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ELECTRONIC TEXTILES: INNOVATIONS AT THE INTERSECTION OF FASHION AND TECHNOLOGY

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Introductions. The article presents information about the materials, production technologies, areas of application and flexible characteristics textile electronics, tissue sensors and wearable intellectual systems.

Aim of the article. Provide the scientific community information about electronic textiles, its structure, principles of work and basic areas of application.

Materials and methods. A wide range of materials and methods that cover both textile and electronic components are used to study the properties of electronic textiles. The materials used in electronic textiles have investigated the properties of textile bases, leading threads and fibers. Methods of microscopic analysis and electrophysical measurement were used.

Results and discussion. Electronic textiles are textiles with built-in electronics and some fibrous materials, having electrical characteristics and performing some useful functions. If it is combined with electronic components, it can feel changes in the environment and react, radiating light, sound or radio waves. Components and relationships are part of the fabric material and, therefore, are much less noticeable.

Electronic textile usually contains conductive threads, which are either spinning or twisting, and include a certain amount of conductive material (for example, silver or stainless steel threads) to ensure electrical conductivity. Conducting fabrics and textiles are covered or woven from metal elements, such as

silver, nickel, tin, copper and aluminum, namely: electro-nylon, electric nickel, transparent grid, soft grid and steel fabric. All these fabrics demonstrate amazing electrical properties with low surface resistance, which can be used to make flexible and soft electric circuits in clothing or other products, as well as in pressure and position measurement systems.

The main properties of electronic textiles are that it is lightweight, durable, flexible and elastic, resistant to moisture and temperature, a good conductor of electric current.

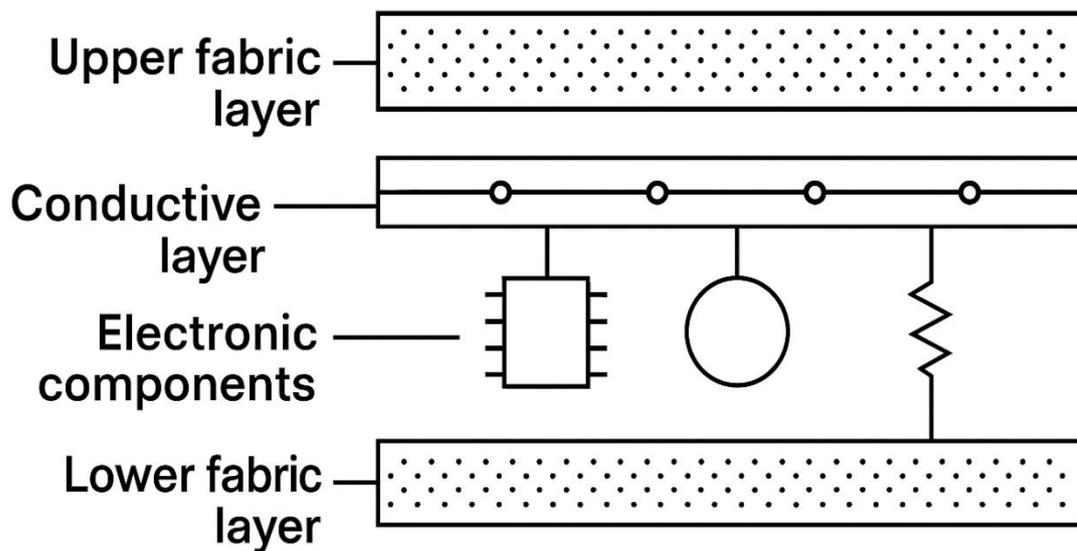


Fig. 1. Structural diagram of electronic textiles

The main disadvantage of electronic textiles is that the devices become more and more complex, but often they lack the necessary textile characteristics of softness, flexibility and ability correct with double curvature surfaces, loss of the performance during bending, stretching, washing, which still requires a huge contribution from the already mentioned areas, in particular, materials science and nanotechnologies. Such wearable sensors should maintain their sensitive abilities in conditions of normal wear, which can cause a serious mechanical deformation of the subject of clothing.

The sphere of use of electronic textiles can be divided into two types:

1. Electronic textiles with classic devices electronics, such as conductors,

integral schemes, ordinary batteries and LEDs integrated into clothes.

2. Electronic textiles with electronics, built-in directly in the textile basis. It can be as passive electronics, such as conductors and resistors, and active components, to an example of transistors, solar elements and various diodes.

Most research and commercial electronic projects textiles are hybrids in which electronic components, integrated into textiles, are connected to classic electronic devices or components. The examples include touch buttons, which are made entirely in textile form using textile weaves with conductive properties, which then connected to devices such as musical players or LEDs that are installed on wicker conductive fiber networks for the formation of displays. Printing sensors for physiological and environmental monitoring were integrated into textiles, including cotton and neoprene.

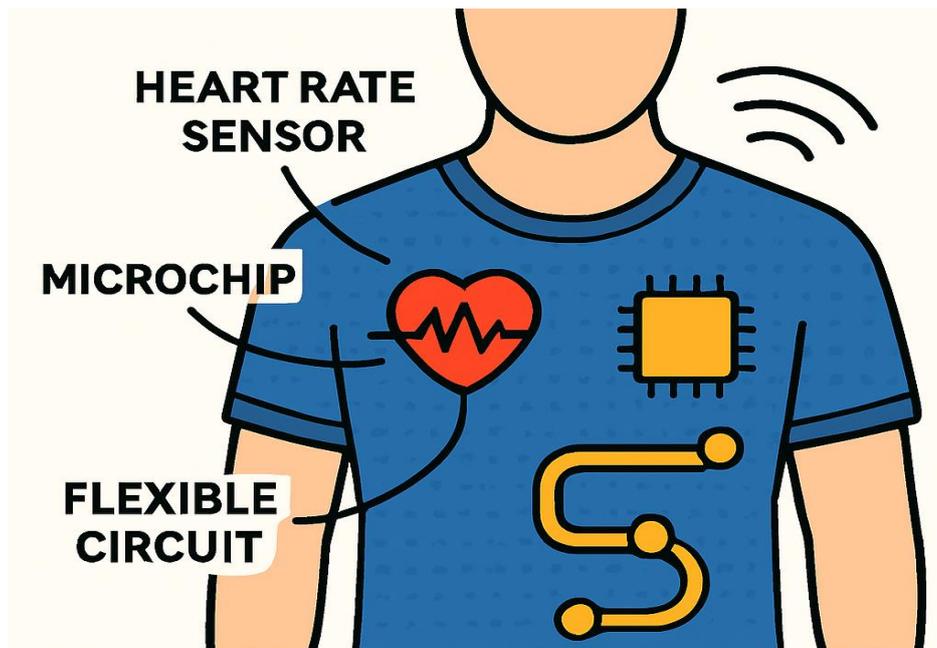


Fig. 2. T-shirt made of electronic textiles

The figure 2 clearly shows that the following are built into the t-shirt made of electronic textiles: a heartbeat sensor that measures the pulse in real time; a microcircuit that controls data processing; a flexible electrical circuit that connects the components without disturbing the elasticity of the fabric; Wi-Fi signal – for data transmission.

Electronic textiles are not just a fashionable innovation, but a key element in

the technological transformation of our everyday lives. Their significance in the modern world encompasses several important the sphere of life. For example, in medicine, when sensors are embedded in clothing that will give the opportunity you to monitor life indicators: heartbeat, temperature, glucose level.

In the military and aerospace industry, electron textiles are used to create clothing that responds to external conditions – changes temperature, color or shape. Military costumes may contain GPS, biometric sensors and communications integrated directly into the fabric. Also, a promising direction in military affairs is a combination of electronic textiles with unmanned technologies, where instead of traditional rigid of boards, electronic textiles allow you to create lightweight, flexible surfaces for transmitting signals, which reduces the weight of drone. Also, textiles with built-in shielding elements can reduce the impact of external signals on drone control. In Ukraine, FPV-drones are already tested with optic control, which provides stable data transmission even in difficult conditions, although it is not quite electronic textiles, the direction of optical fiber solutions is close in principle – the use of flexible, lightweight materials for the integration of electronics.

Electronic textiles are widely used in everyday life. For example, a "smart" clothing that is capable of changing the appearance depending on the mood or the environment, for example, dresses with LEDs for the red carpet, or clothing with built-in microprocessors, cameras, headphones and even mobile phones is it no longer fantasy, but reality.

Electronic textile becomes part of the concept of Ubiquitous Computing – a widespread computerization where technologies integrate into the environment.

Since the early 2000s, the term "Fibertronics" began to appear in scientific publications, although the first experiments with leading threads and sensors in textile materials have been observed since the 1990s. Today, Fibertronics is an interdisciplinary industry that combines textile materials with electronic components and is the basis for creating smart clothing, interactive fabrics and electronics that can be worn.

This direction continues to develop through progress in nanotechnology,

material science and microelectronics.

Table 1

The main components of fibertronics

Component	Function
Optical fiber	Transmission of light or signal
Sensors	Measurement of physical parameters
Microchips	Data processing and transfer
Flexible conductors	Electrical connection between components
Protective layers	Mechanical and electrical insulation

Smart home textiles with air pollution sensors, temperature and humidity are also actively used, which regulates air ventilation and air conditioning systems so that the air remains fresh and comfortable.

Conclusions.

The role of electronic textiles in the future will be extremely important because it combines the comfort of traditional clothing with the functionality of modern electronics. Here's how he can transform different spheres of life:

- 1) clothing with built-in sensors will be able to monitor health, which is very useful for the elderly;
- 2) electronic textiles will allow you to create a reasonable military uniform, it can be possible to use camouflage fabrics that change the color or surface temperature;
- 3) fabrics with energy-giving properties (solar elements) can feed devices unnecessary batteries.

Electronic textiles are not just technology, but a new stage of clothing evolution that combines aesthetics, comfort and intelligence. Its role in the future is to make our lives safer, healthier and more interactive.

Research and development of electronic textiles, "intelligent" materials and technologies that can be worn are now engaged in many leading world universities: High-Low Tech Group in MIT Media Lab, E-Textiles Lab in Virginia Tech, XS Labs at Concordia University – and this is not a complete list.

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