Mechanical Properties of Three-Dimensional Fabric Sandwich Composites

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Three-dimensional fabric sandwich composites (3D fabric composites) were prepared by impregnating epoxy resin in a hand lay-up procedure. Two types of the 3D fabric composites with the core height of 10mm and 20mm were selected to study the mechanical properties of 3D fabric composites, including flat compression, shear and flexure properties. The results showed that the flexure properties of the 3D fabric composites increased with the increase of core height, while the flat compression and shear properties decreased. Compared with the 3D fiber composites, the 3D fabric composites have much better flat compression and shear properties, although the flexure properties were similar. This work would provide a reference for the optimization of design and mechanical properties of the 3D fabric sandwich composites.

An Investigation into Acoustic Properties of Lightly Needled Estabragh Nonwovens Using Taguchi Method

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Sound pollution has become an important issue that has been addressed by scientists of various disciplines. Control of sound in areas of transport and building industries is of paramount importance. Textiles are widely used as sound insulators. Among the broad spectrum of textiles, nonwoven fabrics due to their technical merits and wide acceptance are extensively used as sound controlling media.

In this work, various blends of polypropylene and naturally grown hollow Estabragh fibers were used to prepare sound absorptive nonwoven layers. The fiber blends were fed to a laboratory scale carding machine. Carded webs were lightly needled on a laboratory scale needling machine. Acoustic properties of needled samples were evaluated using Impedance tube method. Taguchi method was used to analyze the effective parameters influencing fabric acoustic properties. Results showed that the proportion of Estabragh fibers in the blends strongly affects the noise absorption coefficient (NAC). Frequency is the second effective factor and is followed by nonwoven layer mass (areal density) and punch density, respectively.)
Improving Dimensional Stability of Cotton Knits through Resin Finishing

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The aim of this study was to compare the effectiveness of different crosslinking resins in improving the dimensional stability of cotton knits. A honeycombed pique knitted structure was selected for the study because of its known propensity to high shrinkage. It was found that the fabric shrinkage can be effectively controlled by using a suitable type and concentration of the cellulose crosslinking agent. The crosslinking treatment also results in some loss in the fabric bursting strength, which can be kept to a minimum with the help of a suitable fabric softener. However, the type of the selected softener is also critical as some softeners may result in the deterioration of the fabric's pilling resistance.

Hygienic Property of Microfiber Synthetic Leather Base Modified via "Two-Step Method"

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A "two-step method" was adopted to improve the hygienic property of polyamide microfiber synthetic leather base. Firstly, the amino-terminal hyperbranched polyamides (NH2-HBP) synthesized by N, N'-methylene bisacrylamide (MBA) and diethylene triamine (DETA) was cross-linked to microfiber synthetic leather base pretreated with formic acid, in which glutaraldehyde was as the crosslinking agent. Secondly, Gelatin hydrolysate was cross-linked to the preliminary modified microfiber synthetic leather base by using glutaraldehyde as the crosslinking agent. The modified microfiber synthetic leather base was then obtained. Hygienic performances, mechanical properties and the micro morphology were taken as indexes to optimize the dosages of glutaraldehyde and NH2-HBP. The results showed that when the glutaraldehyde dosage was 1.1 times that of the primary amino groups (the primary amino group dosage was about 0.201 mmol/g), the modification effect improved greatly. In this condition, the water vapor permeability, hygroscopicity, tensile strength and tear strength of the base were 0.7691 g/10 cm*24 h, 3.357 mL/g*24 h, 18.79 N/mm2, and 103.18 N/mm, respectively. These values were 86.7%, 48.8%, 19.8%, and 2.69% higher than those of unmodified base, respectively. When NH2-HBP dosage was three times of that the primary amino groups, the modification effect also improved.
Compressed air is a major component of energy costs incurred in the weaving of textile fabrics on air-jet looms. The consumption of compressed air in air-jet weaving depends on different process variables. In this study, the effect of weft yarn count, reed count, fabric width and loom speed on the compressed air consumption of air-jet loom was determined using response surface methodology. Fabric width was found to be the most dominant factor affecting the air consumption followed by loom speed, reed count and weft yarn count respectively. A statistical model for predicting the compressed air consumption on air-jet loom was developed. The prediction ability and accuracy of the developed model was assessed by the fitted line plot between the predicted and actual air consumption values. The prediction model may be used for optimizing the production planning, estimating the share of compressed air cost in weaving a particular fabric style and in identifying any air wastages in the weaving shed by comparing the actual compressed air consumption with that predicted by the model which was developed under controlled conditions without any air leakages.

The adsorption character of kapok fiber with direct dyes and dyeing technology of cationic modified kapok fiber with reactive dyes had been studied in this article. The results indicated that the dyeing adsorption isotherm of the direct dye Solophenyl red 3BL on kapok fiber was a type of Freundlich adsorption isotherm. The optimal dyeing technique parameters of the cationic modified kapok fiber with the reactive dye Cibacron FN-R included 0.5~1% (o.w.f) of dyes, 15~20g·L-1 of NaCl and 2g·L-1 of JFC with bath ratio of 1:50 at dyeing temperature of 40 for 30min, and the dyed kapok fiber was fixed with 15~20g·L-1 of Na2CO3 for 60min. As a result, the dye-uptake, fixation ratio, washing-fastness, friction-fastness and K/S of cationic modified kapok fabric were enhanced by above technique.
Photostability and Durability Properties of Photochromic Organosilica Coating on Fabric

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Photochromic fabrics have been prepared by a dip-coating method using a silica sol-gel solution containing photochromic dyes. The coated fabric showed a rapid photochromic response. Three methods, such as incorporating a UV stabilizer in the coating layer, hydrophobic treatment of the porous surface, and covering the coating layer with an additional silica layer, were used to improve the photostability and durability. All three treatments improved the photostability, without noticeably changing the photochromic response/fading speeds. Most of the treatments reduced the washing and abrasion durability. The extra coating layer increased the fabric rigidity.

Poly (ε-caprolactone) Fiber: An overview

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(ε-caprolactone), (PCL) or simply polycaprolactone as it usually referred to, is a synthetic biodegradable aliphatic polyester which has attracted considerable research attention in recent years, notably in the specialist biomedical areas of controlled-release drug delivery systems, absorbable surgical sutures, nerve guides, and three-dimensional (3-D) scaffolds for use in tissue engineering. Various polymeric devices like microspheres, microcapsules, nanoparticles, pellets, implants and films have been fabricated using this polymer. It can be transformed by spinning into filaments for subsequent fabrication of desirable textile structures. Spinning may be accomplished by various routes. The fibers may be fabricated into various forms and may be used for implants and other surgical applications such as sutures. Although numerous studies have investigated different properties and applications of PCL, but there is no comprehensive study investigated different fabrication methods of PCL fibers and their biomedical applications. The present article presents a review on the production of PCL fiber by various methods, along with correlations between structure and properties of the fibers. The applications of these fibers in biomedical domains are also discussed.
Experimental Analysis and Orthotropic Hyperelastic Modeling of Textile Woven Fabric

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This paper presents an experimental study and hyperelastic modeling of orthotropic mechanical behavior of textile woven fabric. The strain energy function of the hyperelastic model is a combination of the warp extension, weft extension and the shear angle between warp and weft directions. The experimental and fitting analysis of the anisotropy is realized using off-axis tensile test for five textile woven fabrics. Orthotropic hyperelastic modeling highlights the anisotropy tensile property of textile woven fabric compared to orthotropic linear elastic modeling. A particular attention is given to the influence of weave structure on the fabric anisotropy.

Modeling Ultraviolet Protection Factor of Polyester-Cotton Blended Woven Fabrics Using Soft Computing Approaches

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Ultraviolet protection factor (UPF) of woven fabrics has been modeled by using two soft computing approaches namely adaptive network based fuzzy inference system (ANFIS) and artificial neural network (ANN). Three fabric parameters namely proportion of polyester in weft yarns, weft count and pick density have been used as input parameters for predicting fabric UPF. Two levels (low and high) of membership function for each of the input parameters have been used to reduce the complexity of ANFIS. The eight linguistic fuzzy rules trained by ANFIS are able to explain the relationship between fabric parameters and UPF. A comparison between ANFIS and ANN models has also been presented. Both the models predicted the UPF of fabrics with very good prediction accuracy in the testing data sets.
Influence of the Temperature on the Efficiency of Cellulose Treatment Using Copolymer Chitosan-Eugenol

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In order to achieve effective antimicrobial protection of textile materials against microorganisms, a natural compound called chitosan has become very interesting. In regard to the antimicrobial protection of textile materials, functionalization with chitosan does not affect some other properties, such as for example anti-oxidative or any other action. For this reason, it seems appropriate chitosan to be combined with any natural antimicrobial active compound, such as eugenol an extract of clove oil. During this research viscose as a representative of cellulose fibers was used because it can be functionalized relatively easily. In the term of functionalization, the drying temperature of viscose, after antimicrobial compound being applied onto substrate, is also important besides the successful synthesis of copolymer chitosan/eugenol. FTIR spectroscopy was used to evaluate the efficiency of synthesizing a chitosan/eugenol graft copolymer. The spectrophotometric method Acid Orange 7 was chosen as a method by which the proportion of available antimicrobial active amino groups can be determined. In addition, microbiological testing of selected pathogenic micro-organisms was also performed. The results were compared with the results for viscose functionalized by a 1 % solution of chitosan.

Thermo-physiological Comfort Properties of Polyester and Polyester/Acrylic blended Synthetic Fabrics treated with Herbal Finishes

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Comfort in clothing mainly lies in moisture management which often refers to the transport of both moisture vapor and liquid away from the body. Moisture management of fabrics is chiefly influenced by the thermal properties of those fabrics. In spite of the convincing properties the synthetic fabrics have, they are not much preferred because of their hydrophobic nature and thus providing less comfort to the wearer comparing to the natural fabrics like cotton, wool, silk etc. The previous studies report that the herbal finishes improve the anti-microbial and other medicinal properties but no or very little work have been carried out on the comfort aspect. Hence an attempt is made in this work to study the influence of certain eco-friendly herbal finishes such as Neem and Bermuda grass on the thermo-physiological comfort properties of synthetic fabrics used in the production of clothing. The thermo-physiological comfort includes properties like Wicking, Water vapor permeability, Thermal conductivity, etc.
Preparation of Antibacterial Silk and Analysis of Interface Formation Mechanism

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Nano-Ag-loaded SiO2 antibacterial agent (Ag/SiO2) was prepared by chemical reduction method and served as a modifier to endow silk fabric with antibacterial activity. Impregnated antibacterial silk (I-silk) and grafted antibacterial silk (G-silk) were obtained by dipping method and grafting with coupling agent KH550, respectively. The morphologies and valence-bond structures were characterized by scanning electron microscopy (SEM), transmission electron microscopy (TEM) and Fourier transform infrared spectroscopy (FTIR). The washing fastness and antibacterial performance of G-silk were detected by washing test and oscillation flask method. The results showed that the chemical structure of G-silk changed in comparison with that of natural silk. The antibacterial rates of G-silk against E. coli and S. aureus were 96.5% and 92.8%, respectively. And it was still over 80% even after being washed for 30 times, suggesting good washing fastness and long-acting antibacterial activity.

Optimization of Process Parameters for Fabrication of Wool Fiber Reinforced Polypropylene Composites with respect to Mechanical Properties

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The present study aims at optimizing the process parameters of compression molding process with respect to mechanical properties for fabrication of wool fiber reinforced polypropylene composites. An experiment has been designed using Box-Behnken with three levels and three variables using temperature, time and pressure as independent variables and tensile, flexural and impact strengths as dependent variables. The process conditions are optimized using response surface methodology with Box-Behnken experimental design. Regression equations have been obtained to analyze tensile strength, flexural strength and impact strength and the optimum process parameters are identified. The results show that the optimum conditions for compression molding are 176C, 7 min and 35 bar.
The Property of Automobile Engine Oil Filtration Material and the Development of New Filter

Jian Yong Feng
Jianchun Zhang

The main purposes of this paper are to research the structure and property of commonly used oil filtration materials on the basis of hierarchical cluster method and to develop new filter. For this objective we selected ten different oil filtration materials and made a deep comparison of filtration properties among them. In addition, the hierarchical cluster method was used to classify these ten oil filtration materials into three different categories. Objective classification results in the case of data matrix of different properties had a rather accurate result, which was almost consistent with the result of subjective classification. It could be found that three different kinds of filtration materials had different structures and properties in practical application. In addition, the results indicated that the filtration property of this new filter developed on the basis of hierarchical cluster analysis was very close to the first kind of materials.

1,2,3,4-Butanetetracarboxylic Acid Cross-Linked Softwood Kraft Pulp Fibers For Use In Fluff Pulp Applications

Kristoffer Lund
Harald Brelid

Cross-linked fluff pulp fibers for use in, for example, acquisition layers in absorption products can be found in patent literature. Cross-linking improves properties such as the wet resilience of fluff pulp fiber networks. Among the more commonly seen cross-linkers are polycarboxylic acids, such as 1,2,3,4-butane tetracarboxylic acid (BTCA). These acids form ester bonds with the hydroxyl groups in the fiber wall. In this study, softwood kraft pulp fibers were cross-linked with BTCA. The swelling behavior of the fibers and properties related to acquisition in absorption products were studied. It was found that the water retention value (WRV) decreased as a consequence of the introduced cross-linker. After deprotonization of a large part of the introduced carboxylic acids, the WRV increased, but the cross-linker was still able to limit significant swelling of the fiber wall. The wet bulk under load of fiber networks, composed of cross-linked fibers, generally increased with a decrease in WRV. Furthermore, it was found that the property development obtained after a cross-linking reaction with BTCA may be predicted by introducing a relative reaction intensity, \( \text{RI}_{\text{rel}} \), that takes into account both time and temperature in the curing step. This shows that the time and temperature in the curing step are interchangeable.
Investigation of Moisture Transportation Properties of Knitted Fabrics Made From Viscose Vortex Spun Yarns

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Moisture transportation through fabrics is one of the important parameters which affect clothing comfort. The combination of different factors which include fiber, yarn and fabric structure will yield varying degrees of clothing comfort. This research work concentrated on the use of viscose fibers spun on the vortex spinning system, which was used to knit six fabric samples of different knit structures. The fabric samples were produced and tested for moisture transportation characteristics, which included air and water moisture permeability. The results obtained in this research work indicated that water wicking, air permeability; water vapor permeability, evaporation rate and drying time were affected by the type of knit structures. When the fabric samples were washed, the fabric water transportation properties were altered. Air permeability and evaporation rate for the knitted fabric samples showed negative correlation with fabric thickness. Air and water permeability showed a significant decrease when the samples were subjected to laundering.

Physical and Mechanical Properties of Nylon 6/ Titanium Dioxide Micro and Nano-Composite Multifilament Yarns

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In this study, the effect of titanium dioxide particles (TiO2 micro and nano) on physical and mechanical properties of nylon 6-based multifilament yarns was investigated. For this reason, master-batches of nylon 6/TiO2 micro and nano-particles were prepared by melt compounding before spinning and then multifilament composites incorporating 0.03, 0.33, 0.5 and 0.7% TiO2 micro and nano-particles were successfully spun in a melt-spinning machine. Characterization of these composites multifilament yarns was carried out using scanning electron microscopy (SEM), transmission electron microscopy (TEM), energy dispersive x-ray (EDX), X-ray diffraction (XRD) analysis. Characterization of mechanical strength properties including tenacity and elongation at break of the resultant composites are discussed as a function of filler loading. Through the application of scanning electron microscopy (SEM) and transmission electron microscopy (TEM), it was found that incorporating the micro titanium dioxide caused severe aggregation at the nylon fiber surface. By contrast, the diffusion of nano-particles within bulk of multifilament yarns was much more consistent, although aggregation of the titanium dioxide nano-particles still appeared. The results manifested the improvement of mechanical properties of the nano-composites containing TiO2 nano-particles.
Evaluation of Color Difference, Whiteness and Luster of Multifilament Polyester Woven Fabrics

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Alireza Shiasi

This paper investigated the color difference, whiteness, and luster of multifilament polyester woven fabrics based on weave pattern, weft density, dye concentration, and interaction between super bright warp yarns and semi dull weft yarns. Plain, weft rib (2/2), sateen (1/4)(3) and steep twill(2/3) was selected as weave pattern. Warp yarn type and its count, and warp density were kept constant. Measurement of whiteness was conducted on pre-treated un-dyed fabric samples. Color difference and luster of samples was evaluated after dying in warp and weft direction separately. Plain and weft rib (2/2) weaves showed the lowest and highest value of whiteness and luster respectively. Interaction between weave pattern and application of super bright yarn as warp was obtained in these parameters. The luster and whiteness of samples was decreased by increase in weft density. The trend of luster and color difference in weft and warp direction by increasing the weft density was not similar and was dependent on dye concentration and effectiveness of super bright warp yarns according to fabric pattern. Woven fabrics with steep twill (2/3) and weft rib (2/2) revealed the highest values of color difference compared with plain and sateen (1/4)(3) in warp direction. In weft direction, plain weave showed the lowest value of color difference and all three others had almost the same level of color difference. Moreover, the visual assessment was organized based on twenty-two observers in standard condition and D65 light source.

Investigation of Wash Durability of Silica Nanoparticle Coated 100% Cotton Reactive Dyed Fabric Treated by Sol-Gel Technique

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In this research a hydrophobic surface of 100% cotton woven fabric was developed by sol-gel technique. Fabric samples were dyed with Drimarene Reactive Red 5B and Drimarene Reactive Blue BR dyes (0.5% and 3% o.w.f) and then treated with a combination of silica nanoparticles, silane hydrophobes (alkyltrialkoxysilanes), and silane cross-linkers i.e, tetraethoxysilane (TEOS) and teramethoxysilane (TMOS) by dip-dry-cure process. After coating, wash durability of dyed samples were investigated for water repellency and water uptake according to AATCC standards. The effect of coating on dyeing behavior was assessed by measuring the (K/S)\(\lambda\)max value, while change in color (\(\Delta E\)) and fastness properties of coated fabric also investigated. It has been observed that durable hydrophobicity achieved on cotton reactive dyed fabric through non-fluorine sol-gel route with silica nanoparticles with better fastness properties with little effect on shade.