



Testing Problems and Quality Management Strategies of Building Energy-Saving Materials

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Abstract. In order to improve the energy-saving quality of building materials, this paper first analyzes the development of building materials and energy-saving management, and then puts forward the background of building materials inspection and energy-saving management; Clearly define the supervision and management responsibilities and implement the quality management and control work; Strengthen the detection of new energy-saving materials; Standardized sampling; Strengthen the training of testing personnel; Unified testing quality standards, hoping to provide reference for relevant personnel.

Keywords: building energy-saving materials · testing · Quality Assurance

1 Introduction

At present, the problem of environmental pollution is increasing, and the energy consumption of the construction industry is large. In order to meet the requirements of sustainable development strategy, the industry should change the previous model and pay attention to the application of energy-saving materials and technologies. By using energy-saving materials to replace traditional materials, we can make efficient use of materials, improve the efficiency of enterprises, reduce the impact of construction on the environment and improve the green and environmental protection of engineering construction. In order to give full play to the advantages of energy-saving materials, we must ensure the quality of energy-saving materials and implement the testing work. At this stage, there are many problems in the testing work. We need to carefully analyze these problems and take effective measures to properly solve them, so as to continuously improve the efficiency of energy-saving material testing.

2 Main Types of Building Energy-Saving Materials

2.1 Hollow Concrete Block

In order to meet the requirements of engineering design and reduce construction costs, we must use energy-saving materials. In modern energy-saving building materials, concrete

hollow body is a common material and an indispensable material in building materials. The production process of hollow concrete block is relatively simple and belongs to common wall building materials. Hollow ratio is the largest reference index of air concrete block and the main reference for making good materials. Generally, the hollow ratio should exceed 40%. Although the center of this material is empty, its reference strength and height are the same as that of solid concrete, which also makes it effectively used in building seismic construction [1]. At this stage, it is commonly used in wall, high-rise buildings and bridge construction. The hollow concrete block has light weight and hollow structure, which can improve the thermal insulation effect and reduce energy consumption.

2.2 Aerated Concrete

Aerated concrete is based on injecting air into traditional concrete. Compared with hollow concrete, it has lower production cost and more advantages in energy-saving effect. It is generally used in filling composite wall in construction. Based on the principle level, injecting air into traditional concrete can produce small bubbles and fill the concrete with air (as shown in Fig. 1). When making aerated concrete, in order to ensure its stability and strength, it is necessary to add foam stabilizer to prevent small bubbles inside from causing small cracks [2]. Because of this advantage, aerated concrete has been effectively used in engineering construction, which can save costs and improve the effect of building construction.

2.3 Building Materials Made of Fly Ash and Slag

In the past, clay solid bricks were usually used as building materials. With the continuous development of building energy conservation, clay was gradually replaced by slag and pulverized coal. In practical application, the strength, heat insulation and yield of slag and pulverized coal are better than those of clay. Slag and pulverized coal are industrial wastes. By using these two materials to replace clay, we can reuse resources, reduce energy consumption and protect the environment.

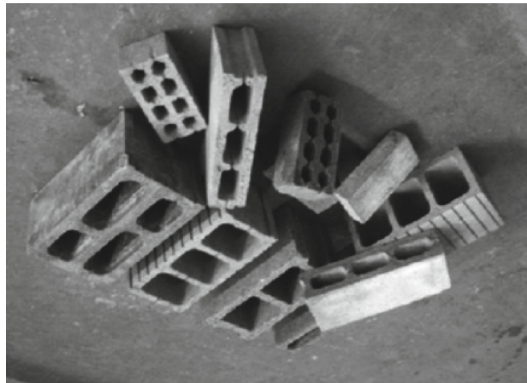


Fig. 1 Aerated concrete block

3 Problems in the Inspection of Building Energy-Saving Materials

3.1 Limited Testing Technology

In order to ensure the quality of testing work, enterprises should strengthen training, improve the professionalism of testing personnel and supplement professional theoretical knowledge for personnel. If the inspectors do not fully understand the testing process and links, it will affect the efficient development of energy-saving material testing, which is not conducive to the quality of testing, but also bring potential safety hazards to the construction. With the continuous development of energy-saving technology, higher requirements are naturally put forward for testers. However, some personnel did not fully grasp the latest testing instruments and did not implement the testing in strict accordance with the testing standards, which affected the reliability of the testing results.

3.2 Lack of Unified Testing Standards

Energy saving materials have many advantages. However, due to the short application time in the industry, the lack of sound management system and different testing standards in each place, there are many quality problems in the application of energy-saving materials. If there is no unified testing standard, the testing effect of the same materials in various regions will also be different, which will affect the application effect of energy-saving materials, and it is easy to continuously improve the overall testing standard, resulting in the materials that can be used before being judged as unqualified and prohibited from use [3].

3.3 Unqualified Test Items

Many types of materials need to be used in the project construction. Relevant departments and industries have made corresponding provisions on the testing process of various materials. It is necessary to carry out targeted test and testing projects in combination with specific building materials. However, the actual situation is that some enterprises will reduce some testing items for the purpose of saving time and cost, which can not ensure the integrity of energy-saving material testing, resulting in the impact of testing results. Although many domestic manufacturers produce energy-saving materials, there are many problems with the materials produced. By inspecting some manufacturers, it can be found that some manufacturers ignore material testing, resulting in material quality and performance can not be guaranteed, and there is a large gap in material quality in the market.

3.4 Test Data Error

In the material inspection work, if there is an error, it will affect the final inspection data. For example, many materials will be stacked together in the site. However, due to the low identification of some materials, the inspectors are prone to misjudgment and errors, which is not conducive to the progress of testing work; In addition, some factors such as disorderly stacking of materials, scattered testing and unclear sampling lead to

a large gap in testing results. In the early stage, the inspection work was not strictly implemented, and the practice of the construction unit in the later stage made the project have great potential safety hazards.

4 Quality Management Strategy for Inspection of Building Energy-Saving Materials

4.1 Enhance Attention

In order to promote the orderly development of energy-saving material testing and reduce the influence of human factors, we should pay attention to quality management and control in our work, so as to effectively solve the problems in testing. Relevant departments should adhere to optimizing and improving relevant systems and standardize the behavior of personnel in drawing design, energy-saving testing and project construction. In addition, we should adhere to the optimization of relevant testing standards. From Table 1, we can see the test items of common materials for building energy conservation. At present, with the rapid development of science and technology, testing technology and equipment are also being updated, and new technologies and equipment are constantly produced in the market. If the testing unit lacks effective understanding of the information and characteristics of some new energy-saving materials, the testing results will be affected. In this regard, the relevant administrative departments should improve the existing testing standards. Materials with imperfect basic information cannot be put into the market. We should also update the energy-saving material information entry system in time to ensure that relevant departments can grasp the information of new materials in time. In addition, the government should formulate unified testing standards to restrict the development of testing work, so as to ensure the reliability of testing results. As shown in Table 1.

Table 1. shows the testing items of some common building energy-saving materials.

| Test items | Test performance index | Test basis |
|---|---|----------------|
| Hollow glass | Sealing performance, dew point, UV radiation resistance | GB/T11944-2002 |
| Thermal resistance of thermal insulation material | Thermal conductivity thermal resistance | GB10294 |
| Density of thermal insulation marinate | Density performance | GB/T6343-1995 |
| Strength of thermal insulation materials | strength | JGJ144-2004 |
| Water absorption of thermal insulation materials | Moisture content | JGJ144-2004 |

4.2 Clearly Define the Supervision and Management Responsibilities and Strengthen Quality Control

In order to improve the quality and efficiency of energy-saving material testing, enterprises should improve the requirements for testers, so as to ensure the orderly development of construction projects. Inspectors should improve their awareness of material testing, understand their work contents, obligations and responsibilities, and earnestly implement all work. In the testing work, the testing unit shall take samples of testing materials in advance, pay attention to the changes of materials and record relevant data in time. In the acceptance link, it should be implemented according to the regulations, so as to promote the orderly development of all links of testing work and reduce material problems. Enterprises should also strengthen supervision and management, so as to improve the reliability and effectiveness of testing work.

4.3 Strengthen the Detection of New Energy-Saving Materials

At present, new energy-saving materials continue to appear in the market, but the data related to new energy-saving materials have not been updated in time, which makes the testing units unable to formulate corresponding market access standards in combination with material testing in time. In addition, when examining the material qualification and filing, the testing unit has the problem of not rigorous management, and the market is chaotic, resulting in serious problems in industry management. In order to change the current situation, the supervision and management units should strengthen the supervision of the market, and the relevant departments should effectively detect the energy-saving materials in the market and reduce the materials whose quality does not meet the requirements; For example, when testing the apparent density of expanded polystyrene board, vernier caliper and balance with an accuracy of 0.1 mm (weighing accuracy of 0.5% of the mass of the test piece) should be used according to the corresponding testing standards; The size of the test piece is $(100 \pm 1) \times (100 \pm 1) \text{ MM} \times (50 \pm 1) \text{ mm}$, and the number of samples is 3. It should be noted that the thickness of this material is not always 50mm, so it should be the thickness of the test piece; Sample condition adjustment. Before the test, the temperature of the sample shall be $23 \pm 2 \text{ }^\circ\text{C}$ and the relative humidity shall be $50 \pm 5\%$. The state adjustment shall be carried out for 16 h in such an environment; Test procedure. First measure the size, then weigh the mass of the test piece, and then calculate the result according to the formula, i.e. Take the average value, and the result shall be accurate to 0.1 kg/m^3 ; The apparent density of closed cell foam materials with a density lower than 30 kg/m^3 Calculate according to the formula $\rho_a = (m + m_a)/V$, m_a is the mass of the discharged air, which is the air density at atmospheric pressure and a certain temperature multiplied by the volume of the sample.

Based on the induction, n of relevant codes of conduct, restrict and standardize market development and reduce adverse competition. Testing institutions should strictly demand themselves, standardize testing behavior, strengthen the management of testing personnel, and ensure the quality of testing work.

4.4 Standard Sampling

Before testing energy-saving materials, samples need to be taken. It should be noted that the materials are different and the selected parts are different. The testing personnel should take targeted samples in combination with the site conditions and material characteristics. Generally, the construction site will set up a storage mechanism. During the operation of the mechanism, it is necessary to keep a corresponding distance from the protective facilities. For example, based on the perspective of site spatial distribution, we can reasonably increase the sampling amount of cement materials for the exterior wall, and the sampling should be distributed in all positions of the exterior wall, so as to ensure the universality of sample collection. The collected samples should be sent to the testing department in time. The inspectors shall strictly abide by the working standards and specifications and carry out the work effectively to avoid major mistakes in the inspection.

4.5 Pay Attention to the Training of Testing Personnel

Relevant departments should regularly carry out the qualification examination of testing units every year, so that units with bad testing behavior and low technical level can make rectification, and optimize the industry market environment. In addition, we should strengthen the training of testing personnel, constantly improve their technical level, actively introduce high-quality and high-level talents, and improve the overall level of testing team. Technicians shall make records during the inspection, inspect the data and results, and ensure the reliability of the inspection report.

4.6 Unified Testing Quality Standards

The testing unit is the main body to implement the testing of energy-saving materials. It should build an effective control system in the industry, optimize the control of energy-saving materials, and promote the unified development of quality testing standards. First, when selecting the energy-saving material test base, it should be combined with the industrial quality inspection standards for reference in the project. Second, in the inspection, we should judge whether the construction process has damaged the materials. Use information technology to build an information platform to ensure the sharing and timeliness of material testing quality standards. The unit should also do a good job in material data recording and promote the unified development of testing standards.

5 Conclusion

To sum up, the use of energy-saving materials in construction projects can reduce energy consumption on the basis of maintaining the use function of buildings and environmental quality. In order to ensure the quality of energy-saving materials and give full play to their role, it is necessary to do a good job in the testing of materials, take diversified measures in combination with the current problems, and constantly improve the level of testing.

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