Research on Material Selection of Product Design under Environmental Awareness

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Abstract: Human demand for artificial objects is multifaceted and constantly changing. Therefore, product design system is becoming more and more complex, and there are various conflicts and constraints between design elements. From the requirement of product design with environmental awareness, this paper expounds the adverse effects of design materials on the environment. On the basis of analyzing the influencing factors of material selection in product design, the influencing factors model of material selection is constructed, and the environmental principles of material selection in product design are put forward to guide designers to realize the sustainable development of design.

1. Introduction

With the development of the society, human demands on products have changed from only paying attention to using functions in the past to the requirement of all the properties such as using function, pleasure function and environmentally friendly function at present. Therefore, how to construct the relationship between the demands of human and the demands of environment to balance the system, improve design efficiency and guarantee product performance has become an issue of universal concern in the field of design at present. The life cycle of the products is getting shorter and shorter and the application of product molding materials not only affects the way of expression and the means of realizing the product modeling, but also directly relates to product recycling. With the rapid development of material science and technology today, it is a very important and urgent task for product designers to grasp the development trend of various new materials in a timely manner and apply the latest achievements of materials science correctly in modeling design to increase the added value of product modeling and reduce production and recovery cost. (As shown in Figure 1)

![Green product basic system](image-url)
2. Product Design under Environmental Awareness
The concept of green products first appeared in the United States environmental pollution prevention and control regulations but the real meaning of green products was born in the former Federal Republic of Germany. Green Product (GP), also known as Environmental Coordination products (ECP) has the basic idea of incorporating environmental factors and pollution prevention measures into product design at the design stage, take the environmental performance as the design goal and starting point of the product, and strive to minimize the impact of the product on the environment. Generally, it means focusing on product environmental attributes (Natural resources and utilization, environmental impacts and detachability, recyclability, repeatability, etc.) during the product lifecycle and make it a design goal. While meeting the requirements of environmental objectives, the basic functions, service life, economy and quality of the product should be considered and guaranteed in parallel. Modern product design takes industrial product as the main object, and focuses on the comprehensive creative design of the function, structure, material, craft, visual communication, aesthetic foundation, agreeable nature and relation related to modeling. On this basis, we can build the basic system diagram of Green Product.

3. Application of materials and environmental problems
There is no doubt that material is the matter basis for product design. One of the core contents of material science is to study the relationship among the organization, structure and properties of materials. On the other hand, material is an applied science. Only through reasonable technological process can the material of practical value be prepared, and the material can be made into engineering material through mass production. The impact of the material on the environment consists of two aspects, like two sides of a coin, positive and negative. On the one hand, materials can repair the damage to the environment in varying degrees, control or reduce the environmental pollution and so on, but the effect is temporary, local and relative. On the other hand, the negative impact of materials on the environment mainly refers to the direct or indirect damage and damage to the environment caused by the production, preparation, processing, use and regeneration of materials.

In theory, the negative impact of materials on the environment has inevitability, irreversibility and universality. Environmental problems caused by materials arise and develop at the same time with human desires, economic development, and scientific and technological progress. From the point of view of natural environment, there are two limitations to all kinds of materials that human beings need. The first is that the amount of specific resources contained in the earth is relatively limited, and the resources of certain materials are not infinite or inexhaustible. The second is that the total amount of pollutants the earth can hold is limited, and its self-purification ability is extremely limited. Once the amount of pollutants goes beyond the bearing capacity of a Space-time Ecological Environment, there will be irreversible environmental pollution.

4. Influencing factors of material selection in product design
Design is a conscious modeling activity, which means that people consciously use tools and means in production to process materials into visible or tangible entities with certain shapes, making them useful or commodity names. Thus, design and materials are inseparable. To synthesize people's demand for green products at the present stage, we can construct the basic model of material selection from four aspects: functionality, aesthetics, economy and greenness. (as showed in Figure 2)
4.1 Functional
Function is the use and performance of industrial products and the design purpose of industrial products. Function plays a leading role in the structure of the product, and also has an impact on the appearance and shape of the product.

4.2 Aesthetic property
Aesthetic property, as a nonquantitative index of fuzziness, is often neglected in engineering design. In the design of industrial products, it is one aspect to realize the beautiful shape and orderly structure of products. Reasonable arrangement and application of the sensory and physical properties of materials can bring new features to product modeling.

4.3 Economy
The manufacturer and distributor of the product, while satisfying the needs of people or the market, part of the purpose is to obtain higher economic profits. Therefore, in product design, the economic content of the product is not a decisive index, but it has become one of the criteria for product evaluation.

4.4 Environmental Protection
The degree of influence of products on the outside world in the whole life cycle reflects the green degree of products. According to different design objectives and contents, the green performance of the product is manifested in material design, energy-saving design, human centered design, recycling and disassembly design, etc. It includes resource saving, energy saving, environmental impact and human hazards.

The above four parts embody the purpose and related principles of product green design, but they can not be defined simultaneously through unified technical indicators. These elements interact and restrict each other. Each aspect can adopt corresponding parameters and indicators to balance.

5. Environmental principles of product design material selection
The material selection of green product design should be based on material flow. In the concurrent engineering environment, environmental factors should be evaluated for each link in the whole design.
process, so that the product has the least adverse impact on the environment, and materials that meet the requirements of green products are obtained.

In addition to the principles of material usability principle, the process principle of material selection and the economics of material selection, the environmental principle of material selection should be paid more attention.

The environmental means the production, forthputting and scrapping of materials have a major impact, beneficial or harmful, on the environment. If the material cannot be reasonably selected and used, it will cause great waste of resources and energy, causing serious pollution to the environment. For product modelling, the following principles should be considered:

- Choose the green material. Green materials have environmental coordination, low energy consumption, low cost and low pollution, and have become a hot spot for global material science workers.
- Reduce the type of materials used. Try to avoid using a variety of different materials during design, especially for parts that are difficult to separate.
- Use a detachable structural design. This structure is used to facilitate product recovery or recycling, sorting and reuse after disposal when using a variety of materials.
- Try to use raw materials that are not coated or coated. The material has a "feeling of appearance", and through the surface characteristics of the organoleptic material, different psychological feelings are generated, and the rational use can enhance the unique artistic expression of the material. However, most of the paint will cause great pollution to the environment, so use it as little as possible.
- Use materials that can be decomposed and absorbed by nature. If the waste material of the product is not easily decomposed and difficult to be absorbed by the natural environment, it will cause great pollution to the environment. The high-scoring waste after processing and using the material is an example, especially the pollution caused by plastic packaging materials is extremely serious. In contrast, degradable materials are environmentally friendly. For example, starch toothpick is made from plant starch as a raw material, and is made into a disposable toothpick by curing, molding and grinding. It can be naturally decomposed when exposed to water, and is environmentally friendly. Compared with bamboo toothpicks, starch toothpicks have high smoothness, moderate hardness and hardness, and can protect teeth.

6. Summary
Through the analysis of material requirements of green design and product design, the article grasps the factors affecting material selection and summarizes the environmental principles of selecting materials. On the basis of considering the function, process and cost of the product, the environmental and sensory properties of the material are taken as important considerations, making the selected materials more in line with the needs of modern society, improving product performance and meeting the needs of sustainable development.

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