

MODERN BUILDING MATERIALS BASED ON MINERAL AND CHEMICAL
ADDITIVES USED IN THE CONSTRUCTION PROCESS AND THEIR USE IN
EUROPEAN COUNTRIES

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Annotation: This article discusses the properties, technological advantages of modern building materials based on mineral and chemical additives, as well as the experience of their use in European countries. Advanced solutions for increasing energy efficiency, environmental safety, durability and quality indicators in the construction process are considered. The possibilities of adapting these experiences to the conditions of Uzbekistan are also analyzed.

Keywords: mineral additives, chemical additives, modern building materials, energy efficiency, ecology, European experience.

The use of energy-efficient, environmentally friendly and high-quality materials in the modern construction industry has become one of the global requirements. Especially in European countries, construction technologies based on the principles of sustainable development are widely used. Modern materials produced using mineral and chemical additives play an important role in improving the quality of construction, reducing energy consumption and extending the service life of structures. Such additives improve the physical and mechanical properties of concrete and other composite materials, making them suitable for modern structures.

Mineral additives include microsilica, blast furnace slag, fly ash, limestone powder and mixtures rich in volcanic active substances. They increase the density of the concrete composition, reduce water permeability and increase strength. Chemical additives include plasticizers, superplasticizers, hydrophobic substances, hardening accelerators or retarders, which improve the rheological properties of the mixture, increase the workability of concrete, and increase its resistance to cold and heat. When mineral and chemical additives are used together, the quality indicators of concrete increase significantly.

Today, modern materials based on these additives are widely used in the European market. High-strength concretes (HPC) are used in large engineering structures, bridges and transport roads. Self-compacting concrete (SCC) facilitates complex formwork and increases construction speed. Lightweight thermal insulation materials are helping to increase energy efficiency. Fiber and composite materials are also characterized by their seismic resistance and long-term strength.

The use of these materials has been widely established in Germany, France, the Netherlands and the Scandinavian countries. For example, in Germany, the water-cement ratio is reduced by 20–25% with the help of superplasticizers, which increases the strength of concrete. In France, concrete based on slag and microsilica is widely used in bridges, subways and hydraulic structures. In the Scandinavian countries, composite materials with strong thermal insulation have been introduced in the “passive house” technology. All these processes are carried out under strict control based on European standards such as EN 206, EN 934 and EN 197.

Additives are added to the concrete mix at various stages of the production process. Superplasticizers increase the mobility of the mixture, while mineral additives strengthen the microstructure and density of concrete. As a result, water consumption is reduced, porosity is reduced, and a dense and

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strong material is obtained. Such technological processes not only increase quality, but also save energy and labor resources, and ensure environmental safety.

This technology has many advantages. The strength, durability, and heat resistance of concrete increase. Construction time is reduced, energy consumption is reduced, and structures are built that meet environmental requirements. At the same time, there are some disadvantages - the high cost of additives, the need for special technological equipment, and the mandatory laboratory testing for quality control are examples of these.

Uzbekistan's rich raw material base and cement production potential create great opportunities for adapting these technologies to local conditions. Using fly ash, limestone powder, and other mineral additives, it is possible to obtain inexpensive and high-quality materials. The gradual introduction of European experience into local production, the approximation of national standards to EN standards, and the development of environmental technologies will significantly improve the quality indicators of the construction industry.

Thus, modern building materials developed using mineral and chemical additives are widely used in developed countries today and have proven their high efficiency. These approaches enhance the technical and mechanical properties of concrete, ensure environmental safety, reduce energy consumption, and speed up construction processes. The widespread implementation of these experiences in Uzbekistan will increase the quality level of the country's construction industry and contribute to sustainable development.

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