

The Innovative Research of Graphene Composite Fiber Fabric in Functional Fashion

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Keywords: Graphene; Composite fiber; Functional; Fashion design

Abstract: Graphene has attracted the attention of researchers in many fields as a new type of nanomaterial. Among them, the "light application" combined with fashion design is a new research direction in the field of development and design in functional fashion. Through sorting and summarizing the characteristics of graphene composite fiber (GCF) fabrics, this study further proposes innovative application proposals of GCF in the design of functional fashion products. At the same time, it puts forward the development status and trend prospect of functional fashion which integrates practicality, innovation and other aspects in the current environment.

1. Introduction

In recent years, with the rapid development of economy and society, the ever-changing technological development has brought unprecedented great impact on the fashion industry. The combination of high-tech fabrics with the field of fashion design creates many different sparks. Fashion also begins to break through its basic functions such as covering and keeping warm, and is developing rapidly towards the direction of functionalization, intelligence and fashion [1]. Among so many new science and technology materials, graphene material, one of the most subversive and innovative new materials in the 21st century, has shown a strong development trend in many fields such as energy, biology and medicine by virtue of its own advantages and properties. The application of graphene composite fiber (GCF) fabric in the field of textile and costume has also come to the fore, which has gradually become a research hotspot in the field of functional fashion design.

However, in the current research results of the fashion industry and fashion design, the research on GCF fabrics mainly focuses on the fabric characteristics and functional research and development, and the related research on market-oriented product promotion and product design and development of the fabric are slightly insufficient. In other words, the related results transformation and product development degree have their own deficiencies, which mean that the relevant research remains to be further in-depth.

In the field of fashion, the use of new fabrics can not only enhance the functionality and fashion degree of fashion design products, but also bring high added value and irreplaceability to the enterprises, and even become a lever to subvert an industry. Therefore, this study focuses on the combination of traditional fabrics and GCF fabrics, and applies them into functional fashion design development through means of fashion design and operation, aiming to propose a clear development direction for innovative costume integrating functionality and vogue.

Graphene is one of the materials with the highest strength as well known, which has high property of toughness that can be bent. The thickness of graphene is only 0.335 nm, which is equivalent to one in two hundred thousand of human hair, but its hardness can be 200 times higher than other materials of the same specification. In addition, graphene has great optical properties and good thermal conductivity, which is close to transparent visually. The thermal conductivity of graphene material is higher than that of carbon nanotubes and diamond, which is the carbon material with the highest thermal conductivity so far. Graphene's special structure allows it to be used as ultra-thin and

ultra-light aircraft materials, super-tough body armor materials, nano-sensor materials and so on. Meanwhile, graphene fibers also have special functions such as antibacterial, mite resistant, heat resistant, cutting resistant, uv resistant, far-infrared heat resistant and cool conduction.

The combination of graphene and traditional fabrics (cotton, polyester, polyamide, etc.) into composite fibers could be widely used in costume. GCF fabrics used in the field of textile garment have the following advantages. Firstly, the fiber breaking strength of GCF fabric is effectively improved, which enhanced the durability of clothing. Secondly, GCF fabric has good flame retardancy, enhances the UV protection performance of the product, which could effectively protect the skin from the UV light. Thirdly, GCF fabric also has the ideal far-infrared emission function, which could effectively maintain the body temperature; In addition, GCF fabric itself has good electrical conductivity. These excellent characteristics and functions make GCF fabrics have great value and potential in the field of functional fashion [2].

As one of the important new fabrics in functional clothing, GCF fabric has attracted the attention of many enterprises and has been put into research and development. GCF fabrics with graphene embedded into the fiber structure are widely used in intelligent costume. Because of its special advantages of fast heating speed and even heating ability, the twisted fabric can be made into heating clothes, which improves the safety and comfort. At the same time, the textile fabric of GCF is extremely soft, which is not afraid of folding and can be washed [3].

GCF fabric products that have been formed on the market currently include a series of products such as vests, shawls and heating pants. In the "Background Eight Minutes" artistic performance of the 2018 PingChang winter Olympics, the actors' costumes adopted graphene and GCF fabric of spontaneous thermal fiber, which not only guaranteed the basic function of lightweight and warm, but also had the additional function of motion and luminescence. The graphene in GCF fabric could be heated actively to keep out the cold while ensuring fashion degree without looking bloated visually. This is a bold experiment of graphene, and it also demonstrates the power of high-tech graphene.

In addition, according to foreign media New Atlas, Vollebak, a high-tech outdoor costume company, has also launched a functional costume item made of GCF fabric -- Graphere Jacket. This company enjoys using advanced materials such as graphene to make surprise products [4].

2. Functional Fashion Design

Functional costume refers to the clothes made of functional fabrics, which has one or several functions of antibacterial, flame retardant, water and oil repellent, ultraviolet and electromagnetic radiation repellent in addition to its own basic use value.

Functional fabrics generally refer to fabrics with some special functions. One of which is the costume made of outdoor sports functional fabrics. This kind of fabric is mainly used for mountaineering wear, ski wear and winter jackets, with rough style and stiff feel. It has high requirements on product performance, which should be suitable for exploration and harsh environment and have a protective effect on people. The other is the clothing made of outdoor leisure functional fabrics, which is defined as outdoor activities when going out of the house. This kind of fabric is mainly casual and fashionable that has fine workmanship, which is soft and comfortable to wear, and suitable for tourism, outdoor activities and so on. According to different functions, people's functional requirements for clothing fabrics include the followings. Portable use requirements include machine washable and wearable; Safety and health requirements include comfort, harmless, healthy, safety, environmentally friendly and pollution free.

According to the classification of functional fabrics, there are quick-drying fabrics, anti-ultraviolet fabrics, waterproof and breathable fabrics, windproof fabrics and so on. Most functional fabrics are synthetic fiber functional fabrics, such as bamboo charcoal fiber, bamboo fiber, chitin fiber, moisture absorption fast drying fiber and composite fiber. Carry out the functional finishing or the coating treatment of the functional fabrics, such as soft, moisture absorption, breathable, fluffy, flame retardant, and three defenses. Functional costume is designed based on functional requirements, so the quality of the clothing and the technical requirements of clothing are relatively high. This type of

clothes includes work clothes with scientific and technical functions that have protective effects in special environments, which could also automatically adjust temperature or have various functions such as heat resistance and diamagnetism.

The research and development of functional textiles has become an international trend and hot spot. Such technological textiles in the western countries have occupied the international high-end market. Taking sports fiber fabrics as an example, Dupont's Supplex has the characteristics of cotton softness, nylon strength, odor resistance, wind resistance, quick drying and water permeability. Nike's Drift has the characteristics of fast perspiration microfiber. Reebok's Hydro move products are mainly using "breathing" drainage fibers and focusing on the temperature control functions. Swiss Schaller's 3XDRY products are taken dry and instant fast drying as their highlight.

Compared with the mature functional apparel products of many western countries, China still has a large gap in the research and development level of functional textiles with them, and it is necessary to accelerate the pace of research and development innovation. As far as the current market research status is concerned, the demand for functionality in the procurement of fabrics is increasing. Functional features such as "wrinkle resistance", "antibacterial property", and "waterproof and air permeability" are all the concentrated demand points of costume enterprises in the selection of fabrics. Among them, "wrinkle resistance" improves the performance, which is easy to take care of; "Antistatic" solves the problem of suffering from the static electricity in dry season; "Waterproof and breathable" adapts to the functional needs of some high-end casual wear, professional sportswear and outdoor clothing; Underwear and children's wear emphasize more on fabric moisture absorption to bring comfort. Therefore, functional fabrics and apparel products represented by GCF fabrics are one of the inevitable development trends of the fashion industry and apparel design in the future.

3. Innovation of GCF in Functional Fashion Products

3.1 Innovation in fashion design

In the development of functional fashion products using GCF fabric, the design of the fabric itself is the basic foothold. The graphene material is deeply combined with various kinds of traditional fiber materials, and blended with other natural fibers such as cotton, wool, silk, hemp, and polyester acrylic fiber to prepare GCF fabrics with different functional requirements.

When designing, it should be used as much as possible in costume types with relatively high functional requirements, such as underwear, outerwear, hosiery, baby clothing, home clothing, outdoor clothing, etc. In the process of specific design, it should be fully considered that the unique fiber line texture of the GCF fabric and the advantages of the clothing silhouette and detail performance. And it should be considered that which could better integrate with the fashion trend and popular elements and become more diversified in fashion art style. Although there are relatively mature fashion products on the market, the category is relatively single, and the design is relatively simple. Therefore, in the design process of GCF fashion products, it is necessary to fully explore and expand new design innovations, especially to fully consider the flexible and variable functionality, which kind of fabrics is more suitable to combine with, and whether it could be combined with a variety of design media. Through the design method suitable for GCF fabrics, it could fully highlight its unique texture, which could blend various decorative materials and fabrics, such as lace, denim, fur and other special materials. According to different materials and styles, with a variety of embroidery and stitching methods, the GCF fashion products could break through the existing bottleneck of the single design style, which is easy to use in various styles without any sense of violation. Therefore, the GCF fashion design could be more autonomy, randomness and individuality, which could more satisfied with the diversified market demand.

3.2 Innovation in fashion marketing

With the advent of the Internet era, the traditional economic industry is facing a huge impact, and the apparel industry is no exception. The traditional corporate image recognition system and visual

marketing concept have been difficult to cope with the challenges faced by brand design in the era of Internet economy. In the era of "Internet +", people's consumption level and the aesthetic pursuit of quality and spiritual level have been significantly improved, and the concept of sustainable development for ecological health has been deeply rooted in the hearts of the people. GCF fashion meets the current consumer's appeal to ecology and nature, so the meaning of its target brand has been different from the traditional understanding.

From the perspective of economics, the brand concept not only reflects the enterprise's own distinctive characteristics, promotes and maintains the enterprise value system required for the normal operation and long-term development of the enterprise, but also determines that the behavior and development direction of the brand need a certain amount of social acceptance. At the same time, under the market economy environment, the industrial mission undertaken by fashion enterprises is not only to simply meet the supply and demand balance of the market, but to spread positive and healthy values and guide people towards a sustainable development path through fashion products and brands such as GCF. Through careful selection and design innovation of styles, fabrics, decorative patterns, production techniques and other factors, while providing quality products, it conveys the ideal lifestyle and values recognized by the public and creates an excellent clothing brand concept.

Marketing is a booster for brand success. With the continuous development of the garment industrialization process, the marketing strategy of apparel brands will become more and more diversified. We could change the internal management mechanism of the brand, combine design and marketing through the network, and promote with the advantage of the Internet like some rapidly developing new Internet brands. At the same time, offline physical experience stores promote the research and development of new functions, and reposition the functions and roles of physical stores, which make it an interpretation platform for the experience platform and brand life concept that complements the Internet shopping platform.

4. Conclusion

The low price and widespread resources of graphite provide a basis for the research and application of graphene. The excellent properties of GCF make it possible to have unlimited development space and expansion space in the field of textile and fashion industry, especially in functional clothing design. The hotspot about application prospects of GCF at home and abroad will also last for a long time. However, as a new type of composite fiber, graphene is still in its infancy in many aspects such as basic research and development, design and use. The room for improvement of its individualized and diversified design and development is still huge, it is expected that more perfect and complete research results could be presented soon. Acknowledgements

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