Superflexible Organic/inorganic Composite Nanofibrous Membrane towards Water Purification

Bing Gao, Xiaohai Huang, Zhi Liu*

Anhui Polytechnic University, Wuhu, China,

Abstract:

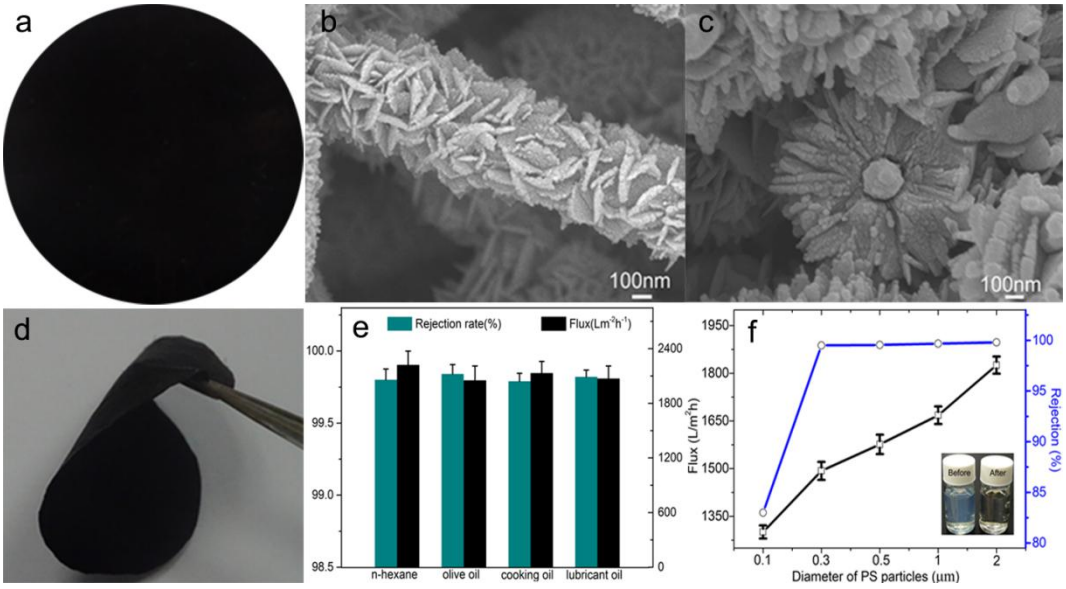

Fig. 1 Superflexible organic/inorganic composite nanofibrous membrane towards water purification, a PVDF-HFP/CuO-nanosheet membrane; b,c morphology of resulting membrane; d foldable membrane; e application in oil water separation; f application in microfiltration.

Superflexible organic/inorganic composite nanofibrous membrane was fabricated by electrospinning followed by hydrothermal method (Fig. 1). The resulting nanofibrous membrane shows superflexible, superhydrophilic and good mechanical properties. Therefore, this nanofibrous membrane exhibits potential application in water purification including water filtration, oil water separation, pollutants degradation, etc (Fig. 1).

Keyword：superflexible; nanofibrous membrane; organic/inorganic; water purification

Brief CV of Reporter：

Dr. Zhi Liu received his PhD degree in Textile Materials and Textile Design from Soochow University in 2017. He was studied in School of Environmental Engineering at Nanyang Technological University in Singapore form Dec. 30, 2015 to Jan. 6, 2017. He is currently associate professor in the School of Textile and Garment at Anhui Polytechnic University. His research interests include ultrafine nanofiber forming theory and industrialization in protein separation, medicine/food concentration and composites, functional fiber/textile fabric construction and application in filtration and protection textile, bio-based porous materials construction and applications in water purification and heat preservation. He has been responsible for more than 10 research programs, including National Natural Science Fund of China, Natural Science Fund of Anhui Provence, etc.

Investigation on electrochemical oxidation of glucose and gluconic acid using platinum catalyst

Yan Yongjie*

Research Initiative for Supra-Materials (RISM), Shinshu University, Nagano, Japan

Abstract: Glucose is considered as a promising biological fuel source for bio-energy supply. In recent years, as replacement of instable enzymes, platinum based abiotic catalysts have received much attention for catalytic oxidation of glucose. However, catalytic performance of glucose using platinum based catalysts is inferior compared with efficient bio-enzymes such as glucose oxidase. Since the oxidized product of glucose is considered gluconic acid and only two electrons are released from glucose, this research is to investigate the influence of gluconic acid on glucose discharge as well as the feasibility that the gluconic acid can be further catalyzed by using platinum catalyst. The results indicated that glucose has much higher electrode potential than gluconic acid. The presence of gluconic acid in the glucose solution decreased the electrode potential of the anode as well as the direct voltage between the anode and cathode. This would possibly reduce the corresponding current and discharge charge when used as a biofuel cell.

Keyword： Glucose; Fuel cell: Gluconic acid; Electrode potential

Brief CV of Reporter：

Yan Yongjie received his PhD degree in Bioscience and Textile Technology from Shinshu University, Japan in 2019. He is currently a Researcher in Research Initiative for Supra-Materials (RISM), Shinshu University, Nagano city, Japan. His research interests focus on the development of biological functional materials and bio-energy device.

Nanocellulose-Based Functional Materials: From Self Powered Sensor to Soft Robotic and Radiative Cooling

Pengfei Lv[1,2], Qufu Wei[2*]

1. School of Materials Science and Engineering, Tianjin University, Tianjin 300350, P. R. China.
2. Key Laboratory of Eco-Textiles, Ministry of Education, Jiangnan University, 1800 Lihu Avenue, Jiangsu Province, Wuxi 214122, P. R. China.

Abstract: Nanocellulose is currently in the limelight of extensive research from fundamental science to technological applications owing to its renewable and carbon-neutral nature, superior biocompatibility, tailorable surface chemistry, and unprecedented optical and mechanical properties. Nanocellulose-derived functional materials integrate important cellulosic properties with the features of nanomaterials, which are now being extensively applied in diverse fields such as self-powered sensors, soft robotics, and radiative cooling. The fundamental design and synthesis strategies for nanocellulose-based functional materials are discussed. Their unique properties, underlying mechanisms, and potential applications are highlighted. Finally, we will provide a brief conclusion and elucidate both the challenges and opportunities of the intriguing nanocellulose-based technologies rooted in materials and chemistry science. It is expected that the development of nanocellulose-based advanced functional materials will yield unlimited opportunities and challenges and will continue to be a prosperous research field involving scientists and engineers from diverse technological backgrounds.

Keywords：Nanocellulose; self-powered sensor; soft robotic; radiative cooling

报告人简介：吕鹏飞，天津大学材料学院助理研究员。2019年在江南大学纺织科学与工程学院取得博士学位（导师：魏取福教授）。于2017年-2018年赴美国北卡罗来纳州立大学生物材料系/化学系做访问学者。2019年8月加入天津大学材料学院先进高分子研究所国家杰青封伟教授、国家高层次人才王玲教授团队从事博士后研究工作。主要致力于功能纳米纤维材料的设计与制备及其在传感、智能可穿戴、软体机器人和热管理等领域的应用研究。迄今已发表SCI学术论文50余篇，累计被SCI引用843次（H-因子18），申请中国发明专利8项，主持国家自然科学基金、中国博士后科学基金、国家公派创新型人才、江苏省研究生创新工程等国家级（或省部级）项目6项。近年来，以第一/通讯作者在*Adv. Funct. Mater.*、*Mater. Horiz.*、*Chem. Eng. J.*、*Carbohyd. Polym.*、*Mater. Design*、*Cellulose*、*Nanotechnology*等国外SCI期刊发表论文13篇（总IF > 100：其中1区论文6篇包括IF > 10的论文4篇，Top论文10篇）和EI论文1篇。曾获江苏省优秀博士论文（2020）、王善元优博基金（2021）和国家奖学金等荣誉。

纱线基多功能柔性器件构筑及性能研究

罗磊
武汉纺织大学，武汉，中国

摘　要:

随着柔性电子器件的不断发展,可检测人体动作、感知环境变化、兼具储能特性等多功能柔性电子器件逐渐受到人们关注。纺织纱线因具有多孔、柔性和强度等优点被视为良好的柔性基底。本研究以棉纱为柔性基底，通过负载多壁碳纳米管和聚吡咯，结合纺纱技术，构筑不同类型的柔性电子器件，探究其传感性能、电化学性能和电热性能等，为制备多功能可穿戴柔性电子器件提供了重要参考和理论基础。

关键词：纱线；传感器；超级电容器

报告人简介：

罗磊，1990年生，男，博士，副教授，硕士生导师，国家非织造材料工程技术研究中心博士后，中国纺织工程学会会员，美国纤维学会会员，2017年获美国北卡罗莱纳州立大学与江南大学联合培养博士学位，同年入选湖北省级人才项目资助，加盟武汉纺织大学纺织科学与工程学院任教。主要从事功能纺织材料的制备及其应用研究，近年来主持包括湖北省自然科学基金，湖北省教育厅科研项目，教育部重点实验室开放基金，仙桃市科技局重点研发项目等多项科研项目。发表SCI论文30余篇，以第一/通讯作者在Electrochimica Acta、Chemical Engineering Journal、Materials & Design等国际学术期刊发表论文15篇。获授权专利2项。

相变储能纤维的研究进展

柯惠珍
闽江学院，福州，中国

摘　要：相变储能材料已经广泛应用于建筑节能、太阳能储存、电池产品、储能调温纤维及其纺织品等许多领域。相变储能材料的种类可分为有机、无机以及共晶相变储能材料。相变材料的储热相变温度对其在储能调温纤维及纺织品的应用具有重要的影响。报告将重点介绍相变储能纤维的种类及其制备方法，并比较不同种类相变储能纤维的结构与储热性能特点。总结相变储能纤维用常见相变储能材料和支撑材料的种类及特征，展望相变储能复合纤维材料的研究方向及发展前景。

关键词：相变材料；储能纤维；储热调控

报告人简介：

柯惠珍，博士，副教授，硕士生导师。福建省高层次C类人才，“闽都学者”拔尖人才，福建省纺织服装实验教学示范中心主任，福建省新型功能性纺织纤维及材料重点实验室常务副主任。

主要研究方向：聚合物功能纤维材料、高效纳米纤维水/空气净化膜的设计研发、纺织材料功能化加工技术等研究。

主要业绩：2018年入选福建省高校杰出青年科研人才培育计划。2017年博士学位论文获得王善元全国纺织科学与工程一级学科优秀博士学位论文奖。2014-2015年国家公派留学于美国纽约州立大学石溪分校。主持和参与国家级、省级等项目40余项。在国内外期刊上发表第一作者和通讯作者学术论文60余篇，其中SCI收录论文40余篇，授权专利50余项。指导大学生创新创业国家级、省级等项目7项。获得福州市自然科学优秀学术论文一等奖2项，福建省自然科学优秀学术论文三等奖1项。

Construction of Durable and Stable Electromagnetic Interference Shielding Fabrics

Lihua Zou[1] and Zhenzhen Xu[*]
1. Anhui Polytechnic University, Wuhu, China,

Abstract: Durable electromagnetic interference (EMI) shielding is highly desired, as electromagnetic pollution is a great concern for electronics' stable performance and human health. Although a superhydrophobic surface can extend the service lifespan of EMI shielding materials, degradation of its protection capability and insufficient self-healing are troublesome issues due to unavoidable physical/chemical damage under long-term application conditions. Here, we report, for the first time, an instantaneous self-healing approach via microwave heating to achieve durable shielding performance. First, a hydrophobic layer was coated on a polypyrrole (PPy)-modified fabric, enabling protection against the invasion of water, salt solution, and corrosive acidic and basic solutions. Moreover, after being damaged, the hydrophobic layer can be instantaneously self-healed via microwave heating for a very short time, i.e., 4 seconds, benefiting from the intense thermal energy generated by PPy under electromagnetic wave radiation. This self-healing ability is also repeatable even after intentionally severe plasma etching, which highlights the great potential to achieve robust and durable EMI shielding applications. Significantly, this approach can be extended to other EMI shielding materials where heat is a triggering stimulus for healing thin protection layers. We envision that this work could provide insights into fabricating EMI shielding materials with durable performance for portable and wearable devices, as well as for human healthcare.

Keyword ： Electromagnetic interference shielding, Superhydrophobic coating, Multifunctional textiles, Self-healing, Conductive polymer

报告人简介：

邹梨花，女，安徽工程大学讲师。2015年11月毕业于东华大学纺织学院，获工学博士学位。2019年12月至2020年12月赴美国特拉华大学研修12个月。主要从事电磁屏蔽及智能纺织品的研发工作。在国内和国际知名期刊Nano-Micro Letters, Nanoscale，Journal of Colloid and Interface Science，Advanced materials interfaces等发表论文16篇，授权发明专利5篇，主持和参与多项省部级项目。

一维、二维纳米材料通过涂层结构优化策略制备柔软的高性能电磁屏蔽织物

兰春桃[1*]， 邹梨花[2] , 徐珍珍[2]
1. 中国科学院北京纳米能源与系统研究所，北京， 中国
2. 安徽工程大学，芜湖， 中国

摘　要: 随着电子产品和无线通讯技术的迅猛发展，电磁辐射污染已经对精密仪器性能和人体健康造成威胁。电磁屏蔽织物能够保护电子器件和生物体免受电磁辐射的危害，开发具有高效电磁屏蔽性能的涂层织物显得尤为迫切。然而，由于电磁屏蔽性能与其柔软性对导电涂层厚度一般有相反的要求，在同一织物中实现两者之间平衡仍然充满挑战。这里，通过增强屏蔽单元与电磁波间的相互作用来优化织物表面的涂层结构，以此提升单位厚度涂层的屏蔽效率，降低涂层厚度，从而获得柔软的高性能电磁屏蔽织物。首先利用一维导电纳米材料碳纳米管（CNT）作为电磁屏蔽单元，通过提高CNT的含量、调控CNT的排列来提高复合涂层的导电能力；在涂层厚度为微米级时使织物电磁屏蔽性能满足商业用标准。随后，在涂层中引入二维纳米材料，构筑导电/绝缘的层状结构，以此增加电磁波在涂层内部的多次反射；通过该方法在涂层纳米厚度时使织物电磁屏蔽性能满足商业用标准。通过以上研究，证实了涂层结构优化策略能够有效制备柔软高效的电磁屏蔽涂层织物，为电磁屏蔽涂层织物的实际应用提供了可能。

关键词：电磁屏蔽；涂层织物；导电纳米材料

报告人简介：兰春桃，女，中国科学院北京纳米能源与系统研究所助理研究员。2020年6月毕业于东华大学纺织科学与工程学院，获工学博士学位。2018年9月至2020年6月获国家留学基金委资助，赴美国Georgia Institute of Technology进行了为期22个月的联合培养。主要从事智能纺织品的研究和开发。在国际知名期刊Advanced Materials， Advanced Energy Materials, Nano-Micro Letters, ACS Applied Materials & Interfaces等发表14篇；参与多项国家级项目。

MXene Modified Textiles and Their Applications on Wearable Electronics

Xianhong Zheng[1*]
1. Anhui Polytechnic University, Wuhu, China,

Abstract: The purpose of this research is to study the microstructure, joule heating, EMI shielding, electrochemical and pressure sensing performance of MXene decorated fabrics. MXene was deposited on the fabrics through various methods including spray-coating, layer-by-layer, pad-drying. The results show that intrinsic flexibility and breathability of fabrics were retained and good electrical conductivity was achieved after the MXene modification. In addition, MXene decorated fabrics had the good EMI shielding performance (EMI SE_T=36.62 dB), exceptional joule heating performance (146.7 °C at 5V), good electrochemical performance (capacitance, 1000.2 mF/cm^2) and excellent pressure sensing performance including high sensitivity (28.723 kPa^{-1}), wide sensing range (0-17.4 kPa) and high linearity (R^2=0.996). MXene decorated fabrics demonstrated potential applications on wearable electronics including electrothermal physiotherapy, flexible energy storage, electronic skin, human-machine interface, etc.

Keyword：MXene; EMI shielding; joule heating; piezoresistive sensor; supercapacitor

Brief CV of Reporter：

Dr. Xianhong Zheng received his B.S. Degree from Zhongyuan University of Technology in 2013, and received his Ph.D. degree from Donghua University in 2019. He studied in University of Texas at Dallas during 2017-2018 as a joint PhD student under the supervision of Prof. Ray Baughman, and researched on carbon nanotube-based artificial muscles. He is currently an assistant professor in college of textile and garment, Anhui Polytechnic University. His research interests are flexible smart wearable devices and functional textiles. He has published more than 15 SCI papers in the above fields, such as Journal of Materials Chemistry A, ACS Applied Materials & Interfaces, Nanoscale, Journal of Colloid and Interface Science, Materials & Design.

A Lightweight MXene-Coated Nonwoven Fabric with Excellent Flame Retardancy, EMI Shielding, and Electrothermal/Photothermal Conversion for Wearable Heater

Xiansheng Zhang*, Xifeng Wang, Zhiwei Lei, Lili Wang

College of Textiles and Clothing, Research Center for Intelligent and Wearable Technology, Qingdao University, Qingdao 266071, P. R. China

Abstract: Multifunctional wearable heater has attracted great interest in personal thermal management, but its potential safety hazards triggered by overheat remain. Herein, in order to minimize the risk of high-temperature induced ignition, a flame retardant Aramid nonwoven fabric was attempted to combine with the highly conductive MXene, where an intimate interface was constructed through their inherent abundant functional groups and the assisted plasma treatment. Interestingly, a very lightweight wearable heater with electromagnetic interference shielding (EMI efficiency of 36 dB for single-layer fabric), electrothermal conversion (up to 260 °C in 76 s at a supply voltage of 5 V) and photothermal conversion (up to 105 °C after irradiation for 175 s at light intensity of 125 mW cm^{-2}) properties was achieved. These integrated properties arose from the interlacing conductive network cooperated by nonwoven fabric and stacked MXene nanosheets, which facilitated the multiple reflection and absorption of electromagnetic waves or light, as well as the low thermal conductivity. More importantly, the newly formed physical barrier from carbonization of the MXene further enhanced the flame retardancy of nanocomposite fabrics, guaranteeing the security in use. This research provides a versatile yet efficient path to fabricate the new generation of safe wearable MXene-based heater, which will expand their working temperature range.

Keyword： Wearable heater; Flame-retardancy; Electromagnetic interference shielding; Electrothermal conversion; Photothermal conversion

报告人简介：张宪胜，青岛大学副教授/校特聘教授，硕士生导师。主要从事石墨烯/MXene等二维纳米材料在功能纺织品中的应用研究，以及耐高温阻燃纺织材料的研究与开发。目前以第一作者或通讯作者在Advanced Materials、ACS Applied Materials & Interfaces、Journal of Hazardous Materials等高水平期刊发表SCI收录论文10余篇，其中入选高被引论文1篇。参与国家重点研发计划-“高品质阻燃纤维及制品关键技术”，主持国家自然科学基金、山东省自然科学基金、中国博士后科学基金等项目。获得山东省科技进步二等奖一项、“中国化学纤维工业协会.恒逸基金”优秀学术论文一等奖一项、中国纺织工程学会陈维稷优秀论文奖一项。目前担任中国纺织工程学会毛纺织专业委员会委员、中国纺织工程学会科普传播专家。

Preparation of porous carbon nanofibers by sacrificial activation method and performances of supercapacitor electrode

He Wang
Anhui Polytechnic University, Wuhu, China,

Abstract:

Carbon nanofibers from electrospun polymer nanofibers have received considerable attention. However, most of the carbon nanofibers with a surface area above 1000 m^2/g were reported to have a supercapacitor electrode capacitance far below 350 F/g. Herein, we report a novel carbon nanofibrous material that has a supercapacitor electrode capacitance as high as 394 F/g (1.0 A/g). We used a polymer blend of polyacrylonitrile (PAN) and novolac (NOC) as materials, to electrospin them into precursor nanofibers and subsequently carbonize the nanofibers into carbon nanofibers. The carbon nanofibers prepared had a specific surface area as high as 1468 m^2/g with a meso-micro pores (average pore size 2.2 nm) predominated porous structure. The carbon nanofiber electrodes after 10,000 cycles of charging and discharging at 1.0 A/g maintained the capacitance almost unchanged. At the optimal condition, the supercapacitor device made of the electrodes had an energy density as high as 13.6 Wh/kg (at 0.5 kW/kg). The high capacitance value comes from the carbon nanofibers with a large surface area and a unique porous structure. The high inter-fiber interconnection contributes to high capacitance. This super-high surface area carbon may be useful for the development of high-performance supercapacitors and other energy devices.

Keyword：Carbon nanofibers; Supercapacitor; Electrode; Micropores; Electrospinning

Brief CV of Reporter：

Mr. He Wang received his PhD degree in Textile Science and Engineering from Tiangong University, Tianjin, China. in 2020. He is currently a Lecturer in the School of Textile and Garment at Anhui Polytechnic University. His research interests include carbon nanofiber materials, porous carbon materials, and processing and modification of biomass materials.

He has been published many articles in high-level journals at home and abroad, e. g. Journal of Textile Research, Journal of Power Sources, Polymer, ACS Applied Energy Materials, etc.

Structural Design of Wrapped Fiber reinforced Composite and its Compressive Properties

Fangtao Ruan[1,2] and Zhenzhen Xu[*]
1 Anhui Polytechnic University, Wuhu, China,
2 AnHui Province International Cooperation Research Center of Textile Structure Composites

Abstract: Axial compression performance is one of the main factors considered in structural design of fiber reinforced composites. However, the properties of the fiber in the composites are weak because of the orientation structure in the composites. Filament fibers were wrapped with reinforced fibre bundles to improve the axial compressive properties of composites in this report. The effect of fiber covering on the axial compressive properties and failure modes of composites were studied, quantitative relationship between fiber coating conditions and compressive modulus and failure strength of composites was established. Through observation of failure interface and internal microstructures, establishing the relationship between mechanical behavior and microstructural changes, than clarifying the transformation conditions between the two failure mechanisms of fiber buckling instability and kinking band failure. The research results can further optimize the structure of fiber reinforced plastic, improve the efficiency of composite structure system.

Keyword： Fiber reinforced composites; structure design; Stress transfer mechanism; Compression failure mode; Failure mechanism control

Acknowledgment
This work was supported by the National Natural Science Foundation of China (No51 903001) and Anhui Province International Science and Technology Cooperation Progra m(1804b06020360)

Brief CV of Reporter：
Dr. Fangtao Ruan received his Master's degree in Functional fiber from Tianjing Polytechnic University in 2012, and PhD degree in Fiber engineering from Shinshu University in 2016. He is currently an associate professor in the School of Textile and Garment at Anhui Polytechnic University. His research interests include fiber surface treatment and interface properties with resin, structural design and preparation of fiber reinforced composites, preparation and modification of functional composites, interface structure analysis and performance evaluation. He has been responsible for 5 science research programs, including National Natural Science Fund of China, Anhui Province International Science and Technology Cooperation Program, Returning brains Innovation Project Preferential Funds of Anhui province, etc.

Preparation technology of braided preform of composites

Yantao Gao*

Shanghai University of Engineering, School of textiles and Fashion, Shanghai, China,

Abstract: Braiding technology is an important method of manufacturing preforms of textile structural composites. The report will firstly review the history of braiding technology. Then the integrated design of manufacturing method of braided preforms will be introduced by 2D or 3D braiding technology. Besides, a novel hexagonal braiding technology will also be introduced. The principle of hexagonal braiding, machine control, simulation of braided architecture and potential application will be presented in detail. At last, a software package developed by author for braid design will be exhibited.

Keyword: 2D braiding; 3D braiding; Preform; Composites; Hexagonal braiding

Brief CV of Reporter：

Yantao Gao obtained his Ph.D. degree from Donghua University in 2013. He had been worked in Shanghai institute of applied physics from 2013.10-2020.08 and then joined in school of textiles and fashion，Shanghai university of engineering science.

E-mail: gaoyantao@sues.edu.cn

Experimental and Numerical Study of Inter-yarn Friction Affecting M echanism on Ballistic Performance of Twaron® Fabric

Yanyan Chu[1], MD.Riazur Rahman[1], Shengnan Min[2] , Xiaogang Chen[3],
1. Zhongyuan University of Technology, Zhengzhou, Henan, 450000, China
2. Beijing Institute of Fashion Technology, Beijing, 100029, China
3. The University of Manchester, Manchester, M1 3 9PL, UK

Abstract: Most previous numerical investigations show that inter-yarn friction is one of the critical parameters to ballistic performance of woven fabrics under ballistic impact. However, the effects of inter-yarn friction on the ballistic performance of those fabric sare not approved by empirical work. There are two premises to empirically prove the numerical analyses, where the fabric structure and yarn mechanical properties and the weight are almost kept. Our previous investigation show that TiO2/ZnO composites o nthe yarn surface by sol-gel treatment can keep yarn mechanical properties and weight unaffected but significantly increase the inter-yarn friction. In this way, TiO2/ZnO co mposites generated by sol-gel treatment were coated to the ballistic fabrics through dip -pad-dry process to vary the inter-yarn friction. Ballistic perforation tests were conduct ed to those fabrics under impact velocity of 460-500 m/s with one-gram weight cylind rical projectile and the numerical simulation work were also carried out. Through com parisons between ballistic impact tests and numerical results, it shows that higher inter -yarn friction is better for energy absorption, especially at more fabric layers. Both nu merical analysis and experimental work have approved that higher inter-yarn friction w ould lead to more large areas engaged in energy absorption and shear broken become more pronounced.

Keyword： Inter-yarn friction; TiO_2/ZnO; Energy absorption; Sol-gel.

Brief CV of Reporter：

Dr Yanyan Chu received her PhD degree in Textile Science and Technology from The University of Manchester, Manchester, UK. in 2015. She is currently an associate professor and GSI in the Textile and Garment Industry Research Institute at Zhongyuan University of Technology. Since 2012, she has been engaged in the research of developing lightweight bulletproof fabrics, and has carried out a number of exploratory and innovative research work in the field of bulletproof fabrics. She has published more than 20 academic papers, and more than 10 papers are included in SCI zone. She participated in the publishment of one English book named “Advanced Fibrous Composite Materials for Baltic Protection”. She hosts one Henan Provincial Key R & D Promotion Special Project (Scientific and Technological Breakthrough), and takes part in one National Natural Science Foundation of China（Youth Fund). She also presides over 2 Planned and Guided Projects of China Textile Industry Federation and one project of Henan Backbone Teacher Funding Program. In 2016, she completed one provincial project of "Research on Nanotechnology for Soft Bulletproof Clothing", which is the Basis and Frontier Project of Department of Science and Technology of Henan Province;

Study on in-plane compression properties and numerical modeling of three dimensional five-directional braided composites

Hongmei Zuo*

Anhui Polytechnic University, School of textile and Garment, Wuhu, China,

Abstract: Delamination phenomenon often occurs on traditional laminated composites while 3D five-directional braided composites (3D5dBC) could avoid this defect in practical application. In this work, the mechanical properties and failure mechanisms of 3D5dBC with different braiding angles are investigated at room temperature under transversal and longitudinal compression via experiments and finite element analysis (FEA) simultaneously. Meanwhile, the compression properties at elevated temperature are also researched. It is found that mechanical properties of composites under longitudinal compression are superior to those under transversal compression. Composite with small braiding angle possesses higher strength and modulus comparing to those of large braiding composite. Moreover, at room temperature, 3D5dBC exhibits 45º shear crack failure mode under transversal compression originated from matrix cracking, fiber failure along Z-direction obtained from FEA, and interfacial debonding; Under longitudinal compression, the structure shows shear expansion failure feature due to thorough fracture of axial yarns along L-direction, braiding yarns fracture along L-, T- and Z-direction, and matrix cracks obtained from FEA. With temperature increasing, interfacial debonding of fiber/matrix gets obvious. The microscopic failure modes and process at room temperature are well explained by FEA method.

Keyword：3D braided composite; Mechanical properties; Damage mechanics; Finite element analysis

Brief CV of Reporter：

Hongmei Zuo obtained her Ph.D. degree from Beihang University. She will join School of textile and Garment, Anhui Polytechnic University soon.

E-mail: zuohongmei1@126.com

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Preparation and Strength Properties bamboo leaves liked polylactic acid /polyethylene glycol micro-nano fabrics via double-stage drafting m elt blowing process

SUN Huan-Wei[1], ZHANG Heng[1*] and NI Qing-Qing[2]

1. Zhongyuan University of Technology, Zhengzhou, China

2. Shinshu University, Ueda, Japan

Abstract: The good biocompatibility and biodegradability of polylactic acid (PLA) melt blowing nonwovens have gradually replaced traditional polyolefin (polypropylene, polyethylene and polyester) melt blowing nonwovens and have been widely used in the application home appliance, packaging and medical care. However, PAL melt blowing nonwovens still have the bottlenecks of highly brittleness and insufficient mechanical properties. Thus, the samples of bamboo leaves liked PLA/polyethylene glycol (PEG) melt blowing nonwovens were one-step prepared by a double-stage drafting process. Thermodynamic properties, structure morphology, mechanical properties and crystallinity of prepared samples were also experimental analyzed. The SEM images implied that the proportion of fibers with the angles less than 20 ° paralleled the machine direction was increases from 28 % to 100 % with the drafting ratio was increased from 1.0 (un-drafting) to 3.0. Besides, the crystallinity of the samples increased from 1.22 % to 37.43 %. Benefiting from the above results, the modulus of the sample increased to 4.20 N/mm² (2.2 times) and decreased to 0.35 N/mm² (4.9 times) in machine direction and cross direction, respectively. From the above, this bamboo leaves licked PLA / PEG melt blowing nonwovens provides the possibility for the industrial application of high-strength medical protective materials.

Keyword: Nonwovens; Polylactic Acid; Micro-nanofiber; Melt Blowing; Bamboo Leaves structure; Double-stage Drafting;

High-binding-fastness Dye from Functional Extracts of Keemun Black Tea Waste for Dyeing Flax Fabric

Peng Wang
Anhui Polytechnic University, Wuhu, China,

Abstract: Black tea natural dye is usually recognized to contain functional coloring matters, which has long been used for the coloration of textile materials. However, due to poor binding and color fastness, a large number of mordants are used in the dyeing process, leading to serious environmental problems. To address these issues, we have developed a no-mordant pad-dry dyeing strategy for dyeing flax fabric with functional components of Keemun black tea (KBT) waste. The dyed flax fabric showed outstanding color fastness to perspiration, rubbing, and washing. Moreover, increasing the KBT extract concentration, dyeing time, and temperature, and decreasing the pH level could significantly enhance the K/S values. FTIR and XPS results revealed that theaflavin compounds dyed thoroughly the fibers successfully through hydrogen bonding force, and the theaflavin compounds could be bound to fibers stably through van der Waals and hydrogen bonding forces based on Independent Gradient Model (IGM) calculations. In addition, the dyed flax fabric possessed good UV protection and antibacterial performance. This work proposes novel approaches for the reuse of KBT waste and the simultaneous coloration and functionalization of flax fabric.

Keyword：Keemun black tea; Flax fabric; Natural dye; Binding fastness; Functional extract

报告人简介：

王鹏，2019 年获得天津工业大学纺织科学与工程专业博士学位，2020 年 1 月至今在安徽工程大学纺织服装学院担任教学研究人员。研究领域包括纺织化学与生态染整技术、环境催化与净化材料、纺织工业废水处理技术以及室内空气污染控制技术等。近年来，成功研制了宽光谱响应锐钛型纳米 TiO_2 水溶胶环境整理剂制备技术，创新开发了减压蒸馏、有机酸处理和 pH 调控等溶胶精制后处理复合技术，并攻克了宽光谱响应锐钛型纳米 TiO_2 水溶胶整理功能织物的制备技术，基于传统轧烘焙工艺技术建成了国内首条光触媒家纺织物（窗帘、墙布等）和汽车用纺织品生产线。利用该成果所制备的环境净化功能纺织品能够在太阳光辐射下显示出高催化活性，成功净化室内和车内甲醛等污染物。先后参与并完成天津市应用基础与前沿技术研究计划项目、浙江省绍兴市公益项目、江苏省双创人才项目等，并主持安徽省高校自然科学研究重点项目、安徽省纺织面料重点实验室开放基金等纵向课题以及多项产学研项目，获得 2020 年江苏省科技副总人才项目。分别在国内外 SCI 和 EI 等收录期刊如“Industrial Crops and Products”、“Cellulose”、“Journal of Cleaner Production”、“Colloid & Polymer Science”、“Fibers and Polymers”、“Materials & Design”、“Carbohydrate Polymers”、“Textile Research Journal”、“International journal of molecular sciences”、“Water Practice & Technology”和中文核心期刊如“纺织学报”、“针织工业”等发表学术研究论文二十余篇，申请发明专利 13 项，获授权 8 项，并获得省部级二等奖两项。

Processing and Performance Evaluation of High-Strength Thermoplastic Composites

Yan-Yu, Lin[1], Mei-Chen, Lin[2], Limin Bao[2], Ching-Wen, Lou[3], Jia-Horng, Lin[4*]

[1] Department of Fiber and Composite Materials, Feng Chia University, Taichung, 407802, Taiwan

[2] Shinshu University, Nagano Prefecture 390-8621, Japan

[3] Department of Bioinformatics and Medical Engineering, Asia University, Taichung, 413305, Taiwan

[4]Laboratory of Fiber Application and Manufacturing, Department of Fiber and Composite Materials, Feng Chia University, Taichung, 407802, Taiwan

ABSTRACT:

In this study, different high modulus fabrics were compounded through a flat hot-pressing method to reinforce the thermoplastic polyurethane and successfully prepared high-strength thermoplastic composites. Among them, thermoplastic polyurethane is used as the base material, and high-modulus carbon fiber, glass fiber and Kevlar fiber are used as reinforcing materials. The result shows that the three high-strength thermoplastic composite materials have a sandwich structure and good flexibility; the high-modulus fabric and the TPU sheet have excellent adhesion capabilities. This study uses a two-step method to prepare high-strength thermoplastic composites. The process is simple, fast and has the characteristics of easy subsequent processing, which gives it a wider range of applications.

C6位羧基纤维素制备及其对金属离子吸附性能

李继丰，张涵林，戴千淳，杜兆芳*
安徽农业大学，合肥，中国
dzf@ahau.edu.cn

摘　要: 为了提高纤维素对金属离子污染物的吸附能力，本研究采用选择性氧化体系制备了C6羧基微晶纤维素(CMCC)。利用现代测试和表征技术分析了CMCC的氧化过程和氧化机理，研究了CMCC对Cu^{2+}的吸附能力。结果表明，HNO_3/H_3PO_4-$NaNO_2$氧化体系将(微晶纤维素)MCC大分子中吡喃糖环上的C6伯羟基选择性氧化为羧基。通过CP/MAS ^{13}C NMR对氧化前后的CMCC进行分析，发现响应峰分辨率和峰肩形状存在显著差异。MCC的C6响应信号位于62- 69ppm，而CMCC的响应信号在该位置减弱，在175ppm附近出现显著的羧基碳原子响应信号。氧化反应在一定程度上腐蚀了MCC的表面，提高了MCC的吸湿性，降低了结晶度，降低了MCC的热稳定性。对Cu^{2+}的吸附实验表明，CMCC对Cu^{2+}的吸附符合准二级动力学模型和Langmuir等温线，饱和吸附量高达165.5 mg/g。吸附热力学分析表明，吸附主要是通过羧基与金属离子之间的化学反应。吸附反应是放热的自发反应，并伴随着熵的减小，说明吸附反应过程中CMCC表面的无序性不断减少。结果表明，含羧基活性基团的功能纤维素可作为一种高效吸附剂，在金属离子污染处理领域具有广阔的应用前景。

关键词：氧化纤维素；C6选择性氧化；铜离子；吸附热力学；吸附动力学

报告人简介：李继丰，现为安徽农业大学纺织材料方向在读博士研究生，导师是杜兆芳教授。2019和2016年分别在安徽农业大学获得纺织工程专业获硕士学位、本科学位。

Ultrathin, ultralight, and anisotropic ordered reduced graphene oxide fiber electromagnetic interference shielding membrane

Lu Xu[1], Yubin Dong[1] and Qing-Qing Ni[1,2]
1 Zhejiang Sci-Tech University, Hangzhou, China,
2 Shinshu University, Ueda, Japan

Abstract: The purpose of this research is to study the electromagnetic interference shielding effectiveness (EMI SE) of ordered reduced graphene oxide fiber (oRGOF) membranes with different fiber orientations. The electrical resistivity of the oRGOF membrane at 0°, 45°, and 90° was measured by rotating the membrane to change the fiber orientation between the axial direction of the fiber and the four probes. A vector network analyzer was used to perform EMI SE tests on samples with different fiber orientation in accordance with the standard waveguide method. The results show that the oRGOF membranes had obvious anisotropic electrical resistivity and directional EMI SE. The measured electrical conductivity along the fiber axial direction (0°) was much higher than that along the fiber radial direction (90°). Furthermore, the EMI shielding performance difference under different fiber orientations was more than 25 dB (31.0 dB at 0°, 4.9 dB at 90°). The thickness of the resultant oRGOF membrane was 0.03 mm and area density of 0.9 mg cm^{-2}, and the specific EMI SE (SSE/t) was 33333 dB cm^2 g^{-1} along the fiber axis. The oRGOF membranes showed flexible and durable performance under repeated bending and straightening cycles tests over 160 times, without significant reduction of the shielding performance.

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Keyword： Graphene fiber; anisotropic electrical resistivity; directional EMI shielding effectiveness.

Brief CV of Reporter：
Lu Xu is a Ph.D. candidate in materials Science and Engineering at Zhejiang Sci-Tech University, China.