



Nanotechnology in Textiles Finishment

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Abstract

The ways of using the nanometer material to give the textile fabric some function is listed and compared in this article. In the early research, first the nanometer material preparation is alone carries on. And then using this to make the finishing agent. Finally put the agent on the fabric by finishment. At present, people combine the preparation of nanometer material and finishing agent together, and then cover this on fabric through the normal finishment. Recently research the trend is to compact the three steps to one step, completing the nanometer material preparation, the finishment agent production and the finishing process at the time. Various examples are given in this article. At the end, some researches about cotton fiber hole structure are listed, which has implicated a new way to take advantage of nanometer material and a bright future about a new type cotton fiber.

Keywords: Nanotechnology, Textiles, Finishment, Nano- tex

1. Introduction

Fiber-based materials in technical applications are an increasing worldwide market and cover a wide area. Numerous textile materials are integrated in automotive systems being responsible there for many functions within important fields like safety, comfort or light weight.

The inorganic nanometer material dispersion will fix on the textile, enable the textile to have each kind of function, will be the various countries material study and textile industry's expert continuously in diligently with the attention and hot spot.

2. Domestic and foreign research progress

In the early research, the nanometer material preparation is alone carries on, then a nanometer granule will disperse to the spinning fluid in uses altogether mixes the spinning preparation chemical fiber, or the nanometer material granule will disperse to the finishing agent, through soak rolls and the nanometer coating is attaching to the textile fiber product on, the implants also is used to implant a nanometer material into the textile fiber.

Altogether mixes the spinning method development the function textile fiber mainly to have: The antibacterial chemical fiber, the far infrared linear chemical fiber, the fire-resistant textile fiber, the regeneration adjusts the warm textile fiber, shines the textile fiber, the electric conduction textile fiber and so on. With altogether will mix the nanometer granule to join in the textile fiber, the existence question mainly will be its easy reunion. The inorganic nanometer particle reunion not only has affected the nanometer material function display, moreover becomes the important restriction factor, which the influence spinning smoothly carries on. In order to solve this problem, generally is disperses a nanometer granule into the mother granule, again uses the mother granule altogether to mix the system with the textile fiber spinning fluid to produce a high polymer/nanometer granule the complex fiber.

At present, generally uses the fabric finishment for natural. The main method includes: soak rolls and the nanometer coating. Nanometer additive The soak rolls with nanometer additive is suitable for putting on the soft fabric to the request. The nanometer coating is joins right amount nanometer in the coating, after drying and the essential heat treatment, forms a thin film in the fabric surface. The coating law adapts broadly to the textile fiber type, processing cost low, but the fastness of wash-resistant and the handles of fabric are bad.

The Xia men China Hua Pu high-tech industry limited company studies one kind of one's own appropriation technology, (Yinqing Wu, 2000) called for implants, the nanometer ceramic powder body implants in the textile fiber, and fixed effectively, this method may use in the natural fiber also to be allowed to use in the chemical fiber. The Yongli Chen and other person has studied the feasibility of implanting several kind of nanometer granules into the PET chemical fiber,

the findings indicated that, In the sol the nanometer granule of carbon black, Fe (OH) 3 and natural ore powder at 130 °C can enter the PET amorphous region, at the low temperature can permanent solidify. During implants, the size of implanted the nanometer granule particle is limited by the fibrous material aperture size, the nanometer granule reunion question also need to solve during the implanting process.

3. The present research tendency

The home position production during spinning or finishing will solve the nanometer material dispersible problem.

The home position polymerization during spinning, by nanometer material and the high polymer, the preparation nanometer material/polymer compound material, through the spinning preparation nanometer function textile fiber, this method truly will realize a nanometer pellet to be dispersible in high polymer nanometer level, not only enhanced the spinning efficiency, moreover enable the material mechanics, the heat studies performance to obtain a bigger enhancement. But only can apply on the chemical fiber textile, cannot apply to the natural fiber textile. This aspect research includes:

Shanghai University of communication (Kulpinski, 2005) the scientific researcher completes a nanometer titanium oxide (TiO₂) the anti- ultraviolet ray textile fiber uses a nanometer titanium oxide and the polyester home position polymerization method, owning the independent intellectual property rights, the preparation nanometer TiO₂/polyester complex fiber.

The Chinese Yi Zheng petrochemical industry the chemical fiber limited liability company. Through joins the chemical additive in the polyester building-up reactions raw material, the hydrogen which in the use polyester esterify process produces, causes titanium alkoxide, titanium inorganic salt, ethylsilicate to have the hydrolytic reaction, the home position forms the nanometer level titanium dioxide or the silicon dioxide inorganic granule, these inorganic granules evenly disperse around the polymer macro-molecule, improved the polyester crystallization and the orientation performance, thus then produces the high strength polyester industry silk using the convention technical process and the equipment.

Chronakis, Ioannis S of IFP Research, (Chronakis, 2005) Swedish Institute for Fiber and Polymer Research, Sweden, covers the active research area of producing ceramic and composite nanofibers with various compositions and properties by means of the electrospinning process. Current critical issues are discussed, such as carbon nanofibers made from electrospun precursor polymer nanofibers, encapsulation and alignment of carbon nanotubes within nanofibers to construct unique functional composite nanostructures, and organic-inorganic nanofibers (hybrids).

Arnim, Volkmar V; Dauner, Martin; Scherrieble, Andreas; Stegmaier, Thomas; Planck, Heinrich of Institute for Textile Research and Process Engineering (ITV), (Arnim, 2005) Denkendorf, Germany, offer a great chance to gain novel physical and chemical properties of the fiber-based materials. ITV Denkendorf focuses on nano structures and nano particles in textile development and processing by finishing systems as well as electro spinning and bi-component technologies. One subject of current interest is the generation of nano scaled textiles by spinning of nanofibers using electro spinning to meet the increasing request for filter media with high filter efficiency in the sub-micrometer range. The demand is based on the need for the filtration of airborne aerosols and nanoparticles as well as on the request for an effective barrier effects against bacteria (less than or equal 0.3 μm), viruses and other microorganisms. The filtration efficiency can be increased by fiber diameter reduction. Fibers in the nanometer scale were produced among others using solutions of polyacrylonitrile PAN and polyimide. At ITV Denkendorf provisions to increase the productivity in electro spinning are under investigation.

The home position polymerization during finishing. A nanometer granule in the reorganization process the home position production during medicinal preparation, will be allowed to cause a nanometer granule to be effective in the reorganization medicinal preparation is dispersed, this aspect research will include:

Wang qing, Chu Yanyan, Cui Shizhong of Area south of Yellow River engineering institute, take titanate acid butyl ester and the zinc acetate as the forerunner, the glacial acetic acid for the catalyst and peptizator, the absolute ethyl alcohol for the titanate acid butyl ester solvent, after the hydrolysis, the condensation responded the preparation titanium dioxide and the zinc dioxide and mix the silver ion nanometer sol reorganization medicinal preparation.

The Shanxi scientific and technical university, Ma Jianzhong, under the alkali catalysis condition take the tetraethoxy silane as a raw material, uses sol-gel method preparation nanometer SiO₂, uses in leather finishing. Daoud, Walid A. xin.john.h of nano technology center, Textile and Garment college, Hong Kong university of science and technology, studied the surface characterization of low-temperature processed titania coatings produced on cotton fabrics by the sol-gel method.

Mahlting, B of GMBU e.V., Arbeitsgruppe Funktionelle Schichten German, used the sol-gel method to prepare nano zinc oxide (ZnO) and titanium oxide on the fabric meanwhile produce the biocidal coatings based on silica nanosols.

The department of materials applied science in engineering college of Osaka University, used the polyethylene and the tetraethoxy silane by the sol-gel method to prepare the fluorizate finishing agent used on nylon fabric. By this way the fabric can acquire highly wear and oil repellency characteristic, and anti-wear characteristic.

Yadav, A.; Prasad, Virendra; Kathe, A.A.; Raj, Sheela; Yadav, Deepti; Sundaramoorthy, C.; Vigneshwaran, N of Nanotechnology Research Group, Central Institute for Research on Cotton Technology. In the present work, zinc oxide nanoparticles were prepared by wet chemical method using zinc nitrate and sodium hydroxide as precursors and soluble starch as stabilizing agent. These nanoparticles, which have an average size of 40 nm, were coated on the bleached cotton fabrics (plain weave, 30 s count) using acrylic binder and functional properties of coated fabrics were studied. On an average of 75%, UV blocking was recorded for the cotton fabrics treated with 2% ZnO nanoparticles. Air permeability of the nano-ZnO coated fabrics was significantly higher than the control, hence the increased breathability. In case of nano-ZnO coated fabric, due to its nano-size and uniform distribution, friction was significantly lower than the bulk-ZnO coated fabric as studied by Instron [registered trademark] Automated Materials Testing System.

Using the hole structure of textile fiber. Lies between the hole structure using the textile fiber, carries the nanometer material production and on the textile fiber load the research report which step completes quite to be few.

Dong Weiguo of Tianjin polytechnic university, (Weiguo Dong,2006)assembles the barium phosphate and the barium hydrogen phosphate granule using high-pressure autoclave into the cotton textile fibres, the temperature control in 150 °C below, washes after the standard 12 above time, rate of live weight growth maintains above 6%, its cotton fibres fabric anti- burns the index to be allowed to reach 21.5%, the textile fibres force drops is smaller than 30%.

The Zhejiang technical University's patent, picks hydro-thermal method,in textile home position production nanometer titanium oxide. The reaction temperature is 145 °C~200 °C.

Take the natural fiber material as the pattern plate, the preparation nanometer material research include:

Li, Nan; Li, Xiaotian; Wang, Wei; Qiu, Shilun of Jilin University, used human hair as template for the synthesis of mesoporous silica tubes. This was accomplished by immersing the human hair in the precursor solution of mesoporous silica then calcining in air. Products showed not only tubular morphology at micron scale but also mesophase at nanometer scale.

Huang, J.; Matsunaga, N.; Shimanoe, K.; Yamazoe, N.; Kunitake, T of Topochemical Design Laboratory, Frontier Research System, Institute of Physical and Chemical Research (RIKEN), Japan. SnO_2 nanotubular materials were prepared by using a natural cellulosic substance as template, and their morphologies were determined by scanning electron microscopy (SEM) and transmission electron microscopy (TEM). The sizes of the nanoparticle obtained by calcination at 300 and 900°C were 2.0 and 9.2 nm, respectively, in fair agreement with TEM observation.

4. The cotton fiber hole structure research

South China University of Science and Technology paper making and pulping project, country key laboratory, Tang Aimin, Zhang Hongwei, Chen Gang, Liu Yingyao, studied the cellulose textile fiber to be possible and the porous performance attribute, used the N_2 adsorption law, the dye adsorption law, the water retention value determination and so on to token the porosity of the cellulose textile fiber of different raw material. They also studied the change of the cellulose textile fiber relative surface accumulated, the amount of porosity, the aperture and the absorbability to the liquid after mercerization and the ultrasonic wave pretreatment. The result indicated that mercerization and ultrasonic wave processing can further enhance the water retention value and attainability surface area of the cellulose textile fiber.

A Yang, Zhou Xiang, Huang Wenhao, used the opposition gel permeation chromatography to test the relations between volume and diameter of differential coefficient attainability aperture in cotton fiber and the accumulation surface area of the aperture in the cotton fiber.

Dong Weiguo of Tianjin polytechnic university,has studied the structure of aperture inside of the cotton fiber used the nitrogen adsorption method. Through the analysis adsorption uniform temperature line and the DFT analysis to token the structure of aperture of cotton fiber (aperture volume, aperture diameter distribution). The result indicated that the interior of cotton fiber existence open hole. The aperture with 2.2 nm diameters, its volume density of distribution is the biggest. the apertures with diameter between 2.0 and 4.0nm,their volumes account for the total hole volume68.16%, the diameter of the aperture over 5.0 nm, their volumes account for the bulk volume 18.49%.

As is shown before, a new research about taking advantage of cotton fiber hole structure is possible.

5. Conclusion and Future

Liking Dr. Tushar Ghosh said that Nanotechnology ushering in a new phase of the textile industry with a bright future. Nanotechnology will not only help the marketing of fabric and fashion because of its unique and incompatible

properties but it is also a revolution for human beings just like the internet wave.

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