



ENERGY EFFICIENT CERAMIC MATERIALS AND PRODUCTS

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Article history:	Abstract:
Received: 10 th February 2022 Accepted: 11 th March 2022 Published: 30 th April 2022	Requirements for improving the thermal protection of buildings and structures, the main consumers of energy, are an important object of state regulation in most countries of the world. These requirements are also considered from the point of view of environmental protection, rational use of non-renewable natural resources and reducing the impact of the "greenhouse" effect, as well as other harmful substances on the atmosphere.
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At the present time and in the foreseeable future, energy conservation is a world-class priority in various fields of human activity, especially in the field of creating a life-support environment.

A group of foreign experts put forward a new idea of solving environmental problems while increasing the efficiency of consumption of natural resources - to live twice as good and at the same time spend half the resources, proposing the so-called factor four, which is obtained by doubling the wealth with a twofold saving of resources. Factor four offers a new approach to progress, focusing on increasing resource productivity. We are talking about reducing energy consumption at times, and not by percentage.

The new regulatory requirements for thermal protection of buildings regulated the principles of a phased reduction in thermal energy consumption for heating buildings in order to reduce the level of energy consumption of buildings by at least 40% in five years. Proceeding from this, it follows that today in the world and in the country, the problem of increasing the heat-shielding properties of building envelopes is one of the most urgent tasks in construction. The solution to the problem of a sharp increase in the thermal protection of buildings, which is provided for by modern building codes, is possible in several ways. The main one is the development and development of new heat-insulating and structural-heat-insulating materials and products capable of providing the required level of thermal protection while maintaining the previous design solutions of buildings. The current economic conditions in the country predetermine a new approach to the selection of effective building materials for housing construction. Therefore, in recent years, there has been an urgent need for new wall materials with increased heat-shielding properties.

Design and implementation of ceramics is possible in the following areas:

1. On brick clay raw materials - this is high-void and hollow porous ceramics, gas and foam ceramics using effective modern foam and gas formers, as well as products with a cellular structure, obtained by partial swelling of pyroplastic melt.

2. On expanded clay raw materials - these are ultra-light cellular ceramic materials obtained due to thermal shock and significant swelling of the pyroplastic melt.

Large manufacturers of building ceramics in Europe in the 70s of the last century, when aerated concrete blocks began to displace ceramic wall materials from the construction market, relied mainly on the production of large-sized ceramic stones and blocks of increased voidness with porous shards. The products had a coefficient of thermal conductivity in the range of 0.14-0.33 W / (m·K) with an average density of 600-1100 kg / m³, mechanical strength of 5-15 MPa.

When using enclosing structures with thermal resistance $R = 3 \text{ (m}^2\text{-K) / W}$, the fuel economy during the heating season can reach 5 kg of equivalent fuel per 1 m² of the wall. Comparative calculations of the economic feasibility of the production of porous hollow blocks, depending on the type and amount of porous additives, can reduce fuel consumption in comparison with autoclaved aerated concrete blocks with a density of 550 kg / m³ by 27-38 kg of standard fuel.

Despite certain achievements in the production of hollow and hollow-porous ceramic products and the existing certain experience in their production in the country and abroad, their implementation is very slow. In addition, it is necessary to carry out comprehensive studies at the level of structural changes occurring as a result of changes in the characteristics of raw materials and technological parameters. For effective ceramic materials with high porosity (over

60-80%), special attention should be paid to studying the influence of the nature of the macrostructure in the form of pore space and microstructure on the physical, mechanical and operational properties, especially thermophysical, since this parameter has a decisive effect on energy efficiency of fences made of these materials. Currently, there is an intensive expansion.

Although the main building ceramic products in Uzbekistan are structural piece bricks, stones and blocks with a density of more than 1300 kg / m³, lightweight structural and heat-insulating wall products with a density of 400-1000 kg / m³, as well as heat-insulating ones with a density of less than 400 kg / m³. In this regard, the development of the production of a wide range of effective ceramic materials is urgent.

The article presents the data of the analysis of the results of theoretical developments of various effective ceramic building materials:

- constructional with a density of 900-1900 kg/m,
- structural and thermal insulation - 500 - 800 kg/m,
- thermal insulation - 100-400 kg/m³.

The development of technology for energy-efficient and energy-saving materials that increase the thermal protection of buildings, provided for by modern building codes, is possible in several ways. The main one is the development and development of new heat-insulating and structural-heat-insulating materials and products capable of providing the required level of thermal protection while maintaining the previous design solutions of buildings, excluding a radical restructuring of the technological equipment of the construction industry.

Therefore, in recent years, an increasing number of studies have been devoted to the development of new technologies for ceramics with a fine-pored structure and the modification of expanded clay porous concrete, providing materials with a reduced thermal conductivity coefficient and their use in new design solutions for walls. One example of such a material is porous-ceramic products and modified expanded clay aerated concrete based on an energy-efficient porous-ceramic aggregate with a density of less than 350 kg / m³. These are promising materials with a thermal conductivity coefficient and, accordingly, sufficient thermal resistance, the material is durable, with sufficient strength, non-moisture-consuming, fire-resistant, ecologically pure. Archaeological excavations prove that the longevity of ceramics is calculated for thousands of years. Depending on the purpose of the material in the structures (load-bearing or insulation), it is possible to manufacture porous-ceramic materials and products with different densities from 150 to 750 kg / m³. It is effective to use porous-ceramic materials and products in the structures of external enclosing panels and floor slabs, in interior soundproof partitions, with a fairly low load from their own weight.

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