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Material Selection of Conductive Fibers for Touchable Gloves and Application of Graphene

Xitong Gao

School of Physical Science and Engineering, Beijing Jiaotong University, Beijing, 100091, China
Email: 20272006@bjtu.edu.cn

Abstract:

In recent years, nanometer conductive materials are the focus of research. Graphene is widely recognized and used in recent years, they have excellent flexibility, mechanical strength and electrical conductivity, with low dimensions and large specific surface area characteristics, in the field of sensors and daily life has great application potential, perhaps some emerging nanomaterials and technologies can provide the possibility of progress for touch screen gloves. Most touchscreen gloves on the market today use metal fibers, but compared with other metals and non-metallic materials, graphene is undoubtedly a suitable and superior conductive fiber choice now and in the future.

Keywords: touch screen gloves, conductive fiber, conductive yarn, conductive material, graphene

1. Introductory

Many of the touch screen gloves currently available on the market cannot fulfill the touch screen function well in cold weather, and often, due to the cold-resistant function, both are not satisfactory. The theoretical value of this research topic is to find a conductive fiber that has high sensitivity, softness, and is easy to incorporate into gloves, and its practical value is its application in daily life. It can not only be applied to touch screen gloves, but also to a range of clothing and accessories, such as watches, shoes, socks, and protective clothing. Due to the narrow scope of this topic, there has not been much domestic and foreign research on this topic in recent years, but it does have some achievements. Conductive fibers are widely used in flexible fabric sensors, smart clothing, etc., because they have the advantages of eliminating static electricity, absorbing electromagnetic waves, and detecting and transmitting electrical signals.

Conductive fibers are divided into two categories: homogeneous and composite, according to the conductive composition. Homogeneous conductive fibers refer to fibers with the same composition, such as metal fibers, carbon fibers. Nowadays, most touch screen gloves are made using silver, copper, and other conductive fibers as the material for the fingertips, while the rest of the glove is made from conventional materials such as wool, rabbit hair, leather, acrylic, and others.

2. Overview of the current status of domestic and international research

Nano conductive materials have been a focus of research in recent years. They have excellent flexibility, mechanical strength, and conductivity, with low dimensionality and a large specific surface area, and have great potential for application in the field of sensors. Perhaps some emerging nanomaterials and technologies can offer advancement possibilities for touchscreen gloves. And in the present and future, graphene is undoubtedly a suitable and superior choice for conductive fibers. In recent years, graphene has gradually come into people's view as a popular nanomaterial with excellent performance. With excellent optical, electrical, and mechanical properties, graphene has important application prospects in materials science, micro and nano processing, energy, biomedicine, and drug delivery, and is regarded as a revolutionary material in the future. Although the manufacturing of graphene is still in the development stage, resulting in the production cost of graphene and the quality of the finished product not being necessarily guaranteed, from the current scientific research fever, it is inevitable that graphene will be developed in the near future to improve the manufacturing industry, reduce costs, and be widely used in various fields.

Compared with developed countries, China's graphene industry started late. Thanks to the support of the Chinese government's policy and the continuous investment of industrial funds, China's graphene R & D level has gradually improved, and has entered the stage of technological breakthroughs. During this period, China's graphene

downstream products, including medium and high-end products, have also shown growth. Graphene supercapacitors, graphene electronic devices, and graphene flexible films and other products have emerged one after another.

Traditional sensor materials are mostly rigid materials, such as metal, semiconductor, the disadvantages of which are large size, poor flexibility, and the human body does not fit, can not effectively detect the signal, low sensitivity, limiting its application. Flexible sensors, unlike rigid sensors, fit well with the skin, capture signals efficiently, and have excellent sensing performance.

Therefore, the preparation of flexible sensors requires the selection of appropriate flexible substrates. Textile materials have the advantages of deformability, wearability, breathability, etc., and the existing textile processing technology is very developed, which makes textile materials one of the excellent carrier forms for flexible sensors. Therefore, the preparation of flexible sensors in combination with textile materials has become a hot spot for research. With the global graphene R&D results entering the market one after another, the global graphene market scale began to expand rapidly, especially in coatings, consumer electronics and new energy sources, graphene demand has grown significantly, further driving the global graphene market scale. At this stage, most of the support policies in various countries are focused on graphene midstream industry chain, Europe and the United States and other developed countries in the early stage of the support policy is mainly focused on graphene basic research and high-end application product development. And in the future, with the acceleration of graphene industrialization process and its display of soaring market value, governments will further increase the policy support for graphene downstream applications to promote the development of graphene industrialization. It is foreseeable that with the gradual maturity of graphene preparation technology and the gradual expansion of application research and development, the transformation of research and development results and industrialization will develop rapidly under the vigorous promotion of governments and enterprises.

In a word, the domestic research in this research field applies graphene in many high-tech fields, but there are fewer papers in the small area of touch screen gloves, and in practice there is no large-scale application into production. At the same time, however, it has been pointed out that the flexibility of graphene is an excellent material for skin-fitting sensors; graphene and its compounds have good electrical conductivity and have a promising application.

In the field of foreign research, graphene is mainly used in the chemical field and high precision field, such as capacity, battery, high strength devices and so on. However, it can be seen that graphene has received considerable attention at home and abroad, and at present, graphene has been widely used in basic research, sensors, transistors, flexible displays, new energy batteries, seawater desalination, hydrogen storage materials, aerospace, photoreceptors, composite materials, biological and many other fields. Basically there is no information about foreign research on graphene applied to touch screen gloves. Based on this part, synthesizing the other properties of graphene, its application in protective gloves has rich prospects.

3. Research objectives, content and expected results

Research Goal: The research goal of this study is to conceptualize the possibility of applying the properties of graphene in terms of sensing, electrical conductivity, and thermal conductivity to touchscreen gloves, to come up with new ideas, and to compare the advantages of graphene compared to other materials.

Research content: The research content of this study will be from the perspective of ductility, abrasion resistance, hardness, electrical conductivity, ergonomics and other perspectives using the search for information method, experimental methods to provide the search for suitable as well as other good properties of the touch-screen gloves of the research expectations, hoping to get the expected, excellent performance and cost-effective cost-effective material results. The feasibility of large-scale application of graphene as a nanomaterial with excellent conductive properties in the field of touchscreen gloves is also examined. As well as, according to the existing multi-type information compared to the doping of graphene, oxides whether in terms of electrical conductivity, thermal conductivity, toughness and other properties of graphene is better than the pure graphene materials as well as other metallic and non-metallic materials.

Critical issue: as a conductive fiber in touch screen gloves, the material should have excellent toughness and conductive properties. So the key question is whether graphene is suitable as a new conductive fiber spun into the touch screen gloves to improve the performance of the gloves. Secondly, if it is to be circulated as a commodity, whether its cost and production process is expensive and complex, textile technology, the performance of the finished product, quality and whether it has a more obvious competitive advantage and other issues should also be considered.

Expected results: through the information compared to the value and cost of various conductive fiber materials, and then look at the future development trend of trendy materials, to prove the feasibility of graphene materials as conductive yarn for touch screen gloves.

4. Research methodology, technical approach, experimental program and its feasibility analysis

Research Methods: Starting from the recent popular materials, we discuss whether the emerging materials have the potential to be used as conductive fibers for excellent touch-screen gloves, and then compare them with the conductive fiber materials for touch-screen gloves circulating on the market now in terms of production process, popularity, and physical and chemical properties, and finally summarize the strengths and weaknesses of the representative conductive fiber materials.

This program was not prepared to use an experimental approach, but rather a research investigation by means of literature references. The feasibility is high although it is only theoretical.

5. Innovative nature of the subject

The innovativeness of this topic is that most of the touchscreen gloves popular in the market are made of metal as the conductive fiber, conductive yarn material, not graphene. However, graphene, as a safe and emerging nanomaterial, has properties that are suitable for a range of wearable sensors such as touchscreen gloves, so it is envisioned that practical feasibility needs to be sought in the review. When graphene is used as conductive yarn in touch screen gloves, it has the advantages of good toughness, good heat preservation, can be made into heated gloves and safe constant temperature, and the performance is less affected in cold weather compared to other materials.

6. Research process

In the application of touch screen gloves, graphene conductive fiber has these obvious advantages over conductive fibers of other materials.

1. Conductivity: Graphene is one of the best known conductive materials in the world. It has superior electrical conductivity, which enables a highly sensitive touch response when touching the screen and allows users to operate the touch screen more accurately.

2. Thin and flexible: graphene conductive fiber is very thin and soft, greatly reducing the thickness and weight of the material, making the touch screen gloves more lightweight and comfortable. At the same time, graphene also has a good flexibility, can adapt to the curve of the finger, to provide a better touch experience.

3. Abrasion resistance: graphene has a very high abrasion resistance, able to withstand the wear and tear caused by a long time touch screen, so touch screen gloves made of graphene conductive fibers touch fingertips more durable.

4. Anti-static: graphene conductive fiber in touch screen gloves also has anti-static properties, which can reduce the generation of static electricity and enhance the comfort and stability of touch control.

7. Conclusion

Overall, graphene conductive fibers have significant advantages in touchscreen glove applications, including better conductivity, thinness and flexibility, abrasion resistance, and anti-static properties, enabling touchscreen gloves to provide a better touch experience and long-lasting durability.

References:

[1] Mechanical, Electrical Conductivity and Sensing Properties of Graphene-Modified Polyester Parallel Stranded Yarns-Dai-Fang Xu, Hua-E Wang, Pace He, Jian-Wei Zhao

[2] Progress of graphene-based complexes in flexible conductive textile materials-Jinhong Tan, Qun Yang, Zhengwei Dai, Genghao Hu

[3] Progress in the research and application of metal-based conductive fibers-Xu Zi-Ao, Wang Jinkang, Zhu Yannan, Ge Mingqiao

[4] Research Progress of Organic Conductive Fibers-Zhou Yi, Zhang Renle, Wu Dewen, She Xue, Xia Peng, Lu Ling, Zeng Jianling

[5] Progress of Graphene Application in Fiber Conductive Coating-Changyuan Song, Xuan Wang, Xueman Wang, Peng Chen, Kui Wang

[6] Structural design of graphene composite fiber and its performance research-Zhenguo Wang

[7] Analysis of Conductive Thread Application in Smart Clothing-Yanqiong Hu

[8] Progress of graphene application in supercapacitor electrode materials-Xiaohong Ding, Xiaoyun Zhao, Sailing Mu, Ruilai Liu, Jiapeng Hu, Xingping Fu

[9] Superior corrosion resistance and thermal/electro properties of graphene-epoxy composite coating on Mg alloy with biomimetic interface and orientation -Pusheng Sui, Chengbao Liu, Aimeng Zhang, Cong SUN, Lanyue Cui, Rongchang Zen