Research on the Application of Architectural Design in the Field of Sustainable Development: The Case of Building Materials

Xiaotong Wang *

Master of Landscape Architecture, Manchester School of Architecture, Manchester, United Kingdom of Great Britain and Northern Ireland

* Corresponding Author Email: 22508774@stu.mmu.ac.uk

Abstract. Due to the progress of industry and construction in recent years, more and more buildings are being constructed. The emissions emitted in the process of building construction have led to the intensification of the global greenhouse effect and other climate disasters, and human beings have begun to focus on the strategy of sustainable development, in which the emergence of green building materials in the construction industry is an important manifestation of sustainable development. This paper takes sustainable development as the theme to find the sustainable development strategy in the field of construction, taking green building materials as an example, by reading a lot of literature to choose different kinds of green building materials, which include green concrete, environmental glass, and environmental paving, and then study and analyze their production process and advantages. In building construction, a large number of green building materials will reduce the emission of pollutant gases, to achieve the effect of energy saving and emission reduction.

Keywords: Architecture; green building materials; sustainable development.

1. Introduction

In the contemporary world, a large number of buildings, with rapid urbanization, have been erected, which has led to the extensive use of fossil fuels in buildings and the emission of large amounts of greenhouse gases (GHGs). So far, carbon emissions from the building and built environment sectors account for a significant portion of the total human carbon emissions, which has a huge impact on global climate change. There are two options to stop climate change from getting any worse. The first is to switch from demolishing and rebuilding buildings to retrofitting them, as the greenhouse gases produced by demolishing buildings, the cost of demolition, and the greenhouse gases produced by the disposal of construction waste are all incalculable. The second is to change the type of building materials, which is mainly reflected in the use of green building materials. This paper collects some green building materials that have been produced in contemporary society by reading a lot of literature and books that contain green concrete, environmental glass, and environmental paving. This paper makes a simple analysis and research on their production materials and methods as well as advantages.

2. Sustainable Development

2.1. Concept of Sustainable Development

Sustainable development is not only about satisfying the demands of the present generation but also about not undermining the ability of future generations to meet their needs. Sustainable development is an indivisible system whose goal is not only to develop the economy but also to protect the natural resources and the environment on which humankind depends, such as the atmosphere, freshwater, oceans, land, and forests.

2.2. Meaning of Green Building Materials

Green building materials are a kind of engineering construction materials derived from the background of sustainable development, which are not only in line with the concept of green ecology

but also can fully meet the requirements of energy saving and environmental protection [1]. Green building material refers to the non-toxic, non-polluting, non-radioactive, environmentally friendly, and human health-friendly building materials produced by using clean production technology, less natural resources and energy, and a large amount of industrial or municipal solid waste. It has the performance of demagnetization, sound reduction, light dimming, temperature regulation, heat insulation, fire prevention, anti-static, and special new functional building materials that regulate human body functions.

3. Analysis of Construction Materials

3.1. Green Concrete

There are two main ways to make green concrete:

Industrial slag concrete: Add the appropriate amount of treated industrial slag in cement, such as fly ash, rice husk ash, and so on, as a way to reduce the amount of cement in the concrete, which not only improves the durability of green high-performance concrete, and reduces the role of industrial waste emissions [2].

Recycled Aggregate Concrete: Aggregate in concrete is made from broken waste concrete, waste bricks, and waste mortar instead of natural sand and gravel added to the cement mortar mix to make recycled aggregate concrete. Such concrete has the effect of saving resources and energy. However, recycled aggregate concrete has a certain service life, because recycled aggregate compared to natural aggregate in terms of porosity, water absorption, and strength, there are certain differences, after reaching a certain service life needs to be repaired or removed in time, and otherwise it will produce certain hazards [3].

3.2. Environmentally Friendly Glass

3.2.1. Low-E glass

The surface of Low-E glass is coated with metal layers and compounds, which can effectively reflect infrared and visible light [4]. It can be used to reduce the radiation of ultraviolet rays to the room and reduce indoor people and home appliances to ultraviolet exposure, which to a certain extent reduces the harm of ultraviolet rays on human skin and home appliances. In the meantime, Low-E glass is capable of conducting heat into the room while reducing solar radiation, avoiding the phenomenon of heat loss. The heat energy released by the sun can be stored by the glass, to be automatically released in the season of lower temperatures, to achieve the goal of indoor heating, can reduce the use of air conditioning, heating, and other heating equipment time, thereby achieving the goal of energy saving and consumption reduction [1].

3.2.2. Vacuum glass

Vacuum glass is a combination of two pieces of glass that pump away the gas between the two pieces of glass so that the gap between them becomes a vacuum state. Although vacuum glass lacks the function of thermal conductivity, it possesses extraordinary heat insulation and heat preservation functions. This feature of vacuum glass to avoid the indoor temperature suffering the influence of outdoor temperature, thus creating a comfortable living space for people, is currently a common type of glass used in residential housing.

3.2.3. Foam glass

Foam glass is an inorganic non-metallic glass material made of crushed glass, foaming agents, modified additives, and foam accelerators, which are finely crushed and homogeneously mixed, then melted, foamed, and annealed at high temperature. Foam glass in a high-temperature environment does not decompose, a low-temperature environment does not deteriorate, does not oxidize, does not burn, has excellent fire performance, and is the ideal building thermal insulation material [5].

However, foam glass has the disadvantage of being fragile, so it is not widely used as a building material, but more as a kind of thermal insulation material.

3.3. Environmentally Friendly Paving Materials

3.3.1. Recycled previous brick

Permeable bricks are divided into no-burn permeable bricks and burnt permeable bricks, No-burn permeable bricks are concrete permeable bricks made by the concrete process, while burnt permeable bricks are environmentally friendly recycled permeable bricks. Recycled permeable bricks are environmentally friendly high-performance permeable bricks made of waste crushed bricks, waste ceramic bricks, and waste concrete block crushed mixture as the main aggregate, and sludge, quartz sand, and waste glass mixture as the binder, and its comprehensive utilization rate of solid waste reaches more than 96% [6]. Its surface texture is finer, water permeable for a long time, and its service life is longer than ordinary concrete permeable bricks. Permeable bricks can effectively reduce rainwater runoff, alleviate urban flooding, promote rainwater infiltration, storage, and purification, reduce urban noise, and reduce the "urban heat island" effect, with significant advantages and broad application prospects [7].

3.3.2. Stone wood polymer composite flooring

Stone wood polymer composite flooring, as a new flooring category, is made of natural calcium carbonate stone powder and polyvinyl chloride, and other polymer materials as the main raw material for the composite material as a substrate, by the finish, processed into the composite flooring. Due to the natural calcium carbonate stone powder and polyvinyl chloride polymer materials, good water resistance and flame retardant properties, stone wood polymer composite flooring with environmental protection, waterproof and moisture resistance, wear-resistant and non-slip, flame retardant good performance [8].

Stone wood polymer composite flooring has been widely used in shopping malls, offices, restaurants, kindergartens, home furnishings, and other indoor spaces from its birth to now. Although it is only a few years, its excellent performance has been recognized by domestic and international markets.

3.3.3. Lightweight microfoam ceramic composite flooring

Lightweight micro-foam ceramic materials refer to the use of special raw material formulations, low-quality ceramic raw materials, and industrial waste as the main raw materials, add inorganic composite foam with the expansion of SiC, MgCO3, Al2 (CO3) 3, and other inorganic composite foaming agent, raw material processing using dry granulator combination instead of ball mills, spray towers combination of granulation and drying raw materials into the energy-saving rollers kiln after molding in 1100 ~ 1200℃ temperature of natural melt foaming, forming uniformly dense closed air holes, made of completely sintered lightweight foam insulation ceramic materials, its production in the production of lightweight foam ceramic composite materials. 1200℃ temperature natural melt foaming, the formation of uniformly dense closed air holes, made of completely sintered lightweight foam insulation ceramic materials, the production of its edges, waste, and production wastewater can be recycled [9].

Lightweight micro-foam ceramic stone composite panels incorporate the advantages of natural stone and foamed ceramics in one, with the natural appearance and texture of stone, while having the superior performance of ceramics, lightweight, easy to construct, both a certain thermal insulation and heat preservation function, the strength of consistency is much higher than the pure stone products [10].

3.3.4. PVC flooring

PVC flooring is based on PVC resin as the main raw material, adding fillers, plasticizers, stabilizers, coloring agents, and other auxiliary materials, on a sheet substrate, coated, calendered, extruded, or extruded process production [11].

PVC flooring has many advantages:

Green environmental protection: The main raw material for production is high-quality PVC resin, which is an environmentally friendly, non-toxic renewable resource, natural and environmentally friendly, 100% free of formaldehyde, benzene, heavy metals, and carcinogens, no soluble volatiles, no radiation;

Ultra-light and ultra-thin: PVC flooring is only 2-3 mm thick and only 2-3 kg per square meter, which is less than 10% of the weight of ordinary flooring materials. In high buildings, it has unrivaled advantages in terms of load-bearing and space-saving. In the meantime, there are also special advantages in the renovation of old buildings;

Super wear-resistant: PVC floor surface has a particular layer of transparent wear-resistant layer by high-tech treatment, fully guaranteeing the excellent wear-resistant performance of the floor material, PVC floor surface wear layer according to the differential thickness of the general situation can be applied for 5-10 years;

High elasticity and super impact resistance: PVC flooring texture is softer, so the elasticity is very good, in the impact of heavy objects has good elastic recovery. When people walk on the floor, compared with the traditional solid wood flooring and laminate flooring, can significantly reduce the impact on the feet, reduce the proportion of people falling and injured;

Super anti-slip: The wear-resistant layer on the surface of PVC flooring has special anti-slip properties, compared with ordinary flooring materials, PVC flooring in the case of sticky water is a more astringent foot, the more water the better the anti-slip properties;

Fire retardant: PVC plastic flooring itself is the main component of polyvinyl chloride, difficult to burn, and can play a role in a certain degree of flame retardant;

Waterproof and moisture-proof: PVC flooring because the main component is vinyl resin, and water has no affinity, so it can be used in wet environments, and will not be moldy due to high humidity;

Sound-absorbing and noise prevention: PVC flooring has a sound-absorbing effect that cannot be compared with ordinary flooring materials, and its sound absorption can reach up to 20 decibels, which can provide a more comfortable and more humane living environment;

Simple installation, easy maintenance: with a better art knife can be cut arbitrarily, but also with a combination of materials of different colors, to meet the diversified and personalized decorative needs of consumers, to achieve the most desirable decorative effect;

Acid and alkali corrosion resistance: PVC flooring surface with a special protective treatment, has a strong resistance to acid and alkali corrosion performance;

Thermal conductivity and warmth: PVC flooring has good heat conductivity, uniform heat dissipation, and a small coefficient of heat expansion. [12].

In conclusion, the favorable performance of PVC is suitable for public places with high public safety requirements. From the early 1980s, PVC flooring into the Chinese market, by virtue of its comfortable touch, exquisite appearance and environmental protection, and low-carbon characteristics of the user quickly favored, and now has been generally accepted, the use of a very wide range of places, such as hospitals, schools, elderly care facilities, office buildings, stadiums, stations, terminals waiting room and other various places [13].

4. Suggestions for Green Building Materials

Nowadays, with the rapid development of industry and construction, the annual emission of carbon dioxide and other greenhouse gases not only breaks the ecological environment but also leads to the increasing greenhouse effect. Therefore, human beings pay more and more attention to sustainable development. In the construction industry, people produce more and more green building materials, and these green building materials are widely used in the current construction industry. In the future development and application of green building materials, human beings should pay attention to the following points:

Humans should fully understand the characteristics and nature of each green building material, which can fully develop the advantages of green building materials and improve the quality of building construction. Wave out, and improve the construction quality, efficiency, and environmental protection of the building;

Part of the materials used in the current building not can be replaced by all green building materials, mankind should actively research and produce new green building materials, reduce greenhouse gas emissions, and promote the further development of the sustainable development plan for the construction industry;

The state and the government should pay attention to the research of green building materials, provide a guarantee for it, and promote the progress of green building materials.

To sum up, there are many kinds of green building materials, most of which are reproduced by using waste industrial materials as raw materials, which not only reduces the pollution of industrial wastes to the environment but also saves the raw materials of green building materials. People in the construction of buildings, a large number of green building materials will reduce air pollution and can alleviate the greenhouse effect and climate disaster. Green building materials are not only the performance of social progress, but at the same time for the sustainable development of the construction industry has an important significance.

5. Conclusion

This research has found that there are different kinds of green building materials in the construction industry, and their raw materials and characteristics have significant effects on promoting environmental protection and sustainable development strategies. The results of this study show that the construction industry can reduce the emission of pollutant gases and dust through the use of green building materials instead of primitive materials, such as cement and concrete, which is a major step towards the protection of the ecological environment and the reduction of atmospheric pollution. It is of great significance to protect the ecological environment and reduce air pollution. In the future, researchers working on the sustainable development of construction can continue to conduct in-depth studies on different types of building materials, in order to create a new type of green building materials that can replace the original building materials, or further improve the existing green building materials to make them more environmentally friendly building materials, in this way, to promote the sustainable development of the construction industry.

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