

Optical design and its impact on developing textile technology

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Introduction

The textile industry is one of the oldest industries, and this industry has witnessed many stages of developments that influenced the use of textiles in many fields.

In the past three eras, synthetic fabrics have played a vital and important role in various uses . The interrelationship between scientific progress and industry has also become an important role that has led to successful scientific solutions to many of the advanced materials that have been used exclusively to produce fabrics with limited functions. Therefore, modern studies aim to know everything that is new and develop it whenever possible, and increase the interest in researches that seek to find solutions to the problems of this industry, either to achieve tangible economic benefit, or to apply the properties of job performance, either through the method of implementation or the use of new materials with features and characteristics that may not have been available in the original service. Where the material plays an important role, whether natural or industrial, and each material has its advantages and characteristics that are suitable for the final use. There is a type of fiberglass which Japan had the primary role in providing it to the market, that allowed its weaving into distinct installations and properties, as optical fibers were used on their own, as well as their benefits, so they were mixed with familiar natural fibers such as flax and Awad M silk.

The research problem:

- The process of designing the optical material lacks innovation and renewal in use, although it performs many different functional purposes.
- The limited use of optical textiles to change home décor, so innovation and renewal are required to serve this area.
- Not to mention optical fibers to obtain new jobs for optical fabrics in terms of aesthetic appearance and utilitarian value.
- Lack of scientific and practical studies concerning optical fibers, despite their use in different types of textiles.

Research objective:

- Addressing the production of a new type of optical fabric that has aesthetic properties, utilitarian value, and how to produce it.
- Achieving an innovative technological method in the field of fabrics through the optical fiber properties used to highlight the technical and aesthetic values of the product.

The research importance:

- Studying the design of optical materials that were produced by optical fiber.
- Ability to take advantage of the optical material and its multiple advantages and use it to obtain textile products with modern technologies that contain the aesthetic appearance and utilitarian function and achieve the requirements of modern life:

Research hypotheses:

- The multiplicity of textile techniques using optical fibers can affect the production of fabrics with multiple functions.
- Desirable visual effects and textures can be achieved in textiles.
- If optical fibers are used either alone or mixed with familiar natural fibers such as flax and silk exhausts, some fabrics that are used for different purposes may be implemented.

Research methodology:

The approach used in this research is the analytical approach.

1. Optical Material Design:

a .Definition of design: Design as a system that seeks to achieve a balance between form and function and among originality, application, novelty and appropriateness, for design is a mean to achieve the desired goals and not the goal itself.

We find the shape of the product is the most important design element for users as they see its external appearance and notice its details from the first sight they lay eyes on it.

Optical material design strategy: A strategy is a pattern of actions that are used to achieve specific results and these actions at the same time work to stop the achievement of unwanted results.

First: the cognitive study: Before starting to take the optical material, it is necessary to understand the properties of the optical material and everything related to its type, its apparent shape, its methods of illumination, its potentials, obstacles and requirements. **Second:** structural or structural design: in which the designer combines technology and art in several basic stages in the design process that are interrelated and not separate from each other . Some of them include logical design analysis, and some that depend on experience in decision-making, both of which have the same importance, depending on the degree of complexity of the material .What the design needs is much more intelligence than manual skill.

a .**Design considerations for the formation of optical materials:** The organization process is related to the aesthetic experience of the designer and the extent of his/her ability to perceive the properties of the optical material so that in many cases it is transformed into an innate cognitive property that is not available in every designer.

First: objective: second: subjective: third: light.

Optical fiber weave:

Optical fibers: They are fibers made of plastic or glass, and they are intended to direct light until it goes along. Optical fibers are used in communications, which work to provide data transfer in a way much faster than what it is transferred by other means of communication. Optical fibers are currently used in textile installations with various applications, most of which are often used as sensors, pressure and temperature measurements.

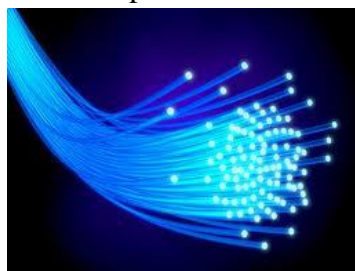


Figure (1) shows the optical fibers without the insulation

Optical fibers have several advantages, including:

- It is luminous fibers by nature and this characteristic depends on a physical phenomenon, which is the phenomenon of total internal reflection, which is the physical basis for the
- technology of transferring light through glass fibers.
- Non-flammable, which reduces the risk of fires. Low energy consumption.
- High sensitivity, lightweight electromagnetic interference resistance.
- Optical fibers can be incorporated into a wide range of basic materials such as polymers, composites and textiles. Besides, it can be used as a medium to spread electromagnetic energy. Optical fibers are made of different materials (glass - alkali metal halides - silver halides - aluminum oxide - or polymers).

2. **Optical fiber weaving method:** Optical fibers possess hardness and brittleness that makes them different from the fibers of traditional textile fibers. Optical fiber fabric is being produced on a traditional two-dimensional loom (manual and automatic) as shown in figure 2.



Figure No. (2) shows the fabric of optical fibers manually and automatically

Thus, the initial plan for developing the fabric that includes optical fibers with silk threads and synthetic, industrial and natural strings can be used to achieve the bending process in the fabric. These strands must be carefully selected in order to achieve good flexibility taking into account the number of strands and the ability to spread and reflect light by optical fibers. The following figure shows an example of optical fiber fabric using a fabric diagram.

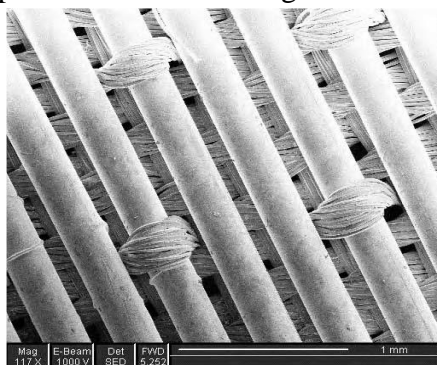
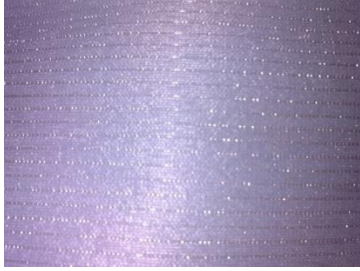


Figure No. (3) shows a schematic diagram of fabric using optical fibers

Practical experiences:

The analysis	data
Polyester - optical fibers	Ores
1/1plain fabric	Histological structure
4 regular weft: 1 optical fiber weft	Arrange the wefts
	the sample

The researcher made an application suitable for implementation by this optical material. These applications are the embodiment of the research experience and the achievement of its results which it has achieved, in order to achieve where it meets many technical aspects and multiple performance methods. Which reflected the researcher has done planning, testing, adapting and developing solutions to problems and identifying and avoiding them on the surface of the woven and the use of other appropriate materials that help in controlling optical material and achieve the necessary lighting for some of the composition elements and the selection of appropriate colors and materials.

Where the researcher saw that a successful design is the one that can reconcile the functional role of optical tissue and the aesthetic role of it in showing the product.

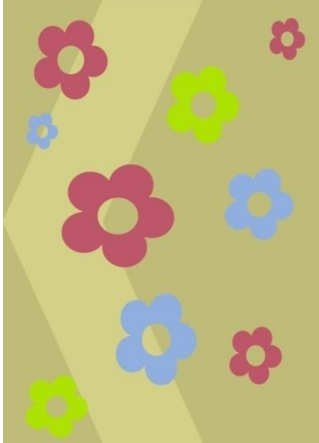
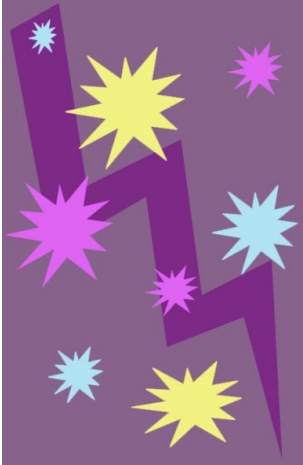

By studying and understanding the textile structures, the materials used, optical fibers and their interactions with the design.

Through the theoretical study of the initial experiences of practical applications, the researcher was able to divide the design in the optical material into:

1- Rhythmic basis design: it depends on the poetic rhythm that the optical material suggests through its artistic and technical characteristics.

2- Intellectual basis design: It is the result of a preconceived idea that the designer put in front of him/her and tried to apply it in practical light.

A design was developed to show luminous places in different colors and non-luminous places while maintaining the overall balance of the design to give it a new and distinctive look.

	
<p>The second design and the bird is placed in a light material</p>	<p>The first design, and the roses are placed in a luminous material</p>
	
<p>The fourth design, and the star shapes are placed in a luminous texture</p>	<p>The third design, and the tree is placed in a light material</p>
	
<p>The lighting locations of the previous piece</p>	<p>The executed piece</p>

Findings and recommendations

First: the results

– The importance of light as one of the elements affecting the final shape of the space design, with its effects on the perception and contact of surfaces, and also on the perception of the size and shape of the basic furnishing elements, as well as its effects on the perception of the space and dimensions of the interior space.

The fiber optic lighting technology described in this study is highly relevant to the philosophy of integrative engineering - as all building systems work together to achieve the best environment and the possible highest levels of energy efficiency.

Design ideas were crystallized in this study that depend on the importance of design with the effects of light and its colors, not with the light itself, as our awareness depends on these effects and the creation of new ideas that would not have existed only through the development of lighting technology for optical fibers, and this works to attract more design professionals.

Second: Recommendations

- Knowing the future perceptions of the technologies that will come after lighting with optical fibers by industrial lighting and moving to the use of natural lighting in optical fibers, through the use of what is known as the system of collecting sunlight Photovoltaic - Cells to the heart of optical fibers and from inside the building.
- From the previous results and after the study that the research dealt with about what is optical fibers, the desired goal is to work to make the best use of optical fiber technology as a modern technology that contributes to the development of lighting in the field of textiles, to be used mainly rather than decorative, to replace traditional systems.
- It is essential that designers work with all disciplines that serve design as one team, which is what is known in the Western countries as Team Work, and do not work independently of each other, in order to reach the design goals to be achieved in a vacuum.
- The importance of curricula in the textile department in specialized institutes and colleges to include more studies concerned with modern fibers and their role in developing the textile industry.
 - Specialists in the field of textiles must continuously monitor the events of the technologies provided by modern fibers and advanced textiles in order to be able to benefit from them in the field of specialization.
 - The need to encourage more studies concerned with studying the effects of lighting by optical fibers on textiles in terms of form, function and performance

References

- Badran Ibrahim “evidence of lighting engineering”- the national center for architectural and engineering consultants.
- Hegazy Al-Sayed Abd Al-Rahim “Cellulose and botanic fibers” part 1- Egypt print house-1940.
- Al-Saify Ihab Bessmark “Aesthetical and constructional foundations of design”- 1st edition- the Egyptian book-1992.
- Sohail Yasser Sohail “directions in design and innovation” Banha university print house.

- Al Gedawy Nermin Kamel Mohamed “morphology supports design through inspiring from nature” journal of architecture and arts- 8th issue- 2017- p.3.
- Ibrahim Maha Mahmoud “strategies of teaching design: enhancement of creative intellect for students of interior design between theory and application”. journal of architecture and arts- 18th issue- 20197- p.513.
- The 6th scientific conference- applied arts and challenges of the 21st century- the 2nd axis- design and the environment- from the 20th -22nd of March-1999.
- Al-Gamal Mohamed Abd Allah “basics of evolution of glass lighting fibres in light of information communication revolution”- the 1st international conference for the centre of technological progress studies and researches with the title “the Arab nation and challenges of the 21st century”.
- Selm, Bärbel Martin Camenzind.) ، (Medical Applications of Textiles Containing Optical Fibers.
- Emirhan) ،Kami -optical fibre in Textile 2005.
- Harlin Ali *, Mäkinen Mailis *, Vuorivirta Anne - DEVELOPMENT OF POLYMERIC OPTICAL FIBRE FABRICS AS ILLUMINATION ELEMENTS AND TEXTILE DISPLAYS. AUTEX Research Journal, Vol. 3, No1, March 2003.
- Mloynahan Collen, Apparel industry Magazine, May, 1992.
- R. Goff David, “Fiber optics Reference Guide "focal press, third edition, Massachusetts,2002.
- John Wilay & Son Lnc “Modern Textile” – New York – 1970.
- Kay, N. Gersil – fiberoptical. In Architectural Lighting- Mc Graw hill- 1999.
- Markus Rothmaier, Minh Phi Luong 1 and Frank Clemens - Textile Pressure Sensor Made of Flexible Plastic Optical Fibers - ISSN 1424-8220- 2008.
- R. Matthews Mauevsberger Herbert: Textile Fiber – sixth edition – London.
- Rsch. Assist. Kami Emirhan - FIBER OPTICS IN TEXTILE- Yeditepe University, Faculty of Fine Arts, Department of Fashion and- Textile Design, Turkey-2005.
- Kiekens Sundaesan Jayaraman,Paul, Ana Marija Grancaric-Intelligent Textiles for Personal- Amsterdam• Berlin • Oxford • Tokyo • Washington, DC-2005-pages 78:85.
- Sundaesan Jayaraman,Paul Kiekens,Ana Marija Grancaric - Intelligent Textiles for Personal Protection and Safety - Published in cooperation with NATO Public Diplomacy Division- 2006.
- Thames& Hudson – The Shining Cloth Dress & Adornment That Glitter – 2003.
- Timson, Paul and Barry Gregson: fiber-optics Lighting and Sensing Technology. Eurotec. London, 1993.
- **Van de Wiele N.V.M.**, "Double Plush Weaving Machine with Single Gripper for Production of Jacquard Velours for Upholsteries and Carpets" Melliand Textile Berchte. No.6, Vol. 60, 1979
- F. Pullman, Science Design, Stage lighting, Sound, Cestume Nakeup, Harber and Row Publishars, Inc, New York, 1983.
- **WU, Z., and Niu, H.**, "Recent developments in FRP strengthening techniques", the third middle east symposium on structural composites for infrastructure applications, Aswan, Egypt, Dec., 17-20, 2002.