A Review of Industrial Materials Applications as a Principal Means of Expression in Art-Design Products

Rosen Mitrev

***Abstract* – The paper reviews the opportunities of using industrial materials as principal means of expression in art-design products. Creative experiences in diverse areas (film, entertainment, theatre, etc.) with certain industrial materials are thoroughly investigated. The materials used, the production technology of the art-design products, the visual effect obtained, and the impact on the spectator are described. It has been concluded that the properties of the materials and manufacturing technologies help to boost the expression of the creative intention of the product, which in turn affects the spectator in the desired way.**

***Index Terms* – material art-design product, industrial materials.**

I. Introduction

In the initial phase of its development, the design [1] did not stand out as a single monolithic science or art or combination between them in the sphere of human knowledge but rather as a set of separate directions with different applications, using various instrumental means and subjected to universal principles. In [2,28], the design types are categorized. Each output product is different and has a material or intangible character. In the whole variety of design products, material art products [3] hold a special place because they are intended to satisfy the aesthetic needs of people by using material objects [3,4]. Through appropriate physical implementation and decoration, they can induce emotions, sensations or moods in the short or long term with varying intensity. The material art-design products come under the design definition of [5] and have solid artistic value expressed through a physical medium.

In addition to the intangible function aimed at human experiences, material art-design products also have an additional essential functionality - they replace natural objects as stage sets, objects with imitating functions, props [6,7], etc. Although the emotions, sensations or moods created by art-design products have an immaterial nature, their aesthetic impact on the viewer directly results from the visual features and additional functions implemented using the material object.

Although over the past two decades, materials, methods of analysis and manufacturing technologies [8,9,10,11,12, 13,14] have been significantly improved, in art-design products, craftsmanship with craft techniques still prevails. The main reason is the need for small series or unique pieces, imprinting the artist's individuality on the product. In some cases, this individuality is more important than the craftsmanship of the physical object.

The paper aims to review published theoretical and experimental studies describing the approaches and examples of creating material art-design products using widespread industrial materials and affordable production technologies.

II. A Review of Creative Experiments with Industrial Materials Used in Making Art-Design Products

Basically, from any industrial material, even waste [4,15], a material art-design product can be produced using a properly directed creative act. The paper summarises some widely used materials and their published applications with great potential for the realisation of the designer's idea.

A. Styrofoam

Expanded polystyrene (styrofoam) [16] is mainly used in the construction industry as a thermal insulator. When making art-design products, these properties of styrofoam are valuable: 1) Low density, respectively low weight of the blank and the final product; 2) Easy machinability with simple hand tools, allowing rapid 3D prototyping of the author's ideas; 3) An easy recycling or reuse. Its main disadvantages are: 1) Low mechanical strength; 2) Low resistance against environmental influence; 3) Low overturning stability of the final product. When making art-design products, styrofoam has two functions [6]: 1) It serves as a physical medium for the initial generation of the ideas, which are brought into form for moulding, i.e. the project is carried out in the model, used for the creation of a matrix; 2) It is a principal mean of expression, structural and forming material.

In [6], an application of Styrofoam is described for the manufacture of prop pillars for film. It has been tested that the patina used to decorate the produced by styrofoam pillars is suitable for the surface coating as it provides the required exterior artistic appearance and is chemically compatible with styrofoam. Visual examination of the end product shows that the material used and its subsequent artistic treatment express the idea proposed by the screenwriter and that multiple variants of the product are possible. The study [17] introduces sculptural forms in interaction with water. They are made of styrofoam, isolated with gypsum glue so that a fibreglass coating can be applied for moulding. In [18] the models of ice cabin in the SPA center - Starozagorski baths are featured, also made of styrofoam. To make the structure waterproof, a waterproof glue surface coating is applied. The glue also gives a surface hardness serving as a rigid shell protecting the object from mechanical surface actions - impact, pressure, stabbing, etc. The artistic perspective of the product is obtained from the decorative surface layer laid on the glue layer. Here, the facade latex paint with added colour pigments creates the sensation of cold and sparkling ice with a realistic

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effect. The same approach was employed to create a Neanderthal group in the cave "Bacho Kiro" - Dryanovo [18]. The composition depicts the space of the cave as a potential habitat for primitive peoples. The spatial object (the Neanderthal) is made only of a single block of styrofoam, processed using a metal brush to model the shape as it was conceived by the designer of the composition. The material used and the appropriate art decoration create a strong sense that the group is an ancient object suitable for the interior of the cave.

B. Fiberglass

Fiberglass is a widely used composite material consisting of short fiberglass threads bound to a polymer resin. In creating art-design products, it is used: 1) At the preliminary stage of the creative act for making moulds for 3D models; 2) At the manufacturing stage - to create the models themselves and correct the technical defects in them [17,19]. Fibres can be laid out in any way, but their orientation affects the mechanical strength of the structure and the copying and rendering of the particular 3D object. Using fibreglass to create art design products has been experimented in [17,19] to create sculptural objects for entertaining water basins. When making objects, the manufacturing process is carried out in the following order: 1) A model for a styrofoam mould is made; 2) Surface coating using gypsum glue is performed, which also has decorative functions; 3) A mould is made from the prepared form; 4) From this mould, the modelled product is replicated as many times as needed. The final model is sprayed with coloured acrylic paint. Through the artistic treatment, a feeling of brightness and softness inherent in the water is created. Despite the stylization of the sculptural object set by the creator, the layer of paint placed in a specific way combined with the fiberglass surface properties creates a feeling that brings the spectator closer to the actual object.

C. Polyurethane foam

The industrial application of polyurethane foam is for thermal and acoustic insulation and as a temporary and rapid means of installing various structural parts. Its different uses can be found in art-design. For example, in the cinema, polyurethane foam is used as a principal means of expression for the creation of 3D objects with different functionalities determined by the project's goals. A typical manufacturing solution is the creation of 3D shapes through pressure-injected foam in a mold [6,18,19]. In [18], props named "cheverme" and full-size human figures were made from polyurethane foam using humans as models. With a sculptural form [20], a suitable colour combination and a correct composition of the objects, a feeling of reality was created, associated with the sensation of delicious food for the spectator. The resulting relief contributes significantly to the realism of the object thanks to the ability of the polyurethane foam to penetrate small holes and depressions.

D. Textile materials combined with styrofoam

By combining textile materials with styrofoam, various artistic and mechanical effects can be obtained according to the purpose of the art-design product. An example is the lamination of 3D shapes. In [21], the results of a creative experiment with two theater performances are presented. In a performance called "The Maids", styrofoam laminated with raw cotton hase was used to create a set costume. Here, styrofoam is used as a major building and forming material. Complemented by the textile material, the 3D form becomes strong, and resistant to shocks and mechanical handling. The required colour combination is obtained through decorative patination with acrylic and latex pigments. In another performance called "Liza Minnelli" to further reinforce, additional lamination with a phaser was made. As the scenography implies a physical manipulation of the forms by the actress, the addition of a phaser makes it possible to reach their excellent mechanical resistance. An incredible impact on spectators is achieved using inexpensive industrial materials and proper lighting.

E. Textile materials

Textile materials are used in the fashion and sewing industries. Creative experiments with textile materials in creating art-design products have shown that through a raw cotton hase, objects with a 3D shape can be successfully developed, which effectively provokes different emotions and moods. The studies [22,23] show the realization of an idea and the production of multiple series of 3D forms "dolls" with various features - size, the complexity of the composition, play of colours, etc. The cut hase is first sewn, and then filled with silicone fluff to achieve a specific volumetric vision according to the designer's idea. Water-based acrylic paints are used to colour the textile blank. Many years of operation of these objects have shown that they do not change colour and are easy to keep. The combination of colors of the dolls, the shape, the expression of the face and the position of the hand (in some) create a feeling of movement in the spectator, even though the dolls are still. Despite the individual characteristics of each doll, a unified perspective was achieved, partly through the materials and production technologies used.

F. Sheep wool

Sheep wool is a natural industrial product used to make wool felt [24]. Specific uses of sheep wool are described in [23,25,26,27]. A series of 3D sheep wool dolls have been developed using the needle-punching process, used in carpet production. The result of the needle-punching is a wool felt, which builds the structure composition and form of the doll. Another effect of using the punching needle and getting the felt is that the doll also gains stability when positioned on a plane surface. A visual comparison of photographs of the Barbie doll and wool felt dolls [27] shows that the plastic Barbie doll, although fashionable and in demand, exudes coldness and has a beautiful but expressionless face. Wool felt dolls exude human warmth, enhanced by facial expressions, most of which can be traced back to the materials used. This is confirmed by the fact that woollen dolls have a very strong effect on children, causing the desire to hold them in her arms. Here, needle punching, efficiently creates an art design product with unique external characteristics.

III. Conclusion

The examination of studies on selected industrial materials resulted in the following conclusions:

1. Repeated creative experiments in different conditions show that widely used industrial materials can go out of their standard sphere of use and through appropriate form shaping and artistic processing, products with a strong artistic value can be created;

2. The properties of the materials and manufacturing technologies used to create art-design products support the

manifestation of the creative intent of the specific art-design product, which affects the spectator;

3. When choosing the material and technology, depending on the designesr's idea of the product, the real properties of the material should also be considered from the viewpoint of the possibility of meeting the set goals. Alternative materials should be compared against a variety of indicators – financial, physical, mechanical, chemical, thermal insulation, etc. properties. Moreover, the opportunity for recycling should not be overlooked.

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