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Application research of new energy-saving environment-friendly materials in architectural engineering

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Abstract. As the eco-environmental crisis problems have gained the increasing social concerns, greenness, energy conservation, and environmental protection have become the inevitable trend of architectural development. The development of scientific technology has promoted the appearance of various new energy-saving and environment-friendly materials, and the popularized material application needs practical demonstration and technological support in a certain promotion process. The paper explores and studies the application of partial new energy-saving and environment-friendly materials in architectural engineering from the perspectives of wall, door and window, roof and etc.

The rapid urban extension helps the architecture field to gain extraordinary developments. Accompanying with the waste of natural resources, the damage of ecological system, and the deterioration of living environment, it is forced on the society, industry, and practitioners to reflect existing problems and hidden dangers. The application and promotion of new energy-saving and environment-friendly materials in architectural engineering is an essential way to improve the current status and enlarge the establishment of energy-saving buildings. Adopting the new materials and technologies which are able to embody the modern scientific development level is to improve the architectural properties in heat preservation, ventilation and energy conservation, ease the energy crisis, and resolve the paradox of modern social and economic development and energy shortage. The enclosure structural material to constitute architectures greatly determines the energy consumption of architectures. Due to the requirements of architectural energy conservation, the architectural materials inevitably have fundamental changes. In the enclosure structure, wall is changed into heat-preserved one, roof is changed into heat-preserved and thermal one. Door, window and curtain wall are required to be heat-preserved and thermal, and added a solar shading system.

1. The necessity to develop new energy-saving environment-friendly material

At present, the problems of energy consumption and environmental pollution worldwide is becoming increasingly severe, even impacting the general environment, CPI (consumer price index) base and energy use. Therefore, intensively applying new energy-saving materials in architecture has an important significance. Its necessity can be embodied as follows: firstly, to reduce air pollution and protect environment. Environmental problem is one of the main problems currently. A lot of mineral materials are needed to burn in the process of architectural construction, which undoubtedly accelerates the environmental pollution and a variety of environmental problems will come in sequence. Thus, China needs to implement and apply the architectural energy-saving materials to alleviate the problem. Secondly, energy is the drive of social and economic development. The energy



shortage, to some extent, restricts the developing speed of national economy. Therefore, China should go on the road of energy conservation, and realize the sustainable use of energy, so as to better develop economy. Thirdly, it is the need of future architectural development. Because more specific needs are made to architectural energy conservation nationwide, the architectural components of massive architectures have undergone profound changes with the national requirements. It can be seen that, the application of new environment-friendly and energy-saving material can not only alleviate the energy shortage, but also meet the need of social and economic development [1].

2. The advantage of new energy-saving and environment-friendly materials

Traditional architectural materials have plenty of deficiencies, like the problems of high building cost, high energy consumption, and high waste, while the appearance of new energy-saving material not only resolves there problems, but also makes up of the problem of short used periods of traditional architectural materials effectively. The advantages of energy-saving environment-friendly material in architectural field are embodied as follows: firstly, reducing energy consumption, saving resource use, and promoting energy-saving materials are to help the architectural field to change the fixed production mode of high pollution and energy consumption and lead it to the new road of “energy conservation” and “environmental protection”. Secondly, it complies with the related national policies and requirements. With the rapid development of architectural field, China has realized the severity of architectural pollution, formulated related policies timely, and called up energy conservation and consumption reduction and carried forward green life, which leads to plenty of energy-saving materials. Thirdly, it is to promote clean production. Energy-saving material not only has the utility of environment-friendly recycling, and relatively high architectural adaptability. Energy-saving material is a new architectural one being beneficial to sustainable development. Using energy-saving materials can better benefit the promotion of clean production [2].

3. The application of new energy-saving and environment-friendly material in architectural engineering

3.1. The application of wall

China's traditional enclosure structural walls are mostly composed of inorganic materials such as masonry, concrete, cement mortar and so on. Nowadays, for the purpose of energy conservation and heat preservation, a large number of organic insulating materials such as molded polystyrene foam boards and extruded polystyrene ethylene Foam Board, Polyurethane Foam, etc. have been introduced, for which has stronger thermal insulation performance than traditional wall materials. Therefore, organic insulation materials are intensively used in building enclosure structural energy conservation to form an integrated wall of inorganic material and organic one, which puts forward new requirements for the construction process. The typical thermal insulation wall is compounded of organic and inorganic materials. In addition to the traditional requirements for load-bearing and sound insulation, the wall has added the requirement of heat-preservation and thermal insulation. Inorganic materials and organic materials are required to be combined into a whole, being able to work together in natural environment. Therefore, there are new requirements for the material properties and construction process of the wall materials.

The new environment-friendly flame-retardant honeycomb composite wall material is produced by using wastes such as cinders, rice straw and so on. It is made by mixing and stirring the waste with cement and binders, which reduces waste emissions and realizes clean production, with the advantages of low energy consumption, light weight, and small amount of required cement, and having broad developing prospects.

The photocatalyst decorative material, taking nanometer titanium dioxide as the optical semiconductor, painted in general decorative materials to achieve the effect of photosynthesis, having strong catalytic and degradable functions and playing a good role in sterilization, stain resistance and deodorization [3]. However, seeing from the present Chinese situation, the material application

remains low and is currently used in hospital agents. Thus, the material promotion needs to be improved.

3.2. *The application of door and window*

The coating layer of low-radiation coating glass has the features of high-transparency visible light and mid-distance high-reflection infrared ray. In contrary to common glasses, it has outstanding thermal insulation effects and good light transmissions. It is the best glass of comprehensive energy conservation to realize the purpose of energy conservation and environmental protection [4]. Door and window are the main tunnels to exchange energy interior and exterior architectures. The energy conservation of door and window has a significant meaning to the whole architectural energy conservation. In winter, the low-radiation coating glass can play an important function for heat preservation, reaching the ideal energy-saving effect of warm-winter and cool-summer. In addition, low-radiation coating glass can effectively resist ultraviolet rays, preventing interior furniture from sunshine and color-fading. Low-radiation coating glass radiates to transmit heat. Using the glass can effectively avoid the quick heat dissipation. What's more, when heating indoor, partial materials will release some harmful matters. However, using low-radiation coating glass can reduce heat loss, then lower the consumption of heating fuels, so as to reduce the release of harmful gases, finally reach the effect of energy conservation and environmental protection. In addition, the transmission property of low-radiation coating glass is good. Comparatively, low-radiation coating glass can reach the visible degree of over 80%. It can be seen, using low-radiation coating glass can not only strengthen the indoor lighting performance but also prevent the light pollution in architectural engineering.

3.3. *The application of roof*

Generally, the roof insulation is to set the insulation material with low bulk density, low thermal conductivity and low water absorption between the waterproof layer and the roof plate. According to this, a large number of optional insulation materials are available. The plate-like material includes aerated concrete block, cement or asphalt perlite board, cement polystyrene board, cement slate board, polystyrene board, and various light aggregated concrete panels, etc.; the in-site pouring bulk-cement material includes perlite, vermiculite, ceramsite, pumice, waste polyphenylene granules, slag, etc.; the material adopting loose bulk directly or in bags installed under the roof top or the ceiling includes expanded perlite, glass wool, rock wool, waste polystyrene, etc.; the on-site foamed and poured material includes hard polyester foam and fly ash, cement-based foamed concrete. The anti-fabrication method mainly sets the waterproof layer under the thermal insulation layer to effectively protect the waterproof layer and facilitate construction and maintenance. However, owing to the high building cost, it has not been used to residential buildings in large quantities.

4. Conclusions

Saving energy and protecting environment is one of the key problems in architectural field research. Energy-saving and environment-friendly design for architecture is the main trend of future architectural development. In the process of energy-saving and environment-friendly design, designers should actively adopt new architectural materials and technologies, so as to realize the goal of architectural energy conservation and promote the sustainable development of architectural field on the basis of ensuring architectural engineering quality and meeting resident's living and using needs.

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