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INTELLIGENT TEXTILES FOR THE FUTURE OF THE LIGHT INDUSTRY

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New fabric manufacturing technologies are increasingly replacing the traditional textiles we use daily. Among these innovations is "intelligent textiles," a concept that, while not yet widespread or accessible, is beginning to attract a consumer base [5]. Intelligent textiles are a key focus in the development of advanced materials and technologies, blending the textile industry with breakthroughs in electronics, sensor technology, nanotechnology, and artificial intelligence [6]. These textiles respond to external stimuli and adapt to environmental or user needs, offering a broad range of applications across multiple fields.

Intelligent textiles are materials that can alter their properties in response to external factors such as temperature, light, pressure, chemicals, or electrical signals [7]. These advancements are supported by research in IT, engineering, and materials chemistry, enabling textiles to integrate mechanical and electronic functions. This combination allows for the creation of interactive clothing and other textile-based products. Intelligent textiles can be classified by how they react to external factors. The first type, passive textiles, can only detect environmental changes, such as textiles with embedded sensors. The second type, active textiles, not only sense changes but also respond to them, for instance by changing color or shape. The third type, adaptive textiles, can autonomously adjust to changing conditions, optimizing their functionality [8].

Modern technology has made it possible for textiles to not only protect the body but also offer added functionality. These may include fabrics with built-in sensors, materials that alter color or insulation based on environmental conditions, and shape-memory materials. Embedded sensors can track physical parameters like temperature, humidity, pressure, and movement. For instance, in sportswear, sensors can monitor an athlete's condition, while in medical garments, they can track vital signs. Another common component is light-emitting features, which are used in fashion or for safety (e.g., on outerwear for pedestrians and cyclists). Shape-memory materials can change their structure in response to temperature or electrical current, which has applications in medical implants and smart clothing.

The potential applications of intelligent textiles are extensive. In medicine, intelligent textiles are used for real-time patient monitoring. For example, "smart" shirts with built-in sensors can track heart rate or oxygen levels, which is especially valuable for individuals with cardiovascular conditions [5]. In sportswear, sensors monitor physical condition during training and help analyze workout effectiveness, a technology already being developed by major sports brands [7]. Intelligent textiles are also used to create camouflage suits that adjust color based on surroundings and impact-resistant materials that harden under force. Fashion designers are exploring

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these technologies to create garments that adapt their appearance in response to light or temperature changes, offering new ways to express style and individuality.

The world has become much more accessible in recent years, yet society still does not fully process all the information available. Intelligent textiles are already in use by well-known companies worldwide but have not yet reached widespread popularity among the general public. Examining the companies investing in this innovation provides insights into the sector's growth.

For example, Owlet is an American company that manufactures smart socks for infants, tracking oxygen levels and heart rate, alerting caregivers if attention is needed. It uses pulse oximetry technology, with real-time monitoring accessible via the Owlet app [6]. Google's Project Jacquard, developed in partnership with Levi's, integrates sensors into fabrics, allowing users to control their smartphones with gestures on their clothing. The standard Trucker Jacket is priced at \$198, and the Sherpa Jacket, offering additional insulation, costs \$248 [5].

Hexoskin produces intelligent clothing for fitness and sports. Hexoskin garments include textile sensors embedded in comfortable clothing for continuous and accurate monitoring of heart rate, respiration, and activity levels. Their smart clothing is available for men, women, and children and is made from high-quality, machine-washable Italian fabric that dries quickly, is breathable, lightweight, odor-resistant, chlorine-resistant, and UV-protective. Hexoskin provides insights into health status, sleep, and personal daily activities. The Hexoskin Smart Shirts and Connected Health Platform are also used in research on cardiac, respiratory, activity, stress, cognitive, and sleep metrics [8].



Рис. 1. The Company “Hexoskin”. Hexoskin Smart Clothing Monitor

These companies represent only a fraction of the rapidly growing field of intelligent textiles. The applications of such textiles are extensive, spanning medicine, sports, and even military and industrial sectors.

Conclusion. Given the rapid advancements in electronics and nanotechnology, it is expected that intelligent textiles will become more accessible and widespread in the coming years. As technology continues to evolve, further breakthroughs in this field are anticipated, making our lives more comfortable and safer.

References

1. Hexoskin Smart Shirts - Cardiac, Respiratory, Sleep & Activity Metrics [Electronic resource]. – Available at: https://hexoskin.com/?srsltid=AfmBOorCOFdbp7-SroikL-FexkDASJpdb86DeMtn1gu4SZJ3UZk_EXv.
2. Богданов Г. Г., Захожай З. В. Еволюція матеріалів для одягу: навчальний посібник. – К.: 2009. – 280 с.
3. Мода в епоху технологій: «розумний» одяг і інноваційні тканини, 24/09/2020 [Електронний ресурс]. – Режим доступу: <https://sfii.gov.ua/moda-verohu-tehnologij-rozumnij-odyag-i-innovacijni-tkanini/>.
4. Owlet Dream Sock: Rated Best Baby Monitor [Electronic resource]. – Available at: <https://owletbabycare.co.uk/?srsltid=AfmBOorCXcj9DQHNICmzjlXgm82yJauF6AaуобМНоGvqgPzG7OsJfrb0>.
5. Технологія розумних матеріалів у текстильній промисловості / Ред. Н. М. Іваненко. – Харків: ХНУРЕ, 2018. – 312 с.
6. Інновації у текстильній індустрії: сучасні технології та їх застосування / Під ред. І. А. Деркач. – Одеса: ОНАХТ, 2020. – 256 с.
7. Гончаренко С. Г. Розвиток функціональних тканин: навчальний посібник. – Харків: ХНУ, 2017. – 224 с.
8. Smart Textile Technologies and Applications / Ed. V. Koncar. – CRC Press, 2016. – 404 p.