

# Application of environmentally-friendly and energy-saving materials in building decoration

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**Abstract.** With the rapid development of urban construction, the state and society gradually realize the significance of environmental protection and put forward higher requirements for the specific construction of the building industry. In this paper, it summarizes and sorts out the environmentally-friendly and energy-saving materials through analyzing and comparing common building materials on the market. During building decoration, make full use of energy-saving and environmentally-friendly building materials to promote their wide application in the construction industry.

## 1 Preface

The rapid development of building industry brings about huge environmental pressure to the society and there are still some defects in the choice of building materials by Chinese construction enterprises. With the proposal of scientific outlook on development, the concept of energy saving and emission reduction has been deeply rooted in the hearts of the people, which requires the building enterprises to regulate the choice of building materials while pursuing economic benefits, so as to ensure the sustainable development of the construction industry.

## 2 Overview of environmentally-friendly and energy-saving materials

### 2.1 Significance

Environmentally-friendly and energy-saving materials refer to building decoration materials that do not use or use less natural resources and energy, have clean production techniques and are harmless to people<sup>[1]</sup>.

With its excellent performance, corrosion resistance, high strength, sturdiness and durability, the use of energy-saving and environmentally-friendly materials during building decoration is suitable and can save a lot of energy resources for construction enterprises and play an important role in environmental protection and ecological construction<sup>[2]</sup>.

### 2.2 Features

Compared with traditional decoration materials, energy-saving and environmentally-friendly materials have the following features:

- Generally, the raw materials of energy-saving and environmentally-friendly decoration materials are industrial and agricultural waste materials. And depending on the corresponding low energy consumption technology, it has a certain protective effect on the environment and has an energy-saving effect<sup>[3]</sup>.
- Energy-saving and environment-friendly materials have good physical properties, which can be reused to effectively save decoration resources, and their hardness and durability can meet the requirements of most engineering projects<sup>[4]</sup>.

## 3 Specific application of environmentally-friendly and energy-saving materials in building decoration

### 3.1 Low-E glass

Currently, Chinese construction enterprises often use glass materials when constructing the building decoration, especially in the process of curtain wall design. The application of glass is becoming wider and wider, which requires construction enterprises to choose low-radiation environmentally-friendly and energy-saving glass when designing curtain walls<sup>[5]</sup>. Low-E glass is crystallization of advanced science and technology. The surface of building glass is coated, and after basic operations by technicians, new energy-saving and environmentally-friendly materials come into being. The style of Low-E glass is shown in Figure 1.

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Figure 1. Style of Low-E glass.

### 3.1.1 Performance advantages of Low-E glass

In order to better introduce the energy saving effect of Low-E glass, I chose common transparent glass, endothermic glass, heat-reflecting glass and Low-E insulating glass respectively with the unified size of 6mm thickness as the objects to compare the averages of their heat transfer coefficient and shading coefficient respectively.

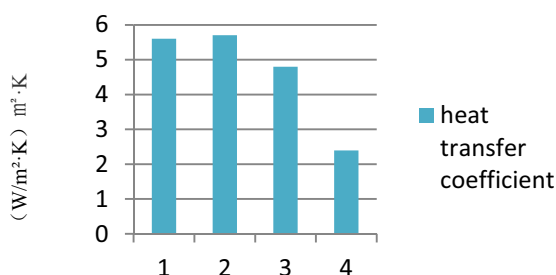


Figure 2. Heat transfer performance of different glasses.

According to Figure 2, the endothermic glass has the highest heat transfer coefficient of 5.7, thus its energy saving effect is the worst. While Low-E insulating glass has the lowest heat transfer coefficient of 2.4, thus the energy saving effect is the best.

### 3.1.2 Classification and performance parameters of Low-E glass

According to the number of functional layers of Low-E glass (the number of layers of metallic silver), it can be divided into single silver Low-E glass, double silver Low-E glass and triple silver Low-E glass<sup>[6]</sup>.

According to Table 1, the value of triple silver Low-E glass is not much lower than that of double silver Low-E glass only from the perspective of shading coefficient because visible light energy accounts for much more than infrared heat energy in the shading coefficient. The heat insulation and energy saving effect of triple silver Low-E glass is far better than that of double silver and using triple silver Low-E glass can effectively reduce the energy consumption caused by indoor air conditioning. The advantage of triple silver Low-E glass is that its transmission ratio of visible light is higher than before, which is able to gain enough sunlight indoors; the

transmission ratio of solar infrared heat is low, the heat transfer coefficient is also lower, and it can effectively insulate the heat.

Table 1. Performance parameter comparison of Low-E glass.

	Single silver Low-E glass	Double silver Low-E glass	Triple silver Low-E glass
Transmittance of visible light(T <sub>v</sub> )	0.54	0.51	0.49
Total transmittance of solar energy	0.53	0.3	0.28
Shading Coefficient	0.55	0.40	0.33
Heat transfer coefficient (W/m²·K)	2.07	1.94	1.86

### 3.1.3 Application of Low-E glass in decoration construction

The building construction of Low-E glass should go through the following processes: first of all, construction enterprises are required to use tools such as laser theodolites and gradienters to formulate reasonable architectural decoration drawings and determine the main building structure according to the drawings. Based on it, determine the center of the connection point between the material and the main building structure, set three axes of X, Y, and Z, and allow tolerance of ±10mm in the three directions.

Second, in case of component type curtain wall, tempered glass or insulating glass that makes the material unable to be cut on site during the construction, the actual size of the glass should be checked before construction and compared with the material data in the design drawing, the center of the frame material and the main structure should be adjusted, so as to ensure the normal installation of the coated glass.

Third, after the glass is connected, the construction unit should perform an overall inspection according to the main building structure and the installation position of the curtain wall, correct the deviation of improper parts position in time, and weld the connection parts with the embedded parts in the main structure, so as to guarantee the firmness and stability of the welding.

Fourth, in the later stage of the installation of the coated glass, design the building to prevent from thunder and fire according to the nodes specified in the design drawings to ensure the stability of the materials and improve the safety performance of the main building.

In the construction of Low-E glass, it is particular about the installation technology. In daily life, it plays a huge role in indoor heat preservation and warming in winter. At the same time, Low-E glass can effectively block outdoor ultraviolet rays to avoid indoor interference from ultraviolet rays, which can reduce the light pollution in buildings, controls the emission of construction pollutants to a certain extent, and protects the environment<sup>[7]</sup>.

### 3.2 Stretch ceiling

#### 3.2.1 Advantages of stretch ceiling over normal ceiling

The advantages of stretch ceiling over normal ceiling are:

- The stretch ceiling breaks through the defects of shape fixing and small piece assembly of traditional solid ceiling, which can be used in large pieces (up to 40 m<sup>2</sup> per piece).

- The stretch ceiling can be easily shaped to various artistic styles. It has rich colors, good waterproof effect and is not easy to fade.

- The site construction of stretch ceiling is simple and convenient with light weight, long servive life and high recovery rate, as shown in Table 2 [8].

**Table 2.** Parameter comparison of stretch ceiling and normal ceiling .

	Stretch ceiling	Normal ceiling
<b>Installation time</b>	1 day/100 m <sup>2</sup>	1 day/40 m <sup>2</sup>
<b>Weight</b>	500g/m <sup>2</sup>	12Kg/m <sup>2</sup>
<b>Recovery rate</b>	100%	0%
<b>Life Span</b>	>10years	3-5 years

#### 3.2.2 Application of stretch ceiling in building decoration

For building units, the design and use of ceilings is an important part of decoration construction, which has an influence on indoor lighting and indoor environment. When performing decoration of ceilings, the construction unit should select suitable decoration materials in the market to meet the material selection requirements for energy saving and emission reduction. After many practice and analysis, it is found that the stretch ceiling is the most often used decoration method in today's architectural decoration, which make up for the disadvantages of traditional solid ceiling. In actual engineering design, the stretch ceiling, depending on its soft film, is able to present a variety of pattens in building decoration, which improves the indoor visual beauty to a great extent. The effect of stretch ceiling in real life is shown in Figure 3.

The effective use of stretch ceiling saves building materials for construction units, improves the construction efficiency and reduces labor costs, which promotes the development of construction enterprises. The stretch ceiling also plays a significant role in indoor design. It can refract indoor lights with its own uneven texture, so as to improve the indoor lighting utilization, perfect the indoor lighting conditions, and make outstanding contributions to energy saving. In production and development, the raw materials of stretch ceiling are mostly PVC, so it has the function of physical insulation at the same time, which plays an important role in reducing the heat loss in the building.

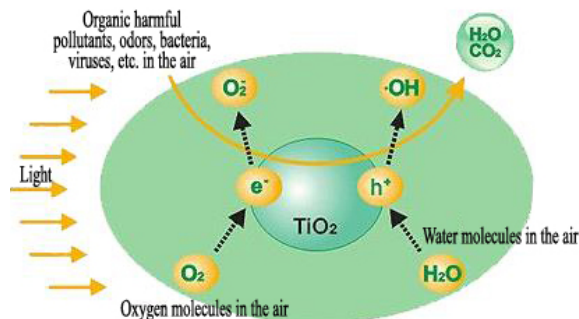


**Figure 3.** Actual application effect drawing of stretch ceiling.

### 3.3 Photocatalysis

#### 3.3.1 Principles of photocatalysis

Photocatalysis remains a new type of building material based on photocatalyst technology. It has its own photoconductor characterized by nano-secondary titanium dioxide. It can make full use of the oxygen molecules and water molecules in the air to convert the organic matter it comes into contact with CO<sup>2</sup> and water. It can produce chemical reaction at the same time of maintaining the stability of its own chemical molecular structure, thereby catalyzing photoredox reaction. Its principles are shown in Figure 4[9].



**Figure 4.** Principle diagram of photocatalysis.

#### 3.3.2 Application of photocatalysis in building decoration

In the process of decoration construction, photocatalysis plays a huge role in improving the indoor environment. The functions are as follows: first of all, photocatalysis can effectively prevent the breeding of harmful bacteria in the room, has the functions of killing bacteria, and is antibacterial as well as mildew proof during its application in building construction.

Second, photocatalysis is featured as hydrophilicity. The contact angle between the surface of photocatalysis and water is nearly zero, so applying photocatalysis to building decoration can give full play to its own advantages and achieve the function of waterproof and anti-fog. The hydrophilicity is shown in Figure 5.



**Figure 5.** Hydrophilicity of photocatalysis.

Third, photocatalysis is able to oxidize and decompose organic compounds and some inorganic compounds, decompose the harmful chemicals indoors, break down the cell membrane of bacteria, solidify the protein in the virus, and effectively wipe out bacteria and harmful substances, so as to purify indoor air and improve indoor environment.

#### 4 Conclusion

In summary, in order to occupy a higher market share under the market economy system, the construction industry must improve the technical standards in the construction, adopt advanced technology, select high-quality and environmentally friendly decoration materials, help accelerate energy saving and emission reduction during the decoration of building construction, strengthen the sustainable development ability of construction enterprises, and continue to deepen and implement the goal of ecological environment construction, so as to assist in the development of the times.

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