abstract: electrospinning, gram positive, gram negative

40. Development and characterization of novel 3D woven structures

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Abstract

Composites are the emerging materials made using fibers and matrix. Fibrous composites are the motivation of researchers for low to medium impact applications as well as structural applications. In order to improve the damage tolerance of composites, a high level of through-thickness and interlaminar strength is required. The reliability of a composite depends on the uniform distribution of the materials and consistency of interfacial properties. The structural integrity and handle-ability of the reinforcing material for the composite is critical. The use of different weave pattern can help in designing high performance composite. This work consists of two parts, first development of novel structures using natural fiber, and secondly, the using high performance fiber. For structural design applications, through-thickness characteristics of reinforcement played a vital role, which is why 3D woven preforms are recommended for such applications. These characteristics are mainly dependent on the fiber and yarn positioning in reinforcement. Although research has been conducted for characterizing woven composites, special attention has not been made on weave pattern parameter which directly affects the mechanical performance of composites. In this research work, 3D orthogonal layer to layer and through thickness woven structures with different interlocking patterns have been thoroughly studied for their mechanical properties, thickness, air permeability and areal density. Jute yarn was used to produce four-layered 3D woven structures. In this research work, 3D orthogonal layer to layer (LL) and through the thickness (TT) woven structures with different interlocking patterns, used as preforms in composites are presented. The mechanical properties of preform as well as associated composites are studied on equivalent fiber volume fraction. The main objective of this research is focused on the effectiveness of weaving patterns on physical and mechanical properties as well as to optimize the weave pattern for optimum performance. The preliminary results showed that hybrid structures can be useful for improving the properties of the orthogonal layer to layer and through thickness woven structures. It was also noted that weft-way 3D woven structures can provide comparable mechanical properties with warp-way 3D woven structures.

Keywords: *composites, 3D woven, hybrid structure*

41. Effect of dual solvent system on the physical properties of polyvinyl alcohol solutions

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Abstract

Polyvinyl alcohol (PVA) is an essential polymer with significant applications in the paper making, textile products, and coatings. It has hydroxyl group which determines its unique physical properties. The physical properties of polar polymer solutions depends on its polar interactions with the solvent. Stronger polar interactions expands the polymer coil dimensions which bring about higher viscosity, chain entanglements, and shear responses. Poor interactions result in the poor entanglements, and Newtonian fluid behavior. The physical properties of PVA solutions were measured in the combined solvent of water and dimethyl sulfoxide (DMSO). DMSO and water makes a complex combined solvent molecule at certain weight fractions. The viscosity of the complex solvent molecule increases with increasing water content in DMSO up to 30% of weight fraction and then reduces with further increase of water contents. This change in complex solvent molecule structure has significant impact on the PVA interactions. The extent of PVA interaction with dual solvent system changes with changing water contents were determined through the physical properties of dynamic viscosity and tan delta.

Keywords: *cellulose, N,N-dimethylacetamide, lithium chloride, intrinsic viscosity, thermoreversibility*

42. Study the effect of blend composition, twist and atmospheric moisture on the properties of hybrid spun conductive yarns

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Abstract

The development of conductive staple spun yarn is gaining significant importance due to their unique combination of versatile functionalities, flexibility, comfort, and durability. The main aim of this research was to develop metallic fiber-based hybrid spun yarns by the conventional technique of ring spun yarn. To achieve this goal, stainless steel staple fibers were blended with viscose fibers on a draw frame in the blend ratio of 20:80 and 10:90. The blended slivers were then processed through conventional speed frame and ring frame to produce the ring spun hybrid yarn at three different levels of twist. The tensile and electrical properties of Viscose-stainless steel hybrid yarns were evaluated relative to the factors of twist, blend composition and amount of moisture present in the atmosphere. The results indicated that with an increase in the level of twist, both tensile and electrically conductive properties were improved. In addition to the compact structure of yarn produced at the higher level of twist, this improvement in electrical conductivity could be due to increased contact area among conductive fibers in the hybrid yarn, which tends to decrease the contact resistance of yarn. Further improvement in the electrical conductivity of yarn was observed with an increase in the amount of moisture in the surrounding atmosphere. This phenomenon could be strongly attributed to the high moisture regain of viscose fibers, constituting a major portion of hybrid spun yarns. Regarding blending composition, it was observed that with an increase in the content of stainless-steel fiber, the electrical conductivity was increased while the tensile properties were decreased. The decrease in tensile properties could be designated to the relatively lower tenacity and elongation of stainless-steel fiber.

Keywords: *conductive, electrical, smart, stainless steel, ring spun*

43.Enhanced thermo-physiological comfort of denim fabrics with coolmax-Lycra blended weft yarns

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Abstract

Melt extrusion process is a well-known and widely acceptable process for development of different products and parts. Melt fiber extrusion is used to develop filament yarns of different types having different morphological structures, materials and geometrical shapes. Composite filaments are sort of structures developed with two or more different materials having distinct properties which maintain their surface integrity at microscopic level. A core sheath filament is a particular type of composite filament in which a material core is wrapped or covered with another material as sheath. These filaments find their application extensively in electronic textiles as electrically conductive filaments, sensors and actuators. In this study an extrusion die has been designed for the fabrication of core sheath composite filament fabrication. The extrusion die was composed of two parts, outer shell part of die and inner core part of die. The outer part was designed as hollow conical geometry at central axial position from top to bottom side. The inner part was designed as a conical tube extended up to the bottom level of spinneret with trilobal structure at its sides for support. The length of trilobal structure was shorter than total length of conical tube. The conical tube was extended to facilitate and guide the flow stream at exit. The flow channels were straight and convergent at diagonal position between the inside walls of outer part and outside walls of inner part. The walls of flow channels facilitate the convergent flow due to their conical geometrical shapes. The two parts were joined to develop the complete geometry of the whole spinneret. The flow channels were created between the free spaces created between the two parts.

Keywords: *extrusion die, composite filament, core sheath, spinning, spinneret*

44. Thermal comfort and mechanical properties of cotton rich and virgin polyester/recycled polyester blended knitted fabrics

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Abstract

Recycled polyester (RP) fibers are considered to be the eco-friendly these can be recycled. The RP fibers used in this work were recycled from polyester bottles. As virgin polyester (VP) fibers are not considered eco-friendly, so, the purpose of this work is to find out the optimized cotton rich blend which gives optimized properties with the minimum use of VP fibers and maximum use of RP fibers. A sample of pure cotton was prepared whereas for all other blends, 50 % cotton was taken for each blend and the remaining 50 % was varied with virgin and recycled polyester fibers. Yarns and then single jersey fabrics of these different blends were prepared. The comfort (Air permeability, water vapor permeability and thermal resistance) and mechanical properties (bursting strength) were evaluated. It was found that the blend with 50% cotton, 20% VP fibers and 30 % RP fibers give significantly improved properties than pure cotton with the minimal use of VP fibers and maximal use of RP fibers.

Keywords: *cotton, recycled polyester, virgin polyester, comfort properties, mechanical properties*

45. Fabrication of reinforcement for knitted thermoplastic composites

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Abstract

Knitting is interloping of one set of yarn and loop formation sequence is horizontal direction in weft knitting. Many possibilities have been introduced in knitting for insertion of yarn in specific direction to alter the properties of weft knitted reinforcements. The aim of this study is development of stable knitted reinforcement for thermoplastic composites. Two different types of yarns i.e. thermoplastic yarn as resin for binding and second yarn can be selected depending upon required properties from reinforced composites. These yarns were then knitted into double jersey rib structure on flat double bed knitting machine of 7 gauge in which thermoplastic yarn was used as knit yarn and second yarn was passed in weft direction. By applying heat and pressure the thermoplastic yarn melt, reshape and bind the reinforced yarn. These knitted reinforced can be used for manufacturing of thermoplastic composites.

Keywords: *composite, thermoplastic, flat double bed, knitting*

46. Investigation of lightweight knitted structure for sportswear garment

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Abstract

In the field of science, innovation comes with the passage of time, especially growth in the knitted industry increases the quality and comfort level of wearable knitted garments. Technical textile also involves in the formation of sportswear garments. Due to strenuous activities of sports persons, the thermal physiological comfort, light weight and durability of garment is necessary requirement. For the achievement of thermal physiological comfort, the properties of yarn and knitted structure has important role in performance of sports garment. Total six samples were prepared by using polyester and tencel yarn. The plaiting technique was used to produce five types of single jersey derivatives. Moisture management, thermal resistivity, abrasion resistance and bursting strength tests were performed on knitted samples. From results it was concluded that the knitted structure that have tuck stitches shown less bursting strength but greater moisture management and abrasion resistance. And the behavior of plain single jersey structure shown poor properties against all tests expect bursting and overall performance of plaited fabric with polyester and tencel yarn far superior than 100% tencel fabric.

Keywords: *single jersey, plaiting, sports garments, thermal resistivity*

47. Development of highly durable superhydrophobic and antibacterial textiles by application of modified metal-oxide nanoparticles

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Abstract

In recent years, the nanoparticles have been used extensively for making textiles functional due to their astonishing properties. But, these nanoparticles have an issue of lack of adhesiveness towards the textiles. Emphasis of consumers on long lived multifunctional, best quality products with least environmental effects has forced researchers to develop new developmental techniques. Therefore, the purpose of this research was to functionalize the textiles with modified metaloxide nanoparticles to achieve high durability with least human and environmental effect. This study reports the durable near super hydrophobic, antibacterial textile based on sustainable cellulosic material such as cotton that showed its functionality up to 100 home laundering cycles. Functionalization of cotton fabric was done with metaloxide nanoparticles modified with different concentrations of silane coupling agents. After modification the nanoparticles were applied on cotton fabric and the functionalized cotton fabric was then characterized by using SEM, EDX and FTIR. WCA analysis, superhydrophobic, and antibacterial activity was observed before and washing. The treated fabric showed their functionality even after severe laundering cycles and it was confirmed that the modified nanoparticles were highly towards the textile.

Keywords: antibacterial, durable, metal-oxide nanoparticles, superhydrophobic

48. Application of Fourier series to analyze the deformation of yarn in multifilament double layer woven structures

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Abstract

The woven fabric geometry and structure have significant effects on their behavior as they provide a combination of strength with flexibility. It has been described mathematically by different researchers but still there are some limitations which can be discussed. The models given by different researchers can describe the internal geometry of woven fabric by describing some part of the binding/crimp wave but we need a model that can describe binding wave in whole repeat. Moreover, we need to obtain not only geometry of binding wave but also spectral characterization for analyzing individual components, which can react on deformation of the shape of binding wave. Therefore, in this study, an attempt is made to analyze the shape of double layer woven fabric by the application of Fourier series. For the weave of the fabric, as it is characteristic that the pattern of binding is repeated periodically across the whole fabric width and the Fourier approximation respects this periodicity and shape of the binding wave. The internal geometry of the woven fabrics and the deformation in the multifilament double layer woven structures has been evaluated by the cross-sectional image analysis method using NIS elements software. The software is semi-objective based, where user intervention was adopted, and all necessary measurements were obtained stepwise from the fabric image. Later, the approximation using the linear function $f(x)$ in Fourier series along longitudinal and transverse cross-section has been performed for double layer woven fabrics, which fits well to the experimental binding wave. The spectral characteristics of binding waves obtained by Fourier series (theoretical) has been compared with the experimental values, which are in accordance with each other. So, it is concluded that the geometrical parameters of yarn in real cross-section of woven fabric can be compared with the theoretical shape of a binding wave in whole repeat and Fourier series approximation can be used for analyzing the spectrum and deformation of woven structure.

Keywords: multifilament yarn, double layer woven, geometric modelling, fabric structure, Fourier series

49. Effect of structural parameters on the puncture resistance of Kevlar woven fabrics

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Abstract

Flexible puncture resistant material is a big demand of in many applications. These are not only very special application as that of industrial but also daily life applications including packaging material, spine resilient garments and gloves for medical and municipal staff, industrial protection wear and spacecraft structures etc. A lot of work has been done on stab resistance but a little on the puncture. Out of the little work done Y. Termonia's work is very considerable in understanding how puncture happens. Wang et al. also studied the puncture resistance of fabrics of polyester in different weight and weave ranges. Hamid Rez et al. studied the behavior of P-Aramid after impregnating with shear thickening fluid. Some similar works have also been reported by scientists like J.N Boucom et al., C.D Cwalina et al. J.B Mayo et al. B. Sun et al. No work is done on understanding the impact of structural behaviors on the puncture resistance of the fabric. Taking Kevlar (P-Aramid fiber from Dupont) and considering two yarn manufacturing technologies (flat filament and spun staple) and three different weaves (Plain, Matt and Satin) of the fabrics we developed six samples on a sample weaving loom. These samples were then tested on universal testing machine for puncture resistance. As per testing procedure thickness of the produced fabrics and maximum quasi static load at penetration was noted. The load values of all samples made from filament Kevlar has been found higher from those of samples made from spun Kevlar. Even lowest value of filament Kevlar sample was higher from the highest of Spun Kevlar. It is due to the fact that in flat filament yarns are more parallel and have better tendency to dissipate energy/force of the penetrating probe. It is also noted that values of Matt weave are highest in both cases as compared to plain and satin weave. This is due to the reason that matt weave has two yarns in both floats of warp and weft. These yarns add to the strength of each. Also in matt weave we have lesser number of intersection points as compared to plaint weave. These lesser number of intersection points help in better dissipation of energy/force being imparted by the puncturing probe. In satin float is much bigger than that of matt weave but here we also know that satin structure is loose and open so during puncture yarns slips over each other without giving much resistance and probe finds way through fabric easily as compared to matt weave structure.

Keywords: Kevlar, P-aramid fabric, filament yarn, puncture resistant fabrics, woven fabric

