

DESIGNING CLOTHES FROM MATERIALS WITH IMPROVED SIGNALING AND DECORATIVE PROPERTIES

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IN THIS THESIS WE ARE CONSIDERING THE PROCESS OF DESIGNING CLOTHES WITH LIGHT-TRANSMITTING ELEMENTS AND OPTICAL FIBER. WE ALSO SUGGEST SOME TECHNOLOGICAL SOLUTIONS FOR OPTICAL FIBER USAGE AS CORE THREADS AND FABRIC WHEFT WHEN DEVELOPING MATERIALS WITH ADJUSTABLE BRIGHTNESS AND COLOR. WE HAVE ALSO DESIGNED SOME NEW CONSTRUCTIVE AND DECORATIVE ELEMENTS IN CLOTHES PROVIDING THE POSSIBILITY TO SUPPLY CONTROLLABLE LIGHT DECORATIVE AND IDENTIFICATION SIGNALS.

Key Words: optical fiber; LEDs, smart clothes; luminous clothing; luminous textile materials

Relevance of the thesis. More and more consumers are interested in clothes that function not only as protection from environmental conditions, but also having unique properties. For example, the clothes in which technical elements can be applied in order to provide signal and enhanced visual and decorative characteristics and most commonly companies use reflective materials for this purpose. However, their use is possible only in terms of reflected light at night. Therefore, there is a need to develop clothing design technology using optical fiber, LEDs, cold neon, providing enhanced signal, informative and decorative properties and the ability to control the supplied light signals.

Analysis of the technical level. Basing on the analysis of the level of technology and existing samples of clothing with elements of technical systems, two main directions have been identified. The first direction is clothing with various structural elements in which you can place technical elements demonstrate the state of the human body and the external environment. Designers often use transparent pockets, loops and belts, eyelets, valves, etc. to connect technical elements to power supplies and clothing. A number of companies use technical elements in clothing production: Nike, France Telecom, PhilipsConsumerElectronics Inc., Invista, Sensatex and Textronics, AlphyninIndustrie e.t.c. The second important direction is usage of various luminous technical elements in clothing in order to send controlled signals, enhancing visual, decorative and signal properties of clothing. Many Chinese manufacturers already produce clothing having luminous symbols, images, graphic drawings, located on clothing as overhead items. The main objective of such products is to use them as mobile advertisement. Luminous clothes are also widely used to increase traffic safety at night.

Research methods. We used image processing methods, methods of systematization and classification, expert assessments, statistical and factor analysis methods, engineering methods for obtaining sweeps of clothing details for typical and individual figures. Do define illumination level, we were using the LuxMeter, specialized application for Android.

Research. A consumer survey was conducted. Children of the primary and secondary school groups and their parents were selected as the target group [1, 2]. 177 people took part in the

survey. The analysis of the survey results showed that the best one is the position of technical elements in the clothes on the shelf and back side, behind the shoulders and in the front part. Basically, the signal elements are arranged so as to make them clearly seen when people are walking. It is also important that the movement of the hands do not overlap with the lighted surface. It was revealed that the area of reflective material for the preschool age group should be at least 0.07 m², and for teenagers - at least 0.10 m². The area and size of the luminous technical elements depend on the purpose of clothing, time of year, age group, the main material of the product [3].

A technology is proposed to combine luminous technical elements with fabrics. It is also important to pay attention to the usage of optical fiber as warp and weft threads. Optical fiber is a widespread material that is used as a transparent filament, made of glass or plastic with an optical reflection coefficient that ensures the transfer of light inside. Optical fiber can have side and end glow [4]. The experiments were carried out to estimate the luminance of the samples of 10x10 cm in size, made of plain, twill, rep, satin, satin, two-day weave and matting and reinforced twill (Fig. 3). In the samples, one thread is white textile and the second is optical fiber.

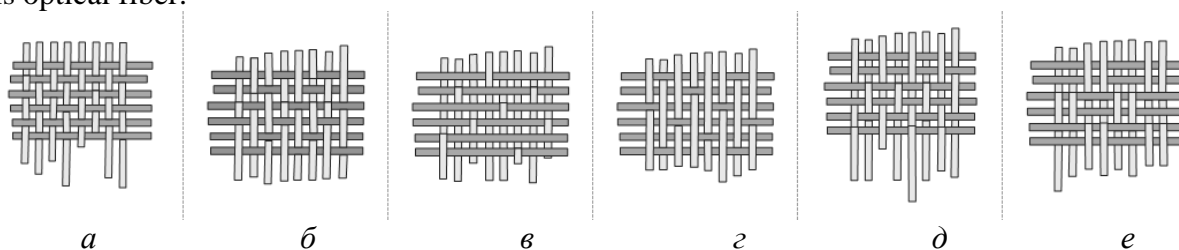


Figure 1. Preferred types of weaves of textile yarn with optical fiber: a-plain, b-twill, c-satin, d-satin, d - rep, e – mat

Evaluation of the brightness of the glow was carried out, using the LuxMeter app for Android using the built-in smartphone sensor located next to the front camera, the illumination results were obtained in lux (Lx). It was revealed that the largest area of luminescence is provided by 4 types of weaves - plain, satin, matting and twill. We also made samples of the use of optical fiber side glow in the form of applications on the fabric. Fiber optic yarns with side diameters of two diameters - 2 mm and 3mm were used. On the basis of the conducted experiments, the limitations are highlighted. When using fiber as an application, we will not allow a kink to an acute angle; the radius of curvature of the pattern must be at least 25° – 40°; the bonding of the fiber-optic filaments at the junction with the light source must be performed in such a way that the ends of the optical fiber are assembled into one bundle.

Basic and model designs and samples of children's vests with luminous technical elements of optical fiber have been developed (Fig. 2 a, b). A patent for an industrial design was received [5]. Protective clothing was manufactured using fiber for motorcyclists (Fig. 2c) [6, 7]. Variants of technological processing of the vest knots are proposed for outputting the optical fiber beams to the wrong side of the vest and for placing the light source based on the known methods of pocket processing in the frame and the buckle.

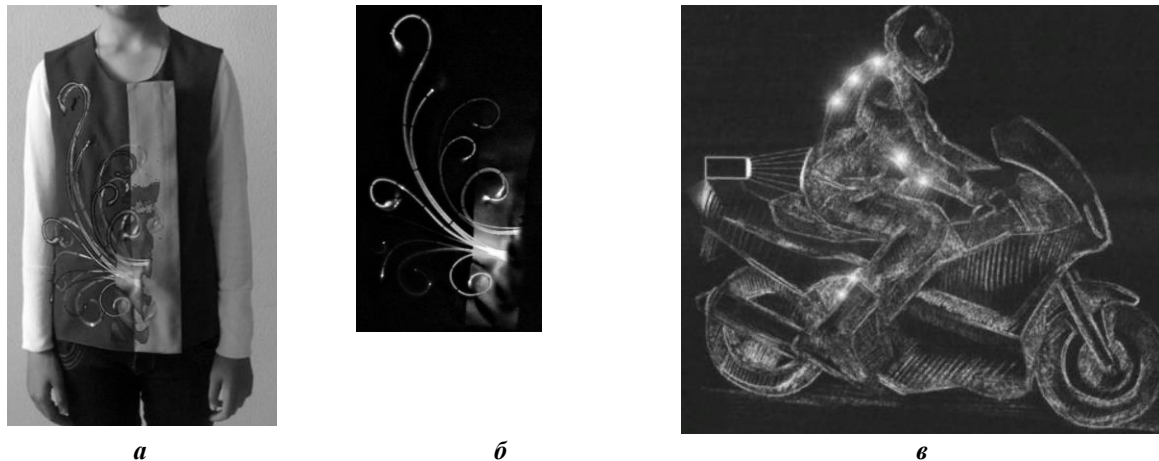


Figure 2. Vest: a - without luminescence, b – with luminous fiber-optic elements, in a model design

Conclusion. Requirements for the size, length, width, position and shape of luminous fiber-optic elements in clothing have been developed. The design of a luminous structural and decorative element made of end-face fiber should be done by placing the beams in a specific pattern that will be read during illumination, since the luminous pattern is recognized only by the illuminated ends of the optical fibers. The pattern of fiber side glows along the entire length. The use of such elements in clothing will provide controlled light signals in clothing both in the dark and in the daytime. Thus, the conducted studies have revealed the need and demand for the manufacture of clothing with enhanced signaling properties, and the use of various elements of technical systems and devices in clothing will ensure the safety of movement on the road.

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