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INNOVATIVE BUILDING MATERIALS IN CREATION AN ARCHITECTURAL ENVIRONMENT

Progressive building materials and technologies can ensure not only the durability of buildings and structures that are operated in difficult conditions and the consumption of a minimum amount of energy with little impact on the environment, but also will contribute to the creation of an effective and harmonious architectural environment in accordance with the requirements of sustainable development. An important role in solving these problems is assigned to recycled (reusable materials); traditional natural and local building materials that due to technical progress have gained new prospects for use in modern environmental and energy-efficient structures and buildings ("old-new" natural materials); nanomaterials and nanotechnologies, the use of which will not only improve the quality and properties of materials, and, accordingly, the environment, but also create completely new materials and architectural solutions with a set of properties. The purpose of this study is generalization, systematization and examination of these innovative materials and products.

Current world construction trends indicate that the most promising trend is the development of an urban environment based on energy-saving technologies as well as environmentally friendly building materials.

There are systems of certification and environmental assessment of green buildings. Leadership in Energy and Environmental Design (LEED) is a set of rating systems for the design, construction, operation, and maintenance of green buildings which was developed by the U.S. Green Building Council. Another certificate system that confirms the sustainability of buildings is the British BREEAM (Building Research Establishment Environmental Assessment Method) for buildings and large-scale developments. Currently, World Green Building Council is

conducting research on the effects of green buildings on the health and productivity of their users and is working with World Bank to promote Green Buildings in Emerging Markets through EDGE (Excellence in Design for Greater Efficiencies) Market Transformation Program and certification.

Building materials' creation must consider the economic, environmental, social and ergonomic aspects in the life activity of mankind and production, including: ensuring the minimum energy costs at all stages of production and use; possibility of material renovation, maximum re-use of material (recycling), preservation of environment. Environmentally friendly materials (also known as green building materials) are those in which low environmental impacts have been carried out for their manufacture, placement and maintenance. They must be durable, reusable, and include recyclable materials as well as local materials. The idea behind a sustainable architecture is to build in such a way as to reduce the environmental impact.

The leading components of a sustainable building architecture are the use of sustainable building materials such as organic compounds or secondary materials and the use of environmentally friendly waste management techniques. The reuse of building materials and industrial waste is currently under development. With the improvement of processing technologies for various types of materials suitable for re-production and waste there is an intensive expansion and use of them in world practice. Recycling allows to reuse construction waste without harming the environment. Besides, the use of industrial waste is particular relevance in conditions with limited sources of supply of material and financial resources.

An important role belongs to such innovative materials as natural traditional ("old - new") building materials, made on the basis of modern technologies. In recent years, an ecological trend is developing in construction, which aims to use natural materials. These materials can be of both plant and animal origin and do not require high-energy expenditure for production and contribute to the development of energy-saving investments that meet current technical requirements. These types of products are perceived as healthy and cheap, in many cases locally available. In addition, the above material solutions can have a significant impact in modern construction due to the increase in prices of traditional construction products and due to energy savings during construction and

when using the investment. Examples of materials of natural origin are: dry and compacted earth, clay, straw, wood, bamboo, reeds, insulation boards made from hemp fiber or straw, sheep's wool, cellulose, etc.

The most complete classification of innovative materials is presented in. Attention should be paid to such innovative materials as: recycled (reusable materials); traditional natural and local building materials that, thanks to technological advances, have gained new perspectives for use in modern eco-friendly and energy-efficient structures and buildings ("old-new" natural materials); nanomaterials.

Today in the world, nanotechnology is used to produce cement, ceramics, metal alloys, plastics, paints and other materials with unique properties on an industrial scale. Nanomaterials are used to improve thermal properties, increase energy transfer efficiency, lighten, heat. The use of nanomaterials in construction is important not only to improve the properties of materials, but also in terms of energy and environmental issues.

Developments in the field of nanotechnology in construction have been reflected in the production of materials such as high-strength concrete, high-strength steel, structural composites, nano-coatings, innovative films, nanocomposite pipes, fiberglass composite fittings. Energy-efficient thermal insulation materials are being developed based on minerals with low thermal conductivity, sorption moisture and increased noise absorption, nanoscale-mineral modifiers of road concrete; nanometric metal-mineral biocidal additives for paints and varnishes, mortars and concrete working under conditions of biological aggression; high-strength concrete with low average density; nanometric internal voltage compensators and the like. A major advancement in the field of TiO_2 based nanoclusters has been the imitation of the effect of lotus petals, which are absolutely water-resistant, making the dome free of contamination and wetting and self-purifying. Transparent nano coatings have the ability to accumulate solar energy, so they can be used on windows and facades of buildings not only to create the effect of solar panels, which reduces energy consumption, but also gives the facade a stylish look.

The use of nanomaterials in construction: allows the use of new architectural solutions; reduces construction costs and the pace of building construction; improves the quality of structures and its performance; promotes environmental conservation; ensures compliance with safety

standards and requirements; allows designers to adapt buildings to biologically similar forms, creating a model of architecture that fully integrates with the climatic, chemical, kinetic and social aspects of life, reducing the environmental footprint of modern society in an urban architectural environment.

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ЗАСТОСУВАННЯ «ЕФЕКТУ НАДМАЛИХ КОНЦЕНТРАЦІЙ» В ТЕХНОЛОГІЇ БЕТОНУ

У зв'язку з тим, що особлива роль у задачах формування оптимальної структури цементних композитів відводиться воді замішування як основного компоненту, який визначає кінетику відокремлених процесів гідратації і структуроутворення, узагальнимо і проаналізуємо різні способи активації води, що призводять до змін її іонного складу, структури і властивостей. Наноструктурне модифікування води замішування, що приводить до зміни її параметрів, є способом поліпшення реологічних характеристик цементного тіста і фізико-механічних властивостей наномодифікованого цементного каменю і бетону, виготовленого на його основі, за рахунок активації рідкої фази і фізико-хімічних процесів, які супроводжують формування структури композитів.

Суть нанотехнології активування води полягає в її здатності до складного структурування у вигляді особливих кластерів, тобто утворення міжмолекулярно-асоціативної води.

Важлива властивість молекул структурованої води – їх здатність утворювати координаційні і водневі зв'язки. На величині енергії водневих зв'язків позначається поляризуюча дія поверхневого іона, з яким молекула води пов'язана координаційним зв'язком. Контакт зрощення утворюється за рахунок появи координаційних і водневих зв'язків. Енергія водневих зв'язків змінюється в значних межах від 1-2 ккал/ моль і за підрахунками тільки енергія водневих зв'язків може забезпечити міцність цементного каменю на рівні 50 МПа.