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LIGHT DESIGN AND TEXTILES

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ABSTRACT

Innovation textile is a new and unusual product type combining information technologies with wide art opportunities. The article considers three types of innovation textiles selected using the functional purpose principle: materials radiating light (electro-fluorescence, light emitting diodes, including organic and fibre optics), materials forming an image (LC screens, OLED, LCD) and materials with fluorescence effect.

A new cloth type named electronic textiles is a material, which conducts and at the same time consumes electric energy. It combined three formerly independent spheres: textiles, electrical engineering and electronic engineering. Textile materials are the base, on which various electronic devices are mounted.

Keywords: electronic textiles, light, light emitting diodes, *OLED*, innovation textiles, luminescence, electroluminescence

1. LIGHT EMMITING MATERIALS ON BASIS OF ELECTROLUMINESCENCE, LEDS, OLEDS, AND FIBRE OPTICS

In development and use of light emitting materials, their own priorities and leaders exist. One of the most widespread integral technologies is use of light emitting diodes. Attempts to use this technology in producing "smart" textiles were made from the beginning of the 21st century. The most outstanding work in this format was carried out in 2009 by well-known British designers *Francesca Rosella* and *Ryan Genz* of the *GuteCircute* London studio (2004). As a futuristic development, they created the well-known *Galaxy Dress* (Fig. 1).

An idea of English designers was to place 24 thousand light emitting diodes on the surface of a silk dress. Each flexible emitting element was manually sewed on the textile warp. As a matter of fact, the dress was turned into a suit display. In order to scatter light uniformly, the designers used four layers of cloth consisting of chiffon and organza. A significant amount of light sources required a large number of special compact *iPod* batteries placed under the crinoline.

Another technological branch of light design is production of materials based on optical fibres. In 2008, in France near Paris, one more leading company in the field of development of fluorescent materials and clothes was established. Beginning from the establishment date, it was named

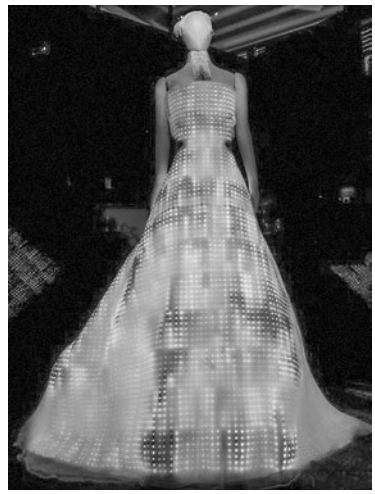

Fig. 1. Galaxy Dress

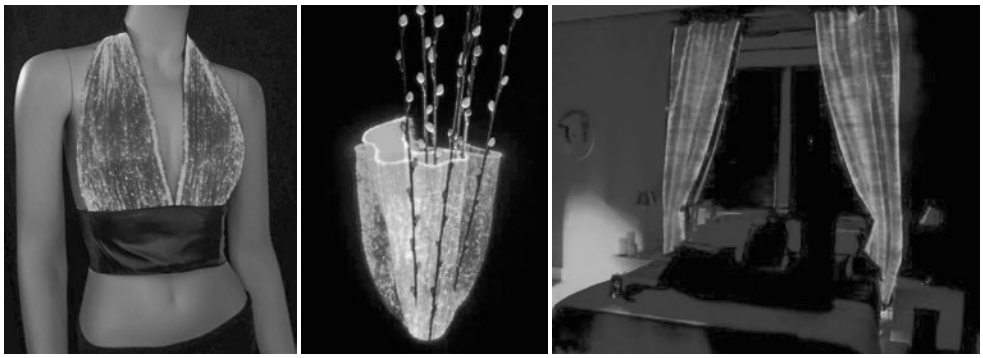

Fig. 2. Textiles of *LumiGram* Company

LumiGram. The range of the products manufactured by the company is very wide: there are dresses, house textiles, decorative clothes to decorate interiors, etc. A source of pride of this French company is a cloth, which is produced according to an original *luminous fabric* technology (fluorescence cloth). At the daytime illumination, *luminous fabric* has a standard image. At the moment, when illumination level decreases, decorative properties of this unusual cloth are fully shown. This effect is based on a combination of standard threads and of optical fibres. The light effects are implemented using light emitting diodes operating by means of tiny controllers and chips. An adjusting system switches on and off the glow mode, as well as changes its intensity and colour. The cloth obtains electric energy due to replaceable compact U-3–5B batteries, which capacity is sufficient at least for 12 hours of continuous operation. The manufacturers ensure consumers a continuous LED operation during 50 thousand hours. The *luminous fabric* technology allows the cloth uniform and soft glowing in the darkness, which makes the material attractive for fashion designers and for developers of interiors (Fig. 2).

The products can be entirely cut off of the fluorescence cloth, or light fibres can be mounted as fragments. In doing so, the composite materials are easily washed and cleaned, which is important in case of their intensive operation.

Prof. Ying Gao, creator of dresses and professor of design at the University of Province of Quebec (*UQAM,* Montreal, Canada), has developed two unique dresses rotating around the figures and shining when someone looks at them. The developers used a sensor system responding to human eyes and at the same time controlling the dress illuminance level. A complex cut off of the products made of organza makes it possible to place behind the cloth top layer compact electric motors, which change geometry of the dresses when supplying a correspondent signal from the sensor. One dress is covered with fibres of a photo fluorescent thread bringing to mind a cloth of ruche type. From the other side of the products are fluorescence threads forming a basic layer divided into separate tapes meeting at the top part of the dresses (Fig. 3).

2. MATERIALS FORMING AN IMAGE: LC SCREENS, OLED, LCD, ELECTROLUMINESCENT MATERIALS

Royal Philips Electronics concern is an undisputed leader on innovation developments in its field. The concern has established a profile compa-

Fig. 3. A “catching sights” dress

Fig. 4. The *Bubble* dress

ny *Philips Design* directly connected with art-and-design developments. In 2009, specialists of *Philips Design* developed an original *Lumalive* technology, which makes it possible to bring various luminescent images to the cloth surface. This effect is reached due to flexible LED displays integrated into the textiles structure. Materials created according to the *Lumalive* technology allow applying them to manufacture dresses, furniture, house textiles and accessories. Due to connection with microprocessors, the cloth surface becomes dynamic, changes image intensity and colour saturation.

Developers of *Philips Design* Company in 2007 under the leadership of *Clive van Heerden*, being the *Skin* project manager and senior innovation chief officer of *Philips Design* in Eindhoven, developed a conceptual project of an "emotional" dress (Fig. 4).

The material, of which a prototype was manufactured, was a two-layer cloth. The inside product layer was filled with special controllers tracking emotional state of the user. A fluorescence dynamic image was brought to the second layer surface using flexible LED displays. The projection nature changed according to the dress owner's mood fluctuations.

Fig. 5.The *Twitter* dress

In order to give a concert dress not only representative but also information properties, *Cute Circuit* British company specialising in creation of futuristic electronic dresses, developed in 2012 a unique dress under the *Twitter* brand for a North American singer Nichole Sherzinger (Fig. 5).

Again, as well as in the *Galaxy Dress* case, the designers built in a set of light emitting diodes into the French chiffon cloth scenic suit. In doing so, they connected light devices with the *Swarovski* crystals. By means of the Bluetooth technology, greetings from Nicole addressed to admirers of her art of any part of the world were brought to the dress surface. Then the cloth was turned into a media screen again, creating an additional spectacular effect during the singer's shows.

Besides the *Cute Circuit* London studio and the well-known *Philips Design,* several progressive creative groups engaged in digital design operate in the world. A British designer Nancy Tilbury being the

Fig.6. A fragment of the designer *Rami Kadi* collection

Fig.7.The fluorescent silk dresses

founder of *Studio XO* and Ben Males, a programmer are among them.

3. MATERIALS WITH PHOSPHOR EFFECT

Rami Kadi is a modern couturier captured by innovation ideas. Using his unique products, he constructs bridges between cultures so that the East and the West would meet. Due to his collections, he pays a tribute of respect to the "handwork", which he especially likes. His another success is connected with a demonstration of his original collection of evening women's dresses "Autumn/winter of 2015–2016" at the *Haute Couture* week in Paris. The cloth of the products was covered from top with a phosphor layer, which allowed a distinct glowing in the darkness of the amazing pattern applied on the dress surface under the influence of ultraviolet lamps (Fig. 6).

When commenting his own products, designer noticed that in this collection he tried to overcome his children's fear of darkness and importunate insects. As a result, the author managed to achieve an art effect comparable with bio-fluorescence of glow-worms.

Professors of the leading Japanese university of Kyoto city *(Kyoto University)* were also interested in the studies in the phosphor material field. *Tetsuya Iizuka and Tosika Tamura*, who were scientists of the Technology Institute being a part of the *Kyoto University* educational holding, have bred an unusual class of silkworm larva generating a special silk thread glowing as a phosphor in the darkness (Fig. 7).

The glow shades are various: orange, green, blue, violet and white. This effect was obtained due to an upgrade of individuals of mulberry silkworm, which were implanted with special genes excreting fluorescent components. According to some forecasts, such silk clothes will be capable to keep their fluorescent properties up to three years. The problem of the scientists for the next period is to give the silk cloth a saturated shade at the day-time light and to increase heat resistance of the natural cloth after a special treatment. This innovation tends to an expansion of the sphere of its practical use.

The *Stone Island,* which is an Italian brand being a leader in the innovation technology market, has manufactured jackets glowing in the darkness (Fig. 8).

For the first time, such products were made in 2013, and they are manufactured until now. For their production, membrane clothes are used, which accumulate light energy at the day time and glow in the darkness. Technologists have laminated the material from within and connected it with a nylon mesh.

Fig.8. A fluorescent demi-season jacket

A specific technology under the *Teflon* brand allows treating the cloth cotton warp using a special method. After that, it becomes air-tight, water-repellent and highly resistant to mechanical loads. Due to a light warp, the product has a small mass and is almost indestructible.

Technological innovations connected with lighting engineering and electronics became a noticeable phenomenon in development of design and production of textile products at the end of the 20th and at the beginning of the 21st centuries. By efforts of some designers and design companies, topical technology developments and technologies are successfully integrated with modern products of consumer industry and generate profit for the companies producing attractive innovation products.

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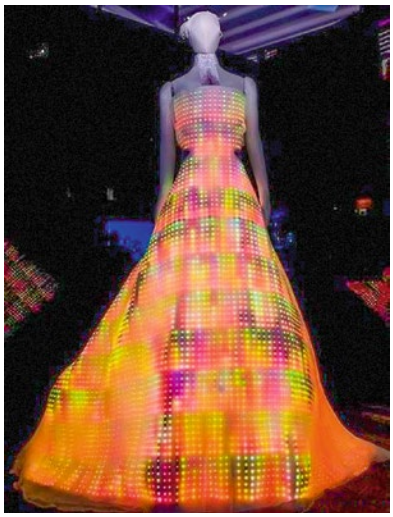

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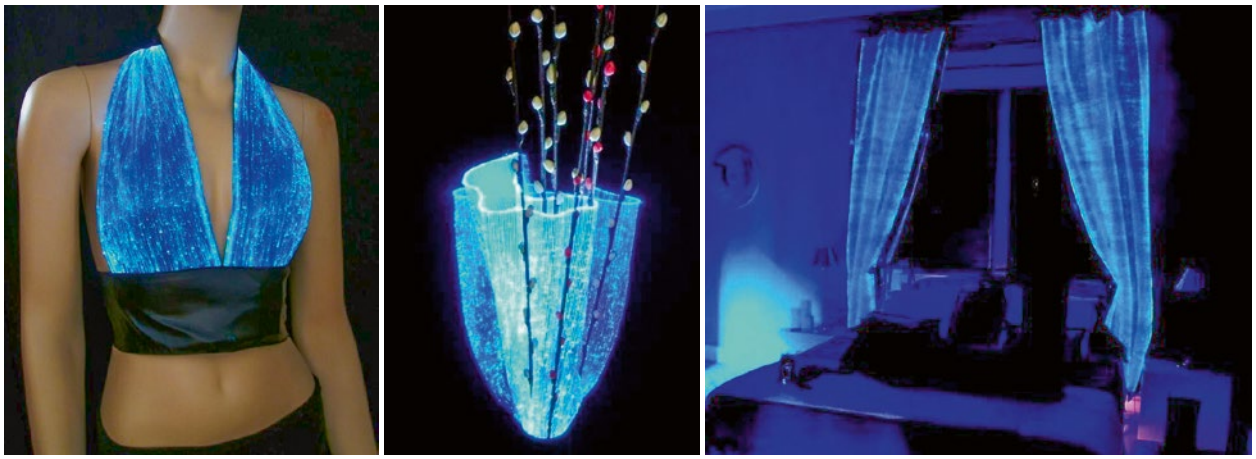

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