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# Research Progress on the Performance of Aerated Concrete

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***Abstract:*** ***With continuous attention to energy-saving emission reduction and ecological protection, people gradually realize the excellent performance of aerated concrete in energy saving, material saving, industrial solid waste utilization and other aspects, and the research of aerated concrete pays more and more attention. Aerated concrete with its own lightweight, high strength, heat insulation, heat preservation and environmental protection advantages, has been widely promoted and applied in green buildings. This paper summarizes the green characteristics of aerated concrete and discusses the application prospect of aerated concrete.***

***Keywords: aerated concrete, green environmental protection, building materials***

## I. INTRODUCTION

With the rapid development of urbanization and construction industry, while meeting the building concept of green environmental protection, aerated concrete, as a light, high strength, heat insulation, insulation and environmental protection building materials, has attracted wide attention in the field of green building, and the market demand continues to increase. The production technology of aerated concrete is still being improved and improved, and it is believed that aerated concrete will play a more important role in the field of green building in the future.

## II. EXCELLENT PERFORMANCE IN AERATED CONCRETE

### *A. Lightweight*

Autoclaved aerated concrete is made of calcium materials (cement, lime), and silica materials (quartz sand, fly ash, granulating blast furnace slag, etc.) with aluminium powder or another gas guiding agent, autoclaved aerated concrete products generally use autoclaved curing[1]. The most important expansion agent for the preparation of autoclaved aerated concrete is aluminium powder. In an alkaline environment, the reaction of aluminium powder and calcium hydroxide will form small bubbles, and finally, a large number of bubbles are evenly distributed in the slurry, increasing the volume of the slurry. Form a high porosity, lightweight aerated concrete. The light quality of aerated concrete can reduce the weight of the building and reduce the comprehensive cost of the building. At the same time, the quality of aerated concrete is light and the inertia force is small, which is conducive to the earthquake resistance of the building.

### *B. Good Sound Absorption Effect*

Sound absorption materials can improve the effect of sound listening and noise control in indoor buildings. Some special buildings (such as studios, recording studios, etc.) have higher requirements for sound absorption effects. Aerated concrete is a material with a porosity of more than 80%. Its strength, permeability, diffusibility, shrinkage and creep properties are closely related to porosity and pore size distribution. pore structure characteristics have an important influence on the performance of aerated concrete[2]. Aerated concrete has high porosity and excellent sound absorption effect in buildings. Relevant researchers will be surface untreated and after drilling, saw joint processing of aerated concrete, under different incident sound frequency with the tube method, the measurement results show that the sound absorption capacity of untreated aerated concrete and other porous sound absorption materials, such as foam glass, foam plastic, sound absorption coefficient is small, but than brick wall, gypsum board, terrazzo, concrete wall board sound absorption coefficient is big, especially under the high frequency sound absorption effect is good. After drilling and saw joint processing, the sound absorption effect of aerated concrete has been significantly improved, so the aerated concrete can be made into sound absorption material for some buildings and parts with low sound absorption requirements to use[3]. For example, the generator room of the power plant using aerated concrete drilling sound absorbing board, the film studio studio and the return air muffler using aerated concrete block have obtained better results, so we reasonable use of aerated concrete can improve the sound absorption effect of the building

 

*C. Environmental Protection*

*1) Aerated concrete manufacturing has less energy consumption*

Aerated concrete is a kind of light concrete, it is mainly made of cement, sand, expansion agent and other raw materials. Compared with ordinary concrete, the main energy consumption in the production process of aerated concrete is the sintering and expansion agent, so the energy consumption cost is relatively low. Aerated concrete is a wall material that integrates many advantages, such as lightweight, heat preservation and energy saving. It is the only single wall material [4] that can achieve 50% energy saving of building. In addition, compared with ordinary concrete, the raw material cost of aerated concrete is also relatively low. As can be seen from the data in Table 1[5] and Table 2 [5] below, we can see that making aerated concrete greatly saves energy compared with sintered clay bricks. At the same time, the production process of aerated concrete can be highly automated and large-scale production, which greatly improves the production efficiency. In the production process, the effective utilization of resources can also be realized. For example, the waste materials produced in the production process can be reused, reducing the emission of waste materials. In addition, aerated concrete in the manufacturing, transportation, use of the pollution is relatively small, is an environmentally friendly building material.

Table 1 Comparison of energy consumption between aerated concrete and sintered clay bricks

| | Baked Brick（KJ/kg） | | air-entrained concrete（KJ/kg） |
|---|---|---|---|
| | Average value | Maximal value | |
| Heat consumption related to the production process | 2615～2930 | 3560～3770 | 1020 |
| Energy consumption related to the raw material characteristics | 96～180 | 340～500 | - |
| Basic power consumption | 171～189 | 234～216 | 370 |
| Total energy consumption | 2984～3197 | 4134～4486 | 1390 |

Table 2 Comparison of aerated concrete and sintered clay bricks

| | |
|---|---|
| Average energy consumption of sintering clay bricks（KJ/kg） | 3090 |
| Energy consumption of aerated concrete（KJ/kg） | 1390 |

*2) Industrial Solid Waste can be used Reasonably*

Aerated concrete can use all kinds of industrial waste, such as fly ash, tailings, coal gangue, waste gypsum, etc., the waste after certain processing, it can be used as the raw material of aerated concrete, to realize waste, realize the reuse of waste resources, reduce the impact of waste environmental recycling waste resources, can achieve the purpose of the energy saving and protect the environment, meet the requirements of circular economy of green materials. At present, China's copper tailings are basically in the state of tailings pond stacking. According to relevant estimates, from 1949 to 2007, the emissions of copper tailings in China were roughly 2.4 billion[6]. Related researchers research with copper tailings preparation without lime aerated concrete, use the solid waste and reduce the calcined lime CO2 emissions, USES a copper tailings slag a wind sand cement raw material system, high silicon content of wind sand to supplement the silicon components of the raw materials, make the autoclaved aerated concrete generated more crystal. In addition, copper tailings and slag with high calcium and magnesium content are used to replace the lime components in the traditional aerated concrete to achieve the purpose of reducing the emission of CO2 [7]. The preparation of aerated concrete with copper tailings was successfully studied, which expands the selection of raw materials of aerated concrete and provides a new way for the treatment of copper tailings.

## III. DEVELOPMENT PROSPECT OF AERATED CONCRETE

### A. National policy support

Green and safe buildings and green development in urban and rural areas are the current important issues of global sustainable development. In this context, aerated concrete as a green material, its production and use will not cause any pollution to the environment, in China has also received policy support, and has been included in the "13th Five-Year" plan of the key development projects. This will provide strong policy support for the development of aerated concrete.

### B. Excellent Performance

Aerated concrete has high-efficiency performance, and can achieve fast hardening, heat insulation and other functions. At the same time, its production process is relatively simple, it can be large-scale production, so it has a wide application in the construction, bridge and other fields.

### C. In Line with User Needs

With the continuous improvement of people's requirements for building comfort and aesthetics, the aerated concrete is also gradually developing towards the direction of humanization and personalized design. For example, different looks and textures can be achieved through different ingredients and processes to meet different design needs. At the same time, aerated concrete can also achieve good sound insulation and heat insulation performance through reasonable structural design and material selection, and improve the quality of living and working environment.

### D. Technology Continues to Develop

Aerated concrete technology has been constantly studied, but also achieved a lot of results, the performance of aerated concrete is also constantly improved. Aerated concrete is widely used in various construction fields, such as residences, office buildings, Bridges, tunnels, airports, etc. It can not only be used as the main building material but also can be used to make thermal insulation walls, sound insulation boards and thermal insulation materials. At the same time, aerated concrete gradually plays a role in other fields, such as aerospace, military, automobile, etc. In addition, it can be used in pipelines and storage tanks. With the increasing of market demand, the application prospect of aerated concrete will be further expanded. To sum up, the aerated concrete block has many advantages, in line with the national industrial policy, is the national key promotion of high-tech projects, broad market prospects, strong product competitiveness, using waste residue, waste into treasure, energy saving, has extremely high economic, social and environmental benefits. It has broad development prospects. With the continuous progress of technology and the continuous change of social needs, the aerated concrete will also continue to develop and improve, to provide more possible options for the future construction market.

## IV. AERATED CONCRETE ALSO NEEDS TO BE STUDIED IN SEVERAL ASPECTS

### A. Crack

The cracking of autoclaved aerated concrete walls has been the attention of engineers and technicians and has also become the main reason hindering the promotion of autoclaved aerated concrete. The main feature of autoclaved aerated concrete is porous, and the lack of systematic and in-depth research on the hole structure of autoclaved aerated concrete hinders the improvement of its performance control level and engineering quality prevention and control ability [8]. Crack is one of the most easy defects of aerated concrete. The main causes include the external environment and the shrinkage of concrete itself. How to solve this problem so as to improve the application scope of aerated concrete is an important research direction.

### B. Roughness

The cause of the rough surface of aerated concrete is mainly caused by calcium carbonate precipitation in the hardening process. Measures to improve surface roughness include the selection of high-strength, corrosion-resistant materials, cleaning surfaces and the use of surface treatment techniques.

### C. Poor Durability

The main reason for the poor durability is the erosion of chloride ions and other harmful substances in aerated concrete, the porosity of aerated concrete is high, and liquid and gas are easy to penetrate, but this also leads to its easy to be eroded [9].

More effective protection measures are developed to improve the performance of aerated concrete, solve engineering problems, and promote the development of aerated concrete.

### *D. Utilization of Solid Waste Materials*

At present, some technologies can process some solid waste into aerated concrete through the process, and expand the application of all kinds of solid waste in aerated concrete and the difference in the performance of aerated concrete produced compared with different solid waste and different processes.

Above are some problems that may occur in the process of aerated concrete production, need through technology sustainable development, using a series of effective measures to prevent and improve, the actual production and use process, and appropriate measures according to the specific situation, to improve the performance of aerated concrete and prolong its service life. At the same time, strengthening production management and quality control is also an important measure to prevent defects in aerated concrete.

## V. CONCLUSIONS

In recent years, remarkable progress has been made in the related research on aerated concrete. In terms of theoretical research, the researchers have deeply studied the mechanical properties, thermal conductivity and durability of aerated concrete through experimental and numerical simulation methods. In terms of experimental research, the researchers have explored the material characteristics, microstructure and formation mechanism of aerated concrete through various experimental means. In addition, some studies have focused on the environmental friendliness and sustainability of aerated concrete and explored its application prospects in green buildings. With the rapid development of the construction industry and people's attention to building environmental protection and energy saving, the demand for aerated concrete is growing, and its application field will be further expanded. As a green building material with wide application prospects, aerated concrete will play an increasingly important role in the future construction field. With the continuous innovation and progress of technology, the performance and application scope of aerated concrete will be further expanded and improved.

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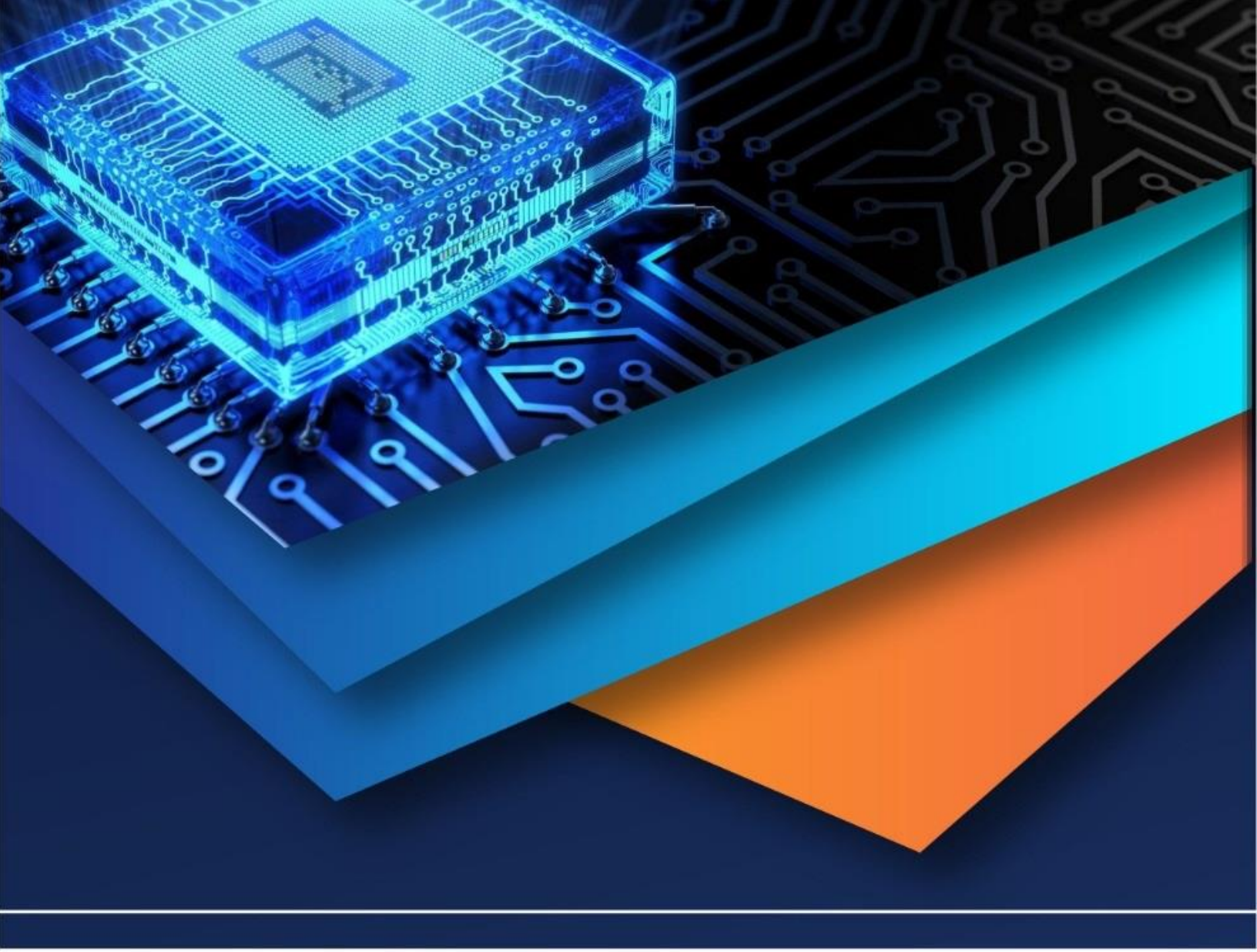

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