



Application and Development of Rare Earth Luminescent Fiber in Light Outdoor Garments

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Abstract: Light outdoor sports have become a healthy and active lifestyle promoted by modern urbanites, towards green fiber, ecological fiber direction, turning to green and sustainable development is the main direction. Rare earth luminescent material is a new type of environmentally friendly luminous material, widely used in various fields. The article introduces the application development of luminescent fibers, analyzes the advantages of rare earth luminescent fibers compared with traditional luminescent fibers, analyzes the application of rare earth luminescent fibers in light outdoor garments, and finally elaborates on the future prospects for the future development of rare earth luminescent materials in the garment industry.

Keywords: outdoor clothing, green, rare earth luminescent fiber, luminescent materials

1. Introduction

Luminescent fibers are divided into fluorescent fibers and luminescent fibers, and luminescent fibers are divided into self-luminous type and light storage type. Rare earth luminescent fiber belongs to the light storage type luminescent fiber. It is by automatic light absorption - light storage - light-emitting this cycle principle, luminescent fibers have non-toxic, harmless, color gloss, soft material and other characteristics. In recent years, luminescent fibers are widely used in the textile field, rare earth luminescent fibers and traditional fibers constructed of functional materials compared to rare earth luminescent fibers with green, non-toxic, sustainable development and other characteristics [1]. In this paper, for the luminescent fibers in the rare earth luminescent fiber research, the research status and development of the field in recent years, analysis of rare earth luminescent fibers in the textiles in the existence of the advantages and disadvantages of rare earth luminescent fibers, rare earth luminescent fibers and traditional luminescent fibers for comparative study, to explore the way of rare earth luminescent fibers in outdoor clothing, to meet the people's diversification of outdoor clothing and personalized needs.

China's rare earth resources are abundant, high in content and full of variety, which provides valuable resources for rare earth research. Through the reasonable combination and utilization of rare earth elements, a wealth of new materials can be formed, which have great application value for the upgrading and transformation of traditional industries, and are currently one of the most core competitive materials. Rare earths have been widely used in various fields, in the textile field in the process of application, for the traditional textile industry to provide a development direction. Reasonable combination of rare earth fibers and clothing is not only the rational use of resources but also an important initiative for the transformation and development of the textile industry. At present, the domestic in the field of rare earth luminescent fiber is still in the research stage, specialized production companies and specialized research areas are also less. Rare earth luminescent fiber in the United States, Japan and South Korea is currently only a small number of industrialized production [2]. It can be seen that the rare earth luminous fiber belongs to a new type of high-tech functional fibers, the need for research and development and upgrading of production technology for innovation and development, in order to ensure that the marketability of rare earth luminous fibers is combined with ecology, in line with the market demand and the direction of social and ecological development.

2. Luminescent materials

Luminescent fiber refers to a certain light or special light, such as ultraviolet light, far-infrared light and other light conditions, can be instantaneous luminescence or continuous luminescence of functional fibers. Luminescent fiber surface glossy, soft texture, with light, non-toxic, harmless, non-radioactive, environmentally friendly, and sustainable light and many other advantages. Luminescent materials from the development of radium to sulfide luminescent materials, and then to the rare earth luminescent materials, the first two due to radioactivity and poor stability, etc., is no longer used [3]. Rare-earth luminescent materials are now widely used in various fields because of their non-toxic, non-radioactive, long luminescence time and reusable properties. Luminescent fiber is the fusion of luminescent materials and fabrics through certain processing

methods, so that the fabrics have luminescent properties. Rare earth elements have a unique electronic layer structure, can produce absorption and emission spectral phenomena, in recent years the rare earth luminescent materials began to be used in the textile industry, the transformation of the traditional textile industry structure and improve the practical function of textiles.

3. Rare earth luminescent fiber research

3.1 Rare earth luminescent fiber luminescence principle

When the light source irradiation stimulation to rare earth materials, its molecular interior will be filled with electron shells, these electrons will automatically select a certain frequency of light absorption and obtain light from it. The electrons absorb energy to ionize, thus transforming it from a ground state to an excited state. When the external energy is removed, it decays to a substable state in a non-radiative form and finally transforms to a lower energy state where it fluoresces in a radiative form. After the laser absorbs laser radiation at a frequency consistent with its laser eigenfrequency, it can absorb the energy of light and can leapfrog to each energy level of light in the heavy state of the first or second photoexcitation unit, producing a continuous absorption of light. Its main characteristic is its good afterglow capability [4].

3.2 Rare earth luminescent fiber textile advantages and disadvantages

Rare-earth luminescent fiber is made of polyester, polyamide or polypropylene as the substrate, its performance and the original substrate performance difference is very small, after adding the rare-earth luminescent material, the tensile properties are basically unaffected, and the rare-earth luminescent fiber meets the requirements of the clothing's serviceability [5]. It can be blended with a variety of fibers, and can also be used in knitting, jacquard, embroidery and other weaving processes. Rare earth luminescent fibers are available in colored rare earth luminescent fibers in addition to natural colors such as white. Colored rare earth luminescent fibers in visible light to show a variety of colors, in the absence of visible light conditions, the fiber itself can also emit a variety of colors of light. Colorful rare earth luminescent fibers and textile fusion, the final product can be without dyeing, not only to avoid the impact of dyes on the luminous properties of fibers, but also to avoid the dyeing process on the environment to produce pollution.

4. Rare earth luminescent fiber design in outdoor clothing

4.1 Application in outdoor clothing

Light outdoor is a kind of outdoor sports without danger, the pursuit of easy, convenient way [6]. Participants in the enjoyment of outdoor sports, a variety of projects and environments, but also requires travel wear to meet a variety of scenarios, both for consumers to create a relaxed, comfortable outdoor experience, but also to meet the consumer's personalized needs of the outdoor apparel design has become a new wind vane [7]. At present, the industry has the phenomenon of single clothing style, weak functionality, lack of sustainable design consciousness, unable to meet the diversified and personalized needs. Luminescent fibers and common chemical fibers have similar properties, can be woven fiber process, in its design and application, need to pay attention to the use of luminescent fiber parameters, otherwise it will greatly reduce its performance. Light outdoor clothing design space is large, according to different functions can be modular division, through the use of rare earth luminescent fiber textiles to meet the local functionality [8]. The design should enhance the practical function of outdoor clothing and meet the diversified needs of people as the starting point for the design of outdoor clothing to enhance the additional functional value.

4.2 Application mode in outdoor clothing

Rare earth luminescent fiber fabrics not only have soft and comfortable, close to the body and breathable, elastic and elongation of good taking performance, but also has a night light-emitting functional and decorative effect. Applied to the local design of outdoor clothing, its products can be self-illuminated at night under the condition of no other light source irradiation, which greatly improves the safety of outdoor sports. In clothing design fabrics, the use of light-emitting fibers itself has the softness and comfort, and other yarn compilation to form a night light-emitting decorative materials, applied to the local functional design of outdoor clothing, clothing design to add beauty and functionality. Rare earth luminescent materials, in addition to white and colored luminescent fibers, in the absence of light irradiation conditions, can also show a variety of colors [9]. In order to give full play to the luminous material in the night light-emitting advantage of the role, but also through the performance of fluorescent dyes and textile dyeing combined, not only can be compatible with other fiber raw materials, and its comfort performance will not be affected.

5. Conclusion

With the emergence of environmental resource crisis, the increasing depletion of non-renewable resources and other issues, materials such as intelligence, novelty, green ecology and other materials have become the mainstream development direction [2]. In the form of green and sustainable development, the future direction of rare earth luminescent fibers will continue to tap the rare earth luminescent materials in the expansion of color, improve the performance of rare earth luminescent fibers textile green and environmentally friendly and fiber luminescence continue to extend the time will be the focus of future research. Because it is an emerging product, the future needs to be explored more, to obtain a greater development space and possibilities.

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