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<th>The Comfort Properties of the Terry Towels Made of Cotton and Polypropylene Yarns</th>
<th>New Directions in Braiding</th>
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<td><strong>ABSTRACT</strong></td>
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<td>The studies of woven fabrics’ comfort properties have aroused interest of the researchers in recent years. Although the studies on the weaving structures of the terry woven fabrics are rather limited, the study of comfort properties will reveal new approaches regarding the subject. The terry-structured fabrics, used in bathroom, pool, sea, sauna and Turkish bath, hold an important place in people’s personal lives as end-products.</td>
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<td>It is the intent of this manuscript to provide a general treatment of braiding: past, present, and future. A history and evolution of braiding, braiding machinery, and related engineering developments is provided with emphasis on the design, manufacture, and analysis of braided composites. Some recent developments are briefly described, including: a composite braider with carriers directed radially inward, a new braiding machine now under commercial development, a new braided structure, called the true triaxial braid, produced by the new machine or by proper carrier loading on a conventional maypole braider; and a computer controlled take-up system using image analysis to monitor and control braid formation. Original work ongoing at Auburn University is described and involves Jacquard lace braids with open structures for use in composites, computer aided design (CAD), computer aided manufacturing (CAM), and analysis of ordinary and lace braids for composite applications. This paper is an expanded version of an invited presentation under the title “New Directions in Braiding” at a Fiber Society presentation in Bursa, Turkey, in the spring of 2010 [1].</td>
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| **Güngör Durur, PhD**  
**Eren Öner, PhD** | **David Branscomb, M.S.**  
**David Beale, PhD**  
**Royall Broughton, PhD** |
Hybrid Reinforcement of Asphalt-Concrete Mixtures Using Glass and Polypropylene Fibers

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ABSTRACT

There is a constant effort to improve the performance of asphalt-concrete (AC) mixtures. Among various modifiers for asphalt, fibers have received much attention for their improving effects. This paper introduces the novel concept of hybrid reinforcement of AC mixtures using polypropylene (PP) and glass fibers. Individually, glass fiber reinforced AC and PP fiber modified AC mixtures have exhibited superior performance compared to other fiber reinforced samples.

Therefore, in this work, these two types of fibers were used simultaneously to improve the performance of the AC mixtures. This type of hybrid AC composite can be engineered by taking advantage of tacky property of PP fiber around its melting point and high modulus of glass fiber. In this way, PP fibers with the length of 12 mm were blended with bitumen at different percentages. Glass fibers with the length of 12 mm were also added to aggregates. Marshall and Specific Gravity tests were performed on hybrid reinforced asphalt-concrete (HRAC) samples by taking advantage of Superpave Gyratory Compactor. In the case of bituminous specimen, penetration, softening point and ductility tests were carried out. The results revealed that PP fibers decrease penetration and ductility of modified bitumen while softening point value is increased compared to unmodified bitumen specimen. Marshall Test results illustrated that PP can statistically affect the properties of the mix and improve the consistency of the mixture. Using a combination of 0.1% of glass fiber plus 6% of PP presented the best hybrid reinforcement through increasing stability and decreasing flow. Therefore, it is concluded that this novel HRAC is suitable for use in hot regions due to growth in the void total mix (VTM) and stability.

Evaluation of Sereni Fiber Reinforced Composite

Ashish Chauhan, PhD

ABSTRACT

Sereni stem fiber due to low weight and high tensile strength was selected as backbone for graft copolymerization with binary vinyl monomeric mixture to explore its effect on percentage grafting, properties and the behavior of the modified fiber. The graft co-polymers were reinforced in phenoplast matrix to form fiber reinforced composites and characterized by XRD, TGA, DTA, SEM and FTIR techniques. Moisture absorbance, chemical resistance in acid, base and mechanical assessment like flexural strength, young’s modulus, stress at the limit of proportionality and hardness of the composite were studied in comparison to the phenoplast.
Preparation and Characterization of High Latent Heat Thermal Regulating Fiber Made of PVA and Paraffin

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Yichao Lu
Bin Wang
Jianjun Xu
Guangdou Ye
Mengjin Jiang

ABSTRACT
A convenient method of preparing the thermal regulating fibers with high latent heat has been developed. PVA thermal regulating fibers were prepared via a wet spinning process, with paraffin being the phase change material. The structures and properties of these fibers were investigated by SEM, TGA, DSC and tensile strength tester. With the paraffin content in the fibers increasing from 30wt% to 70wt%, the latent heat of the fibers increases from 42.8J/g to 87.8J/g and the paraffin phase structures change from separation into partial interconnection. PVA matrix cannot wrap paraffin effectively when the paraffin content increases up to 50wt%, so the paraffin loss in the spinning process increases. The thermal stability of fibers with low paraffin content is better than that of fibers with high paraffin content. After 100 heat-and-cool cycles, the latent heat of fibers lose a little. The tensile strength of these thermal regulating fibers is good enough for application in wrapping, filling and non-woven.

Elastic Strain of PTT/PET Self-Crimping Fibers

Fumei Wang, PhD
Fei Gu
Bugao Xu, PhD

ABSTRACT
This paper studies the relationship between crimp curvatures and elastic strains of two series of PTT (Polytrimethylene terephthalate)/ PET (Polyethylene terephthalate) self-crimping fibers produced with two different spinnerets which merge PTT and PET fluids at different points. The crimp curvature is estimated based on fiber cross-sectional parameters and the polymer properties. The elastic strain, the strain associated with crimp removal, is measured directly from the stress-strain curves of the fibers. It was found that the crimp curvatures of the PTT/PET filaments in the two series increased with their PTT contents. The elastic strains of the PTT/PET filaments in each series showed a linear positive correlation with the estimated crimp curvatures. A linear equation (R=0.979) was established to predict the elastic strain from the calculated curvature for fibers in different series. This prediction equation can help to determine appropriate fiber cross section, composite ratio and distribution of the two components in the design stage of filament. The paper also showed a color image of dyed PTT/PET filaments is helpful in examine interfacial morphology of the two components. Thus, the spinning method has a certain influence on the interfacial morphology in fiber cross-section.
Effect of Two-Step Surface Treatment on the Mechanical Properties of Hollow Integrated Core Sandwich Composites with GF/CF Hybrid Face Sheets

Kejing Yu, Haijian Cao, Kun Qian, Hongshun Li, Juanjuan Wang

ABSTRACT
In this study, effect of two-step surface treatment on the mechanical properties of hollow integrated core sandwich composites with glass fiber/carbon fiber (GF/CF) hybrid face sheets were investigated. The presence of functional groups on the surface during two-step treatment was characterized by Fourier transform infrared spectrometer (FTIR). The results of tensile strength on single filament indicated that no extra loss of fiber strength was observed after the two-step surface treatment for both the glass and carbon fibers. Scanning electron microscopy (SEM) data confirmed the positive effect of the two-step surface treatment on the hollow integrated core sandwich fabric with GF/CF hybrid face sheets. It was found that the hollow integrated core sandwich composites with GF/CF hybrid face sheets showed significant improvements in tensile strength, bending strength and compression strength after the two-step surface treatment, which indicated the two-step surface treatment was efficient.

Effect of Fabric Structure and Weft Density On the Poisson’s Ratio of Worsted Fabric

Nazanin Ezaz Shahabi, Siamak Saharkhiz, PhD, S. Mohammad Hosseini Varkiyani, PhD

ABSTRACT
This paper investigates the impacts of weave structures and weft density on the Poisson’s ratio of worsted fabric under uniaxial extension. In this study nine groups of worsted fabrics comprising of three weave structures (twill 2/2, twill 3/1 and hopsack 2/2), each produced in three different weft densities were examined. Samples were extended in weft direction uniaxially and the Poisson’s ratio of fabric in various extensions was measured. Analysis showed that the effect of both weft density and weave structure are significant with no combination effect on the Poisson’s ratio. It was found that there is an exponential correlation between warp and weft crimp during fabric extension. For the worsted fabrics used in this research in all three fabric structures, fabrics with higher weft yarn density have higher value of Poisson’s ratio. It was also concluded that for the fabrics with the same condition but only different in structures, this ratio is related to the structural firmness of fabric. In all three fabric structures the value of the Poisson’s ratio were following the same pattern of twill 2/2, twill 3/1 and hopsack 2/2 from highest to lowest value. It was revealed that there is a high linear correlation between the crimp interchange ratio and Poisson’s ratio.
Impact of Carding Parameters and Draw Frame Doubling on the Properties of Ring Spun Yarn

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Tanveer Hussain, PhD
Abdul Moqeeet

ABSTRACT
The impact of card cylinder speed, card production rate and draw frame doubling on cotton yarn quality parameters was investigated by using Box-Behnken design of experiment. It was found that yarn tenacity, elongation and hairiness increase by increasing number of draw frame doubling up to a certain level and then decrease by further increase in doubling. Yarn unevenness increases by increasing card production rate and total yarn imperfections increase by decreasing card cylinder speed and increasing card production rate.

The Properties of Modified Polysulfonamide Fabrics with Lamellar Magnesium Hydroxide Crystals

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Linping Zhang
Hong Xu
Dan Wang
Xiaoyan Zhang
Yi Zhong
Huantian Cao
Zhiping Mao

ABSTRACT
Lamellar magnesium hydroxide crystals were prepared successfully on the surface of polysulfonamide fibers with carboxylic acid groups. The polysulfonamide fabrics with Mg(OH)$_2$ crystals were characterized by Scanning electron microscopy, Inductively coupled plasma atomic absorption spectrometer X-ray diffraction, Vertical flammability test and Thermalgravimetric analysis. The vertical flammability test showed that the damaged length of original polysulfonamide fabrics was 34mm, while that of the polysulfonamide fabrics with Mg(OH)$_2$ crystals (treated by 7.5% NaOH solutions) was 14mm. In addition, the Mg (OH)$_2$ crystals played a critical role in the improvement of thermal stability and heat insulation of polysulfonamide fabrics.
Theoretical Review of Optical Properties of Nanoparticles

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Mohammad Esmail Yazdanshenas
Abousaeid Rashidi
Seyed Mansoor Bidoki

ABSTRACT
Nanoparticles are used in a variety of applications and their usage are growing vastly because of their superior characteristics such as high specific area of contact, great mechanical properties high electrical conductivity, high optical scattering efficiency and vice versa. Among these numerous properties, optical properties play an important role in either the type of application in which nanoparticles may be utilized or the type of the nanoparticle which may be used for a desired outcome. Many textile products including fibers, fabrics and textile composites benefit from these capacities of nanoparticles. This paper is a review about the theoretical methods for obtaining optical properties of nanoparticles noticing that the particle type is selected based on generally used particles like TiO₂ in order to acquire needed properties.

Soft Body Armor for Law Enforcement Applications

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Gopal Coimbatore, PhD
Seshadri S.Ramkumar, PhD

ABSTRACT
This paper focuses on the development of a novel ballistic protection composite which can provide both cut resistance and impact protection. The ballistic shield is made by sandwiching high strength, impact resistant, multi-layered woven fabrics between a leather strike face layer and a needlepunched fabric layer that offers protection upto Level IIIA and cut resistance. The needlepunched fabric when punched into the ballistic layer(s) pushes the fibers in the Z direction providing enhanced structural coherence and strength. Three different high performance fibers (Kevlar®, Spectra® and Twaron®) were used to make the composite. Ballistic tests were performed using V50 ballistic requirement based on NIJ standard. The availability of leather layer reduces the velocity of the impact and aides with the blunting of the bullet. A new phenomenon, “mushrooming” of the bullet has been observed. Results on the ballistic protection capabilities of different strike and impact resistant composite chest shields are presented in this paper.
Method of Mesh Fabric Defect Inspection Based on Machine Vision

Guodong Sun, PhD
Xin Dai
Daxing Zhao, PhD

ABSTRACT
An appearance defect online inspection system of mesh fabric based on machine vision has been developed. The mean filter method is adopted to eliminate noise. An adaptive threshold method based on brightness is presented to eliminate the effects of uneven illumination and separate the foreground and background. By analyzing the texture characteristics and defect features of mesh fabric, the mesh fabric defect identification method based on texture features has been proposed. The inspection results have shown the speed of online inspection system could reach 60m/min and the defect recognition rate could reach 95% or more, which meet the automation requirements of enterprises quite well.

Loop Length of Plain Single Weft Knitted Structure with Elastane

Alenka Pavko-Cuden
Ales Hladnik
Franci Sluga

ABSTRACT
For decades, scientists have been trying to define relationships among yarn parameters, knitted fabric parameters and knitting process parameters with loop models. Recently, the geometrical loop models have returned to focus as they assist finding the effective parameters which cause dimensional changes during relaxation. Furthermore, they help designing knitted structures for technical applications and obtaining computer simulations of knitted structures. In the past, geometrical loop models considered more or less porous structures and the yarns used were mostly conventional, i.e. without elastane. The behavior and characteristics of compact knitted fabrics made from elasticized yarns have been investigated only recently. In general, mostly the structures with plated elastane threads have been analyzed. The aim of the research was to study the geometrical parameters (yarn thickness, loop width, loop height, fabric thickness, loop length) of plain single weft knitted structures made from various elasticized yarns, in comparison to equivalent structures made from conventional yarns. In the study, the most frequently applied loop models for the loop length calculations were evaluated with the emphasis on their adequacy for elasticized knitted structures. A new loop model for an elasticized weft knitted structure based on the multiple linear regression was defined.
Ecofriendly Approach to Improve Pectinolytic Reaction and Process Optimization of Bioscouring of Organic Cotton Textiles

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Anbumani N.
Kandhavadivu P.

ABSTRACT
The present study was focused on improvement of the enzymatic bioscouring performance by using specific mixed enzymes such as alkaline pectinase, protease, lipase and cellulase enzymes. An attempt has been made to study the pectinolytic activity of degrading rate of pectin on the organic cotton fabric and removal of wax at various enzymatic process conditions such as enzyme concentration, temperature and time. These process variables are selected based on the artificial neural network (ANN) and output of experiment resulted in fabric physical properties such as weight loss, water absorbency, wetting area, whiteness index, yellowness index, brightness index. The enzymatic scoured organic cotton fabric was tested for wax content and pectin degradation rate on the fabric and their results were optimized with minimum error. The test results were analyzed to predict the optimum process parameters to achieve the required bioscouring fabric properties and removal of pectin degrading rate and compared their results with actual trials.

Thermal Protective Performance of Aerogel Embedded Firefighter’s Protective Clothing

Heping Zhang
Zhengkun Qi
Dongmei Huang
Song He
Hui Yang
Yin Hu
Liming Li

ABSTRACT
Firefighter’s protective clothing (FPC) is a four-component ensemble that protects human body against the following properties: a. radiation; b. flashover conditions; c. puncture and abrasion hazards; while still maintaining an adequate level of dexterity and comfort. Therefore, the thermal protective performance (TPP) of FPC is very important. Generally, FPC with higher TPP will result in fewer injuries. In this study, aerogel is proposed to be used in FPC to improve its TPP, and the feasibility is examined. The results showed that the temperature on the back surface of the FPC samples that were filled with aerogel was 100 °C lower than that of those unfilled FPC samples under the same heat exposure. However, a short temperature jump occurred during the tests due to the penetration of infrared radiation (IR) light. In addition, the weight of the FPC sample in which the aerogel was embedded was lessened about 24.3%. It is concluded that filling aerogel in FPC can effectively improve its TPP and lessen its weight, while some additives must be used to absorb or scatter the IR light that causes the temperature jump.