



Analysis of Green Design Method Boosting the Construction and Development of Ecological Civilization

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ABSTRACT: This paper examines how green design can promote the development of ecological civilization in the context of global environmental degradation. Through the current emerging carbon-negative new materials and the dual carbon goal proposed by China, from the research and analysis of green design at home and abroad, how green design is applied and played in our daily life. At the same time, green packaging design is also part of our research, from the perspective of packaging design, we talked about the importance of green design, and also mentioned how to connect products and markets to better coordinate the relationship between product production and ecological environment.

KEYWORDS: Green Design; Ecological Civilization; Negative Carbon; Green Packaging Design

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I. INTRODUCTION

Human civilization is making progress, the world has taken on a new look, science and technology and culture have made qualitative leaps, manufacturing technology has made rapid progress, social productivity has been greatly improved, economic influence has been rapidly developed, and material and spiritual have been enriched. According to statistics, more than 70% of the emissions that cause global environmental pollution come from industrial manufacturing, and about 5.5 billion tons of harmless waste and 700 million tons of hazardous waste are produced every year. In the development process of industrial design, more attention has been paid to the basic functions, process feasibility and performance of products, while the efficient use of resources and energy and environmental performance have been neglected. This has led to a series of environmental problems, such as climate warming, stratospheric ozone depletion and ground ozone pollution, air pollution and water pollution, which also pose a threat to human health. At the same time, resources are slowly exhausted. At present, industrial production mainly relies on the extensive way of high input, high consumption and high pollution to seek economic growth, The capacity of social production to absorb and consume resources and energy far exceeds the carrying capacity of the environment to the economy, resulting in the crisis of resource depletion. Land degradation is also one of the most serious ecological and environmental problems in the contemporary era. It is estimated that about 29% of the world's land is desertification, 35% of the land is under the threat of desertification, and 6% of the land is seriously desertification. At the same time, a large amount of water and soil loss occurred. According to statistics, the annual loss of soil in the world is about 24 billion tons, and the annual loss of soil nutrients due to soil loss in China alone is as high as 1.339 billion tons, equivalent to 4.67 billion tons of fertilizer^[1].

Therefore, China has put forward the goal of carbon peak and carbon neutrality, and the development of green industrial design is particularly important. In order to further promote, it has put forward a specific system plan, and defined the overall requirements, main objectives and major measures. First of all, we should save energy and resources, implement a comprehensive saving strategy, continue to reduce energy and resource consumption and carbon emissions per unit output, improve input-output efficiency, and advocate a simple, moderate, green and low-carbon lifestyle. In principle, we should adhere

to the principle of "national overall planning, saving priority, two-wheel drive, internal and external smoothness, and risk prevention". In practice, the first is to promote the comprehensive green transformation of industrial manufacturing development, the second is to deeply adjust the manufacturing industry structure, the third is to accelerate the construction of a clean, low-carbon, safe and efficient energy system, the fourth is to strengthen the tackling and promotion of major green and low-carbon technologies, the fifth is to improve the green and low-carbon quality of industrial design products, the sixth is to continue to consolidate and improve carbon sink capacity, and the seventh is to improve the industrial mechanism and market operation. In terms of market operation, it is also necessary to play the role of price and supply and demand, use price to frame the interests of all parties, limit or encourage the energy consumption behavior of relevant parties, and then play the potential huge regulatory power of the market. At the same time, a policy system of "carbon peak, carbon neutral" with clear objectives, reasonable division of labor, strong measures and orderly connection should be established. Comprehensive saving strategy: abandon the extensive high energy consumption mode at the production end, and advocate the simple, moderate, green and low-carbon use mode and production process at the design end. At the same time, designers should mobilize the whole society to achieve the "double carbon" goal in the design concept^[2].

The research and application of green design in foreign countries are mainly concentrated in colleges and universities and some research institutions, such as Massachusetts Institute of Technology (MIT) and The Consortium on Green Design and Manufacturing of the University of California, Berkeley. Many famous foreign enterprises also attach great importance to the research and application of green design of products. Sony and other enterprises attach great importance to the research and application of green design of products, and have adopted green technology in the production and operation process of enterprises and various products developed. In particular, there are some effective response methods and measures to the relevant EU directives, which not only improve the technical content of products and market competitiveness, And it has established a good corporate image. These enterprises will publish and issue a green report or environmental report every year, and publish information on how to implement green design, green procurement, recycling of waste products and other information to the society, so as to gain the recognition of the society and consumers. Green industrial design also has the principles and methods to promote the construction of ecological civilization, which are mainly divided into the following nine principles, namely, progressiveness technology, innovative technology, advanced and practical functions, environmental coordination, optimal utilization of resources, optimal utilization of energy, minimization of pollution, safety and friendliness, and maximization of benefits^[3].

In the process of green design, we should flexibly and reasonably apply these design criteria to ensure the maximum efficiency of our products. In addition, attention should be paid to the redesign of old products, the balance and coordination of selective application, and the selection and focus. The product life cycle design process is mainly divided into design layer, evaluation layer and comprehensive layer. Its design is to consider all links of the product life cycle in the product conceptual design stage, including design, development, production, supply, use, and disassembly, recycling or disposal until scrapping, to ensure that the green attribute requirements of the product are met. The life cycle of a product includes the following links: market demand analysis, design and development, production and manufacturing, sales, use and recycling after elimination. In the design process, the selection of design cases is based on specific evaluation functions, which must include the basic attributes of products, environmental attributes, labor protection, effective use of resources, maneuverability, enterprise strategy and life cycle costs. Life cycle design is to seek the optimal use of resources and energy in the whole life cycle to reduce or eliminate environmental pollution.

II. THE IMPACT OF GREEN DESIGN TECHNIQUES AND NEGATIVE CARBON NEW MATERIALS ON ENVIRONMENTAL GOVERNANCE

From this aspect of the whole life cycle of products, materials are directly affecting the environment in the process of raw material preparation, product manufacturing, processing, use, recycling and other links. First of all, the preparation process of the materials used has an impact on the environment. Industries related to the preparation of engineering materials, such as metallurgy and chemical industry, are the main industries that cause environmental pollution. Therefore, it is of great significance to avoid or reduce the selection of these materials that have a great impact on the environment during the preparation process and reduce their use.

In the process of extraction, preparation, production, use and destruction of materials, a large amount of resources and energy are often consumed, and a large number of pollutants harmful to the environment are discharged, endangering human health and survival, which leads to environmental pollution as one of the three major global crises, seriously affecting human health and normal production

and living conditions. In European and American countries, environmental materials are known as environmentally friendly materials or environmentally friendly materials. Environmental materials are mainly understood as materials with little impact on the environment and products with little pollution and environmentally friendly materials. In Asian countries, especially China and Japan, the Chinese and Japanese terms of environmental materials are relatively similar, for example, environmental materials, ecological materials, green materials, ecological environmental materials, environmental coordination materials or environmental sustainable materials^[4].

The research of Eco-environmental materials has made important progress in both the environmental coordination evaluation of materials and the design, research and development of specific Eco-environmental materials. The life cycle analysis (LCA) is used by many countries such as Austria, Canada, France, Germany, the Nordic countries, the Netherlands, the United States and other international organizations such as the World Economic and Cooperation Organization and the International Organization for Standardization as the method of formulating signs or standards. The materials involved in the evaluation include: transportation materials), packaging materials, construction materials, bicycle materials and other materials. Accumulation of LCA evaluation and results. In the vast majority of LCA case studies, some basic cataloging analysis data are needed, for example, the workload related to energy, transportation and basic materials is very large. The continuous accumulation of evaluation data and the establishment of these data into a database are crucial work in LCA research. At present, there are more than 10 influential material life cycle assessment databases established by different countries, organizations or research institutions in the world. These databases play an important role in LCA research. Well-known enterprises in Japan, such as Canon, Toshiba, Hitachi, Futu, Sony, etc., and Siemens in Germany have also been paying attention to ecological efficiency and resource and environmental efficiency from the perspective of product material and technology development, so that the new products developed by them not only have economic benefits, but also have environmental benefits, to maintain future market competitiveness^[5].

In addition, in the iron and steel industry, compared with the blast furnace iron-making process, the direct reduction iron process has a simpler type of raw materials. Only iron ore, coal and limestone are used, which saves the interesting and coking processes in the blast furnace iron-making process, shortens the iron-making production process, and greatly reduces the environmental load generated in the production process. In terms of ecological building materials, a variety of non-toxic and pollution-free building coatings have been developed, such as water-soluble coatings, powder coatings, solvent-free coatings, etc. There is a coating material used for the surface of sanitary ceramics, which has the general properties of ordinary ceramic surface enamel, and has a new role of sterilization and mildew prevention. In the cement industry, environmental coordination design also has a broad application prospect. For example, using combustible waste to replace part of coal to calcine clinker can not only significantly reduce the energy consumption of cement production, but also play a role in preventing pollution and protecting the environment from the source^[6].

With the development of information technology, the impact of electromagnetic waves on human living environment is becoming more and more serious, and more attention is being paid to it. In order to reduce the radiation pollution of electromagnetic wave to human body, a large number of studies have focused on the development of effective shielding measures. At present, there are two main types of electromagnetic wave protection materials. One is absorbing materials, the other is reflective materials. In the face of serious pollution of urban automobile exhaust.

At present and for a considerable period of time in the future, the research of ecological environmental materials should be divided into several levels, mainly including: the change of the concept and consciousness of the whole people, especially the material industry; Macroscopic state behavior; The state's scientific plan on ecological and environmental materials; In terms of education and discipline construction, we should cultivate interdisciplinary talents; Establish corresponding organizations and academic groups, and strengthen the exchange and cooperation of ecological and environmental materials.

Eco-environmental materials are of great significance for maintaining the balance of resources, energy and environment, and realizing the sustainable development of society and economy. Among them, improving the theoretical system of material environmental compatibility assessment, developing various environmental compatibility new materials and green products, and researching new processes, new technologies and new methods to reduce the environmental load of materials have become the leading direction of material science and technology development in the 21st century^[7].

III. GREEN PACKAGING DESIGN UNDER THE BACKGROUND OF DOUBLE CARBON

Green packaging is also known as "pollution-free packaging" and "environmental friendly packaging". This is a package that is harmless to the ecological environment and human health, can be

recycled and recycled, and can promote sustainable development; That is to say, the whole process of packaging products from raw material selection, packaging manufacturing, use, recycling to waste disposal should meet the requirements of environmental protection and human health. The important connotation of green packaging is "3R1D", that is, reduce, reuse, recycle and degradable

We put forward a new design concept, namely green packaging design. The design concept integrates the strategy of protecting the environment and resources into the design of new products that can be accommodated and sustained by both ecology and economy. Green packaging design is to focus on the recyclability, natural degradability, reusability and other environmental attributes of the product within the life cycle of the packaging product, and take this as the design objective, so that the basic functions of packaging can be guaranteed while meeting the environmental objectives. Compared with the life cycle of traditional packaging products, green packaging design has changed the process from "product manufacturing" to "product use", and expanded the life cycle of packaging products to the recycling of products after use. This feature is convenient for us to analyze, understand and solve the material degradability, environmental issues, recycling and waste management issues related to packaging products from a global perspective during the design process, and is more convenient for the overall optimization of packaging design process. The most distinctive feature of green packaging design is parallel closed-loop design. Different from the serial open-loop design of traditional packaging design, green packaging design requires that each link of the product life cycle must be considered in parallel, and an effective feedback mechanism must be established, so as to realize the closed-loop cycle of each link. At the same time, green packaging design can reduce the generation of waste packaging materials, especially non-degradable materials, eliminate "white pollution", help protect the environment, save resources, maintain and protect the ecological balance, so as to achieve sustainable development, comprehensive utilization and recycling of packaging waste. In the process of green packaging design, we can carry out dynamic design at different levels, such as packaging art design and packaging product design, environmental protection technology and packaging product design, value design and packaging product design, to ensure that the packaging design is truly green, environmentally friendly and optimized^[8].

The main research contents of green packaging design are as follows: (1) Select and develop green packaging materials. Research on technologies that can replace and control harmful ingredients in existing packaging materials, and substitute technologies for natural "poor materials". (2) Try to use recyclable materials when packaging products. Recycling and using reusable packaging materials can improve the utilization rate of packaging materials, save a lot of energy and other resources consumption in the formation process of packaging materials on the basis of reducing production costs, and also reduce environmental pollution and hazardous emissions. (3) Reduce the use of hazardous materials and try to improve the use of non-toxic materials. During the packaging design, the use of toxic and hazardous packaging materials should be minimized. (4) Improve packaging and optimize product structure. Improving and optimizing the product structure and properly reducing the quality can also improve the packaging, reduce costs and reduce the harm and impact on the environment. For example, to enhance the structural strength of the product and the damage resistance of the product, so as to reduce the requirements for packaging materials. The research of DEC shows that increasing the internal structural strength of the product can reduce the demand for packaging materials by 54%, and also reduce the cost of packaging by 62%. (5) Strengthen the recycling of packaging waste. Strengthen the recycling of packaging waste. For example, the mineral water packaging of Evian can be compressed by 2/3 of the volume in the vertical direction after it is discarded, thus reducing the space occupied by the waste packaging during recycling, so as to improve the efficiency for massive recycling and regeneration^[9].

The green packaging structure also has corresponding design principles: (1) Avoid excessive high packaging, which not only has no benefit and effect on consumers, but also wastes resources and causes environmental pollution. During packaging design, it is necessary to avoid using "excessive packaging". The corresponding methods include reducing the volume and quality of packaging, reducing the number of layers of packaging, and adopting thin packaging. (2) Carry out "break up" packaging, that is, try to bulk or increase the packaging volume of some products, and use "break up" packaging for products. (3) Design recyclable and refillable packaging. Reuse and refilling methods can prolong the service life of product packaging, thus reducing the pollution and impact on the environment after packaging waste. Therefore, the cost of collecting and cleaning packages and the impact on the environment should be considered; At the same time, the corresponding refilling network and system should be established. (4) Packaging structure design: green packaging is realized by designing the structure of packaging materials.

In this regard, Japan has made packaging reduction. Typical cases include:

(1) New packaging of Sony's electronic products. Sony promotes its product packaging based on the four principles of "Reduce, Reuse, Recycle and Replace". The company not only follows the "3R" principle of circular economy of "reduction, reuse and recycling", but also innovates and optimizes the product packaging in terms of replacement. Let's take a look at several examples. Sony Corporation adopted foam plastic materials (EPS) for large models of televisions. The cushioning packaging materials were optimized and improved, and 8 small EPS materials were used for split packaging to cushion and shockproof, reducing the use of EPS by 40% compared with the previous; In addition, some products use EPS materials in the front, corrugated cardboard materials in the back, and corrugated cardboard boxes with special shapes for outer packaging, so as to achieve environmental protection and conservation of resources; In addition, for small TV sets, the company uses pulp molding material to replace the original EPS material.

(2) Packaging products of Toyo Can Co., Ltd. The plastic-metal composite tank TULC (Toyo Ultimate Can) developed by Toyo Can-making is composed of PET and iron sheet, and the main object is beverage can. This composite tank can save materials and is easy to recycle. It has the characteristics of low energy consumption and low consumption in the manufacturing process, and is an environment-



Fig. 1 New packing of Sony's electronic products

friendly product. The company also developed and produced an ultra-light glass bottle. The thickness of 187mL milk bottle produced with this material can be only 163mm and 89g, while the thickness of ordinary milk bottle is 2.26 mm and 130g. The milk bottle produced with this material is 40% lighter than ordinary bottle, and can be recycled for more than 40 times. Dongyang canning also produced paper cups without wood fiber and biodegradable paper plastic cups. In order to make the plastic packaging barrels and bottles can be easily and conveniently disposed after use, we choose to reduce the volume on the packaging and design several circular folds on the plastic barrels, which can be easily folded and reduced when the products are discarded. There are many kinds of plastic barrels (bottles), ranging from 500mL to 10L. From the actual cases of Japanese companies mentioned above, We can clearly feel that Japan has done a lot of fruitful research and development on packaging reduction measures^[10].



Fig. 2 Corrugated board material

IV. SUMMARY

In order to pursue economic benefits and efficiency, many manufacturing enterprises only focus on the early product design, manufacturing, cost and packaging, rarely consider the recycling and recycling mechanism after the product is abandoned, and rarely organize production from the perspective of the coordinated development of technology, economy and ecological environment, wantonly destroying the environment continues to accumulate, and the three major problems of resources, environment and population gradually emerge, It has become a huge problem and challenge facing our human society. If we can't deal with it in time, the earth home on which we live will be destroyed by our human hands. In order to solve environmental pollution more reasonably, we began to study green industrial design.

First of all, the research and application status of green design at home and abroad were analyzed. We learned that the research of green design abroad is mainly concentrated in colleges and universities and some research institutions, and the research and application of green design in China is also very important. The research of green design in China is mainly concentrated in some colleges and universities and research institutes, which are supported by the National Natural Science Foundation Committee and other relevant projects of other ministries and provinces, Extensive research has been carried out on the basic theory, key technology and application of green design. At present, a professional team engaged in green design research has been formed, laying a foundation for the development of green design research and application in China. Through research, we learned the inevitable requirements of sustainable development and the development of circular economy, and the implementation of green design is the starting point of the implementation of circular economy. Through the research of green packaging design, we learned the design principles of green packaging structure, the application and development of environmental materials, etc. Therefore, we know the importance of green design, and we can make more suitable products in combination with market demand. Of course, eco-environmental materials are of great significance for maintaining the balance of resources, energy and environment, and realizing the sustainable development of society and economy. Among them, improving the theoretical system of material environmental compatibility assessment, developing various environmental compatibility new materials and green products, and researching new processes, new technologies and new methods to reduce the environmental load of materials have become the leading direction of material science and technology development in the 21st century.

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