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Control of Inter-fiber Fusing for Nanofiber Webs via Electrospinning

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ABSTRACT
Electrospinning provides a viable method to produce both single fibers and mats of nonwoven fibers. For a nonwoven mat, fusing of the fibers at intersections produces an integrated structure. The ability to spin fibrous mats of nanofibers with and without fusing between the fibers is demonstrated using poly(ethylene oxide) (PEO) fibers. The fusing was controlled by adjusting the amount of water vapor in the surrounding environment. Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM) images were used to evaluate the percent of fused fibers in the mat and the diameters of fibers. The major finding of this work is that fusing of fibers can be controlled during formation of a nanofibrous mat via electrospinning in a controlled environment.

Structure, Morphology and Thermal Stability of Porous Carbon Nanofibers Loaded with Cobalt Nanoparticles

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ABSTRACT
Porous carbon/cobalt (C/Co) composite nanofibers with diameters of 200-300 nm were prepared by electrospinning and subsequent carbonization processes. Two polymer solutions of polyacrylonitrile (PAN), polyvinyl pyrrolidone (PVP), and $Co(CH_3COOH)_2$ (Co (OAc) $_2$) were used as C/Co composite nanofiber precursors. The study revealed that C/Co composite nanofibers were successfully prepared and cobalt particles with diameters of 20-30 nm were uniformly scattered in the carbon nanofibers. It was also observed that clear fibrous morphology with grainlike particles and good structural integrity were still maintained after calcination. The TGA analysis indicated the improved thermal stability properties of the composite nanofibers. The Brunauer-Emmett-Teller (BET) analysis indicated that C/Co composites nanofibers with meso-pores possessed larger specific surface area than that of carbon nanofibers.

The Influence of Knitted Fabrics' Structure on the Thermal and Moisture Management Properties

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ABSTRACT

This paper studies the influence of fabric's structure on the thermal and moisture management properties of knitted fabrics made of two types of yarns with thermo-regulating effect: Coolmax® and Outlast®. The main purpose of this study was the selection of the most adequate fabric, to be used in summer and winter sportswear. The results demonstrated that some properties, such as, thermal properties, diffusion ability, air and water vapor permeability are influenced by both raw material type and knitted structure parameters. Wicking ability is influenced to a greater extent by the knitted structure, while the drying ability is primarily determined by raw material and to a lesser extent by the knitted structure parameters. Outlast® fabrics are preferred candidates for warmer climate sportswear, particularly due to their lower thermal resistance, higher thermal conductivity and absorptivity, air and water vapor permeability. When considering sportswear for colder weather, Coolmax® based structures seem to be the best choice. These findings are an important tool in the design of a sportswear product tailored to the different body areas thermal and moisture management requirements.

Compressibility Behaviour of Warp Knitted Spacer Fabrics Based on Elastic Curved Bar Theory

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ABSTRACT

Nowadays, the mechanical characterization of 3-D spacer fabrics has attracted the interest of many textile researchers. These Spacer fabrics present special mechanical and physical characteristics compared to conventional textiles due to their wonderful porous 3-D structures. These fabrics, produced by warp knitting method, have extensive application in automobile, locomotive, aerospace, building and other industries. In these applications, the compressibility behaviour plays a significant role in the fabric structural stability. This compressibility behaviour could be affected by different knitting parameters such as density of pile yarn, fabric thickness, texture design etc.

The aim of this paper is to introduce and develop an appropriate elastic theoretical model to predict the compressibility behaviour of warp knitted spacer fabric (WKSF). Three theoretical models are proposed, based on modelling pile yarns as the curved bars and are improved in three steps: a) with same curvatures in weft and warp directions (model A), b) curved bar for warp direction and cantilever bar for weft direction (model B), and c) curved bars with two different curvatures in weft and warp directions considering the curvature variations under loading (model C: improved model). The results obtained by the proposed models have been compared with previous model based on simply cantilever bars theory in literature. The results show that the simulation data obtained by the model C are closer to the experimental results comparing to the models A and B. Model C based on different weave parameters could better predict the elastic compressibility behaviour of this kind of WKSF in order to compare with previous models.

Development of a Parametric Design Method for Various Woven Fabric Structures

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ABSTRACT
An integrated woven fabric system has been developed. A series of parametric design rules have been defined by analyzing famous woven structures. An expandable script language and its compiler have been developed to generate scalable weave diagrams using those rules. A calculation algorithm has also been developed to generate draft and peg plans based on the weave diagrams. Finally, a two-dimensional realistic fabric image rendering function using the actual image of various yarns, a three-dimensional fabric modeling method based on B-Spline approximation, and a pseudo three-dimensional mapping method for simulated images of final products were all integrated into the system.

Cellulose Submicron Fibers

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ABSTRACT
In order to manufacture cellulose submicron fibers, electrospinning of cellulose was tried with different solvents. Alpha-cellulose did not dissolve in 6% (w/w) sodium hydroxide/4%urea aqueous solution. Alpha-cellulose solution in 85% phosphoric acid was not spinnable at an applied voltage between 15kV to 25 kV and at a spin length of 4 to 6 inches. Electrospinning of alpha-cellulose in N-methylmorpholine-N-oxide/N-methyl-pyrrolidinone/water solvent mixture could be performed at an applied voltage of 28 kV and at a spin length of seven inches during spinning and at an ambient temperature of 38^0C. The degree of crystallinity of the cellulose submicron fibers was found to be 37.88%. The number average fiber diameter of cellulose submicron fibers from 1.25% (w/w) cellulose solution in the N-methylmorpholine-N-oxide/N-methyl-pyrrolidinone/water solvent was found to be 207 nm and the number average fiber diameter of cellulose submicron fibers from 2.5% (w/w) cellulose solution in the N-methylmorpholine-N-oxide/N-methyl-pyrrolidinone/water solvent mixture was found to be 243 nm.

Development of Models to Predict Tensile Strength of Cotton Woven Fabrics

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ABSTRACT

Tensile strength has been accepted as one of the most important performance attributes of woven textiles. In this work, multiple linear regression models are developed by using empirical data for the prediction of woven fabric tensile strength manufactured from cotton yarns. Tensile strength of warp & weft yarns, warp & weft fabric density, and weave design were used as input parameters to determine warp- and weft-way tensile strength of the woven fabrics. The developed models are able to predict the fabric strength with very good accuracy. Warp yarn strength and ends per 25 mm are found to be the most dominant factors influencing fabric strength in warp direction while weft yarn strength and picks per 25 mm are most vital in weft direction.

AC Conductivity Studies on PMMA-PANI (HCl) Nanocomposite Fibers Produced by Electrospinning

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ABSTRACT

Electrospinning is one of the techniques to produce non-woven fiber mats using polymers. The diameters of the fiber produced by this technique are in the range of 10 μm to 10 nm. Electrically conducting ultra-fine fibers are useful in many applications in the fields of sensors, and nanoelectronics. However, it is very difficult to obtain fibers of conducting polymers like polyaniline (PANI) and polypyrrole through electrospinning. Hence they are invariably mixed with other insulating polymers such as polymethylmethacrylate (PMMA) to obtain a conducting composite depending on the percolation of the conducting polymer. Here, we report the preparation of PANI-PMMA composite fibers by electrospinning. The scanning electron micrographs and the frequency dependent complex conductivity ($\sigma^*(\omega)$) of these polymer fibers are investigated at room temperature with different concentrations of PANI (5%, 10%, 15%, 20% w/w). It is observed that there is a significant enhancement in the ac conductivity of these fibers with the increase in the concentration of PANI.

Characterization of Electrospun Novel Poly(ester-ether) Copolymers: 1,4-Dioxan-2-one and D,L-3-Methyl-1,4-dioxan-2-one

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ABSTRACT

Introduction: Because tissue engineering scaffolds serve as a temporary environment until new tissue can be formed, their mechanical performance, thermal properties, and biocompatibility are critical for maintaining their functionality. The goal of this study was to electrospin scaffolds from copolymers containing varying amounts of 1,4-Dioxan-2-one (DX) and D,L-3-Methyl-1,4-dioxan-2-one (DL-3-MeDX), and characterize their mechanical and thermal properties. **Methods and Results:** Image tool analysis of scanning electron micrographs revealed the presence of DL-3-MeDX causes the fiber diameter of the scaffold to decrease as compared to polydioxanone (PDO). Uniaxial tensile testing revealed increasing amounts of DL-3-MeDX in the copolymer decreases scaffold peak stress, strain at break and toughness. Modulated differential scanning calorimetry was used for thermal analysis of the scaffolds and showed that increasing amounts of DL-3-MeDX causes a decrease in the melting as well as crystallization temperatures. **Conclusion:** Based on the results of the mechanical and thermal properties of these copolymer scaffolds, it is evident that these constructs could be functional in a variety of biomedical engineering applications.

The Effect of Spectrophotometer Geometry on the Measured Colors for Textile Samples with Different Textures

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ABSTRACT

Spectrophotometers are usually built based on one of these two kinds of geometry; d/8 (diffuse/8) and 45/0. Considering that measured or observed colors depend on the illuminating and viewing conditions, the 45/0 spectrophotometer geometry or d/8 geometry affects the results. In addition, the sample characteristics such as gloss or texture can also influence the measuring results. Therefore, the effect of geometry will be affected by the characteristics of the sample.

In this paper, the effect of spectrophotometer geometry on the result of color measurement is investigated for textile samples with different types of texture. In addition, the effect of texture on the measured colors was compared for two geometries. To this end, 63 polyester samples contained of 9 color centers each of them has 7 different types of texture were used. The spectral reflectance data of the fabrics were measured using two spectrophotometers with different geometry; d/8 and 45/0. Other parameters of the two measuring systems such as the aperture size, laboratory conditions, the sample's direction in front of the spectrophotometer and the number of specimen's layers were equal. The measured values of two instruments were compared. It was shown that the spectrophotometer geometry influences the color coordinates of the samples. The d/8 spectrophotometer with include mode usually gives larger lightness values. C^* and H^* values are affected by the type of spectrophotometer and this effect is dependent on the color center of the sample. In another part of the present study, the color change via the texture difference was evaluated for each of the two geometries, and the obtained results were compared with each other. It was found that the surface texture of the sample influences the measured color from 0.4 to about 4.8 CIEDE2000 (1:1:1) unit for both two types of the spectrophotometer. Moreover, as same as d/8 geometry, the color change via the texture which is measured by 45/0 shows no acceptable correlation with visual assessments.