

Gorlatova O., Bryzghunova M.

Kyiv National University of Technologies and Design

**INNOVATIVE MATERIALS AND TECHNIQUES IN THE DESIGN
OF MODERN TEXTILE PRODUCTS**

Abstract. *The article considers cases of using innovative materials and techniques in the design of modern clothing and textiles. The study is based on an analysis of the activities of modern designers, artists and enterprises for the manufacture of textile products. The most well-known and widespread ways of using innovative materials and techniques in textile design are stated.*

Keywords: *innovative; textile; design; materials.*

Горлатова О.М., старший викладач, Бризгунова М.С., бакалавр

Київський національний університет технологій та дизайну

**ІННОВАЦІЙНІ МАТЕРІАЛИ ТА ТЕХНІКИ У ДИЗАЙНІ
СУЧАСНИХ ТЕКСТИЛЬНИХ ВИРОБІВ**

Анотація. *В статті розглянуто випадки використання інноваційних матеріалів та технік в дизайні сучасного одягу і текстильних виробів. Дослідження проведене на основі аналізу діяльності сучасних дизайнерів, художників і підприємств з виготовлення текстильної продукції. Викладені найбільш відомі та поширені способи використання інноваційних матеріалів та технік в текстильному дизайні.*

Ключові слова: *інновація; текстиль; дизайн; матеріали.*

Introduction. The use of innovative materials and techniques of decorative transformation of their surface is widespread in the creation of modern textile textured solutions. The combination of such materials with decorative elements of different processing methods allows to change the structure of their surface and get the right texture solutions. The appeal to innovative technologies of transforming different materials contributes to the emergence of new image and style solutions of clothing.

Formulation of the problem. The purpose of this thesis is to analyze the use of innovative materials and techniques of decorative transformation of their surface in clothing design.

The results of the research. The outcome is the discovering the various methods of techniques of decorative transformation in the design of clothing collections.

The current design is connected with industrial progress, it affects a variety of socio-cultural organizations and varieties of design. According to the opinion of the philosopher G.N. Lola, design includes two main elements and states, what exists in it now, and what only has the ability to happen. Design can be defined as the work and the result of this work, the desire to ennoble the world in accordance with the rules of harmony. The work of a designer should be understood as stimulating creativity, which is often opposed to the trading goals of garment companies. It is also necessary to mention that direct deepening of designers in the areas of uniformity, distribution and layout, as a rule, leads to the typification of global taste, which leads to depriving the buyer of the opportunity to independently choose a product. Nevertheless, it is nothing more than new technologies and creative activities of modern designers that contribute to the creation of the latest perfect product.

Design has always been an active condition for the formation of the economy, expressing and including a variety of innovative technologies, which often express an economic strategy, and was focused on the future development of nanotechnology and other areas in the production of clothing. Most of the designers note the huge role of the use of the latest technologies in their own developments, which is very well demonstrated in the design of

clothes. The continuous development of nano technologies forces modern designers to come up with and implement the latest forms, as well as use previously unknown methods of modeling and design, which makes it possible to produce perfect products that will be accompanied by great consumer demand.

The formation of nanotechnology, as well as their introduction into the production of clothing, is taking place for a variety of reasons. The use of these technologies in clothing design makes it possible to guarantee the latest quality materials that will allow you to find previously unknown opportunities that contribute to the development of fashion. Currently, clothes are gradually being transformed into a device that is capable of performing various functions, for example, to control the state of a person or the environment.

Most likely, in the future, garments in the garment industry will be able to change their properties and shape in accordance with weather conditions, different life circumstances and consumer desires. Currently, many fashion houses have shown many collections that involve the use of the latest technologies, such as seamless material, nanofabrics, various types of perforation, and others.

A german designer Anke Domaske decided to offer consumers eco-friendly clothing made entirely from milk. Such clothing improves blood microcirculation and allows you to regulate body temperature. Helena Storey and Tony Ryan have developed a unique photocatalytic clothing technology that purifies the air. A London-based designer found a good way to create sustainable clothing without spending too much money on natural fabrics - just growing it. In such a simple, but scientific way, Suzanne Lee has already created a line of bags, several jackets of current styles and even a whole collection of elegant things that fit like a second skin [1].

A famous [2], dutch designer Ayres Van Herpen has a lot of experiments with the flow of electromagnet exchanges for human organism using the most sophisticated technologies. She covers leather threads with metal foil, as a result the products turn into shimmering objects, which are only slightly in contact with the body. The designer sculpts three-dimensional silhouettes of her outfit from the heat-freezing gel and also uses 3D printers to create products resembling prehistoric animals. Van Herpen decorates her dresses with voluminous plexiglass needles that sprout through the surface of the products like coral reefs. As a result, the finished models look like living organisms covered with scales, metal threads, glass elements, imitation of plastic fur.

Japanese designer Isey Miyake [3] promotes innovative solutions by skillfully maneuvering color, combining many materials, and experimenting with cutting. To develop the design of products, he takes as a basis the following geometric shapes – circle, square and rectangle, of which he further composes a work on the principle of origami, supplementing it with various elements.

An analysis of the latest developments in the field of textile design indicates that special attention is paid to technologies that allow experimentation, emphasizing the contrast of high-tech materials and traditional ones. This contrast creates the characteristic structure and relief of the canvas. In this regard, special mention should be made of the development of designers for the German company "SAHCO" [4]. This company is known for its collaboration with world-renowned designers.

The works of Dutch designer Ulf Moritz [5] have a distinctive feature that is an experimental approach to avant-garde textiles for the interior. He pays special attention to the combination of incompatible materials and techniques to obtain new decorative effects. The brightest author's techniques are decorating the fabric with separate functional parts (circle, stripes, cords, ribbons, twisted or structured thread, sequins of different shapes and sizes),

creating ornamental structures, embroidery on the fabric of centric circles, which tightens canvas.

It should be noted that non-traditional materials such as glass, ceramics, metal, concrete are actively used in the textile design of industrial production. For example, Viennese designers have developed concrete curtains. For the manufacture of such curtains, a geotextile construction mesh was used. They drape well, but at the same time keep their shape due to their own weight.

Trivial, structural fabrics from the “Architextile” Casalis collection (designer Aleksandra Gaca) is an author's experimental box. The canvas can be visually insulated and used for wall panels and linens, separate interior partitions, decorated with interior objects, making the doors in the interior of the hallway more comfortable. Fabrics are made of cotton, paper, polyester, wool, often used lurex threads and wire.

The textile brand “Kinassand” (Sweden) offers 3D fabric BEAM from the “Unfold” collection with visual effects using a special mesh that is glued onto the pattern without clear outlines. The volume effect is achieved by blurring the image through the porous mesh configuration. At the same time, the brand widely uses well-known methods of decoration for non-traditional materials – perforation, applique, embroidery, giving the products an avant-garde approach [5].

A significant contribution to the development and formation of 3D textiles was made by famous artists, sculptors and designers like Christo, Michelangelo Pistoletto, Naomi Kobayashi, Rizzi Jacobi, Janice Kunelis, Robert Morris, Robert Rauschenberg, Peter Kogler and many others. In the field of post-Soviet space the first experiment was with volumetric textile artists of the Baltics, being at that time leaders in the field textile art and design and a special place belongs to Ruth Bogustova, which was the first to create textile objects and installations. Analyzing the current state of textile art and design, in particular the field of 3D textiles and textile installation, it can be stated huge variety due to the use of materials, techniques, technologies, different approaches to the conceptual, compositional solution objects, as well as the purpose of their application.

Today the textile materials include: various types and origins of fiber, paper, leather, fur, wire, hay, straw, vine, algae and all materials containing fiber, and accordingly the materials made of them - natural, synthetic, artificial fabrics and furs, leatherettes, nets, cords, cables.

In order to create the necessary properties and effects of textile materials amenable to etching, dyeing, molding, amalgamation, laser processing, heat treatment, electroplating, various types of printing. All these, perhaps the most extraordinary of all materials and techniques the arts give textile design huge, unlimited opportunities. Depending on the purpose of the object and the creative idea the artist and designer have the opportunity to choose the necessary and desirable for the embodiment design materials. Textile objects, depending on the architect's plan or designer, artist or their collaboration, may be dominant, around which the space is organized according to the shape, color, concept, aesthetic load.

Depending on the plan, textiles can perform secondary functions, providing the environment necessary qualities, creating a background, harmonizing, conquering the environment. One of the main properties of textiles is to soften, spiritualize almost any space, creating coziness and comfort.

Analysis of the basic properties of materials techniques and technologies allows draw conclusions about their active influence on the artistic qualities of works and their appointment in the environment. There is an urgent need for development and entry of three-dimensional 3D textiles into modern Ukrainian interior and exterior space.

The modern artistic and coloristic design of textile objects is based on a combination of traditional materials (wool, cotton, flax, etc.) with non-traditional (metal, fiberglass, carbon

fiber, ceramics, nylon, polymer materials), the contrasting combination of which emphasizes the artistic expressiveness of each material and the difference between high technology and naturalness.

Lee N Walker [6] creates compositions based on textiles, fur, knitwear, etc. using stones, tree branches, metal, wire, coins, shells, plant material, combining them in various ways.

Linda Lammerts [7] combines nonwovens of achromatic colors with stones, tree branches, shells, plant materials, etc.

European manufacturers use all possible techniques and methods for modifying the textile surface, turning the technology into a work of art. In order to create textured solutions for various objects of textile design, it is necessary to take into account the interaction of basic materials and additional decor, contrasting or soft nuances of color, texture, relief, rhythm, etc.

The Austrian company "Swarovsky" which was founded on the 19th century is a leader in the producing of rhinestones [8], which are sewn on and glued. A new company in the Sylver Crystal line releases small decorative embellishments with crystals for textile design. The company "Preciosa" (Czech) [9] and the Egyptian brand "Afourcrystal" let out the lowest possible options for stamps, but do not compromise on their artistic and aesthetic indicators.

An example of using decorative accessories in the design of textiles is a brand of curtains "Tormenta" [10]. The curtains are made from different materials: lurex, sequins, overcoat. The decor of curtains imitates the "golden rain", which helps to create the illusion of a luxurious interior.

In 1938, polyamide was created, in the 1940s, polyester appeared. On the basis of polyester was created the so-called "polar fleece", which is used in the clothing for polar expeditions and climbers.

Currently, many textile experiments are carried out on the basis of polyester. As a result of heat treatment of polyester with steam or acid, using various methods of texturing, this material acquires the texture of stone, glass or ceramic. Various folds, pleating, fractures after heat treatment do not disappear from the surface of this thermoplastic synthetic fabric, thereby decoratively enriching its surface. Many Japanese designers work with polyester, transforming its surface in various ways.

There are three main ways of opening textile textured patterns with trivial folds by means of a high-temperature process: a manual method of using an iron, machine method when a roll of fabric is passed between two hot presses and, thus, elongated folds with pointed ends are obtained, a manual method, by which the fabric is clamped between sheets of chemically treated paper, with pre-folded folds of the desired pattern, and then heated

A famous Japanese designer Janishi Arai works in the field of creating three-dimensional textiles. The fabric "Fluctuation" that was created by him, which is in the collection of the Museum of Modern Art in New York. Inoue Pleats Company became the first enterprise in Japan to manufacture three-dimensional textiles in large quantities, which created a series of three-dimensional effect fabrics – Crystal Σ , Square L, Wrinkle P, etc. Later this company contributed to the popularization of pleated fabrics in the world of modern fashion [11].

Innovative methods of designing textured solutions of complex spatial forms are offered by the Japanese constructor and designer Shingo Sato. It combines 2D plane construction with 3D modeling on a mannequin. The designer gives three-dimensionality to the shapes built on the plane, uses geometric shapes, applies various manipulations with the texture and color of the material. In the finished product, the details are connected imperceptibly, the constructive lines are converted into decorative ones. Among his famous works, there are various products created using the origami technique.

In the 1950s, were found such materials as lycra, a viscoelastic fiber, which is more important for fashion in our times. The designers have actively used all the materials in their

collections, for example, Azzedin Alaya. It was lycra-stretch, which opens up an effective corset for the whole body and, in such a rank, not only for the special features of the figuri, but for the corset [12].

Among the remaining openings in the area of innovative textile textured solutions, it is possible to mean such materials, as tinsel and lyocell, stems on the basis of cellulose fibers, as well as shrinking hygienic fibers, less natural fibers. Among modern textile technologies, nano-textiles, the so-called "smart textiles", have emerged, the structure of it is due to the change in molecular structure. In the field of textile production and nanotechnology, it is possible to mean "Nano-Tex", "NanoSonic", "Aspen Aerogels". For example, the company "Nano-Tex" has opened a waterproof fabric, that does not damaging. "NanoSonic" works over materials, which may cause a unique power to become stagnant in the production of technical textiles. Such materials include, for example, metalized gum, which shows temperatures up to 200°C and aggressively chemically medium. "Aspen Aerogels" building block of unique heat-insulating material [13].

New possibilities in the hallway of modern textile textured solutions have been introduced to microtechnologies. Materials with microfibers capture unwelcoming weather minds. The examples are tactel and gortex [14].

One of the manifestations of microtechnology in textile textured solutions is the development of microcapsules, that is introduced into the structure of the fabric of capsules with substances, such as drugs, aromatic substances, e.t.c. For example the Danish antibacterial fibers "amikor" and "amikor plus" are already broken down, so that bacteria are multiplied. Also there are some materials, which are self-cleaning, if the fabrics can spontaneously spread the smell of bacteria, applied to the titanium dioxin ball on its surface [15].

The International Fashion Machines company produces materials from the so-called "electronic yarn" – threads that allow designing textile texture solutions that can change color depending on the ambient temperature and form a pattern on the surface by combining ordinary threads coated with special inks. and produce an electric current. Another invention of this company is the development of a fabric with a built-in display that reacts to changes in weather by changing its color.

Today, the development of nano-textiles is of the greatest interest. In March 2009, the International Conference "Innovation in Textile Products 2009 – Smart, Nano and Technical Fabrics for Medicine, Industry and Clothing – Industrial and Clothing Applications" was held in London at the premises of the Royal College of Medicine), where issues related to the latest developments in this area. The conference was intended for a wide range of specialists: representatives of industry, educational institutions and clothing designers [16].

In addition, conceptual nano-textiles are known to be used in medicine, sports, special clothing, and virobes for the Internet. For example, the introduction of micro-sensors into the structure of textile textured solutions allows remote quilting behind the camp of people.

So, based on the foregoing, it can be argued that modern trends in the development of conceptual textile solutions encourage designers to transform materials in various ways, change their internal properties, etc. A similar trend developed mainly in the XX–XXI centuries, although examples of the creation of three-dimensional textile textured solutions can be found, for example, in the traditional weaving of the Indians, the Japanese art of knot dyeing, etc.

In the modern world, clothing has multifunctional qualities, as well as being transformed into a device to increase the quality of life of society in various areas, creating more comfortable conditions for existence, which allows it to become an integral part of people's lives.

Thus, clothing created with the use of new technologies is the result of the interaction of a large number of different areas: medical, light industry, costume design and design, industrial production and culture.

Currently, modern design is not only a mass phenomenon, but also includes literally all areas of life in modern society. And also, it develops with the help of the latest technologies, relying on new scientific knowledge, which allows you to create the latest perfect product that is able to meet the maximum number of needs of modern society.

Conclusion. We can conclude that the giving a variety of fantastic effects by flat, smooth surfaces is one of the areas of development of textile materials. Creative stylization is the result of emotions, intuition, imagination and personal worldview of the artist, but, at the same time, it requires justification, clarification, verification by logic, knowledge and accumulated practical experience. As a result of the research, the basic principles of using the innovative materials and techniques in designing clothes were identified, and the most popular use cases were identified.

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