Superflexible Organic/inorganic Composite Nanofibrous Membrane towards Water Purification

Bing Gao, Xiaohai Huang, Zhi Liu*

Anhui Polytechnic University, Wuhu, China,

Abstract:

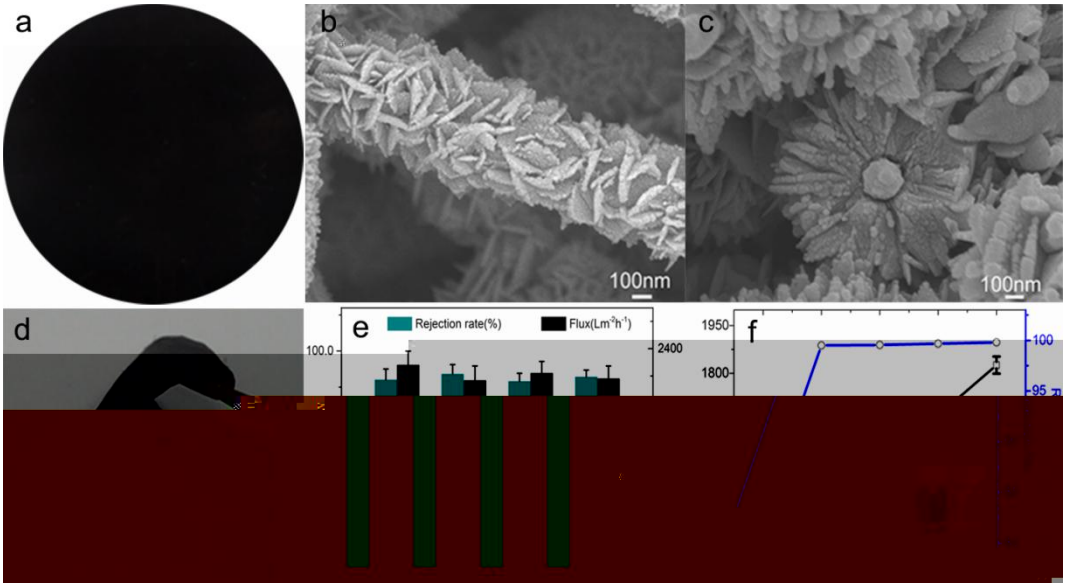

Fig. 1 Superflexible organic/inorganic composite nanofibrous membrane towards water purification, a PVDF-HFP/CuO-nanosheet membrane; b,c morphology of resulting membrane; d foldable membrane; e application in oil water separation; f application in microfiltration.

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.

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

:

,

1990

2017

SCI 30 /

Electrochimica Acta Chemical Engineering Journal Materials &

Design 15 2

:

C “

”

/

2018 2017

2014-2015

40

60 SCI 40 50

7

2 1

[illegible] Conference on Composite Materials

[illegible] Stable Electromagnetic Interference [illegible] Shielding Fabrics

Lihua [illegible] and Zhenzhen Xu*
[illegible] *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

[1*] [2], [2]

1.

2.

:

CNT

CNT CNT

/

2020 6

2018 9 2020 6 Georgia Institute of Technology 22

Advanced Materials Advanced Energy Materials, Nano-Micro Letters, ACS Applied Materials & Interfaces 14

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 microstructu

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

/

/MXene

Advanced Materials ACS Applied Materials & Interfaces Journal of Hazardous Materials SCI 10 1

-“ ”

“ . ”

Preparation of porous carbon nanofibers by sacrificial activation meth od 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 × . l kWrbon ×anofibers ith ϡ co ginŶ

Hom elo na se 5sncd " qn Aigh
digh Tapacitance axewiperc] igh δurface PreaCarbon 5anofibers.
d_ bus ғt Knhui Kolytechnic aɪpu

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

*@arsq `bs*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-pla compres properties and umeri leling three ensional e-directional br d comp

Hongmei Zuo*

Anhui Polytec University, hool of textile Garment, Wuhu,

Abstract: Delamination phenomenon often occurs on traditional laminated while 3D five-directional braided composites (3D5dBC) could avoid this defec application. In this work, the mechanical properties and failure mechanisms of different braiding angles are investigated at room temperature under longitudinal compression via experiments and finite element analysis (FE Meanwhile, the compression properties at elevated temperature are found that mechanical properties of composites under longitudinal co sup to those under transversal compression. Composite with small braidi sses hi strength and modulus comparing to those of large braiding com ver, at ro temperature, 3D5dBC exhibits 45º shear crack failure mode u al compress originated from matrix cracking, fiber failure along Z-dire from FEA, interfacial debonding; Under longitudinal compression, the ws shear expans failure feature due to thorough fracture of axial yarns alo tion, braiding ya 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 SchĶtD ᵡq

2021 China-Japan Academic and Technical Exchange Conference on Composite Materials

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

2019 2020 1

TiO_2

pH

TiO_2

2020

SCI EI “ 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 ” “ ” “ ”

13 8

C6

*

dzf@ahau.edu.cn

:

C6 (CMCC)
CMCC CMCC Cu^{2+}
HNO_3/H_3PO_4-$NaNO_2$ ( )MCC
C6 CP/MAS ^{13}C NMR CMCC
MCC C6
62- 69ppm CMCC 175ppm
MCC
MCC MCC Cu^{2+}
CMCC Cu^{2+} Langmuir
165.5 mg/g

CMCC

C6

2019 2016

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.

This work was supported by National Natural Science Foundation of China (No.52073 259).

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.