

NANOTECHNOLOGY IN THE CONSTRUCTION INDUSTRY

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НАНОТЕХНОЛОГИИ В СТРОИТЕЛЬСТВЕ

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***Аннотация.** Почему наноструктурные материалы обретают в строительстве все большую востребованность? Потому что они обладают высокой износостойкостью, особыми электрофизическими свойствами, жароустойчивостью и другими уникальными чертами. В конечном итоге все сводится к одной цели – созданию наиболее выгодного, экологически чистого, безопасного как для самого человека, так и для всей окружающей среды жилья. В данной статье мы рассмотрим наиболее преобладающие наноматериалы в настоящее время.*

Introduction. Nanotechnologies are actively entering our lives. About ten years ago such developments were considered as something fantastic, but now they are widely used in a variety of industries. Nanotechnology is used in science spheres, engineering, technology, medicine and even proves its potential in the field of sports.

Research and results. The construction industry greatly benefits from the application of nanotechnology materials which allow the creation of advanced homes. There are a number of prospects for the use of nanomaterials in this industry. They are:

- application of solar panels as enclosing constructions;
- creation of the foundation with self-regulation of the soil shrinkage;
- development of structural elements which are sensitive to damage or deformation;
- creation of functional coatings;
- improvement of strength and reliability of buildings;
- invention of coatings which are sensitive to people's mental and physical conditions.

Today the range of nanotechnology in the production of construction materials is quite wide. Here there are some of them:

- high-strength concrete.;
- high-strength alloys of metals;
- composite materials;
- nanocoatings.

High-strength concrete. The addition of modern nanomaterials to the traditional and long-used compositions enables to obtain new characteristics. Concrete, familiar and traditionally used in the construction

industry, can extend its working life to several hundred years with the help of nanoparticles [1].

High-strength steel alloys. The use of nanomodifications in the production and smelting of steel alloys made it possible to obtain alloys with new strength characteristics. These alloys can be used in safety fences, hydraulic engineering facilities and other spheres where increased strength and resistance to corrosive processes are required [2].

Composite materials. Recent technologies have brought a lot of new composite materials to existence. Composites are formed by combining two or more materials with different properties to produce an end material with unique characteristics. They are lightweight, flexible and have immense opportunities to replace traditional materials in construction thanks to their benefits: high strength to weight ratio, corrosion and heat resistance, toughness and insulation properties.

Nanocoatings. The coating can be applied to concrete, metals, brick, plastics, wood and any other building material. The use of nanocoatings in the construction industry can provide fire protection, heat insulation and resistance to corrosion [3].

Antibacterial glass. Antibacterial glass is a glass that kills up to 99.9% of bacteria that form on its surface. It also prevents the spread of fungi. Antibacterial glasses are most often used in rooms where it is necessary to maintain a sterile environment, for example, in hospitals, swimming pools, health and sports centers, bathrooms, etc.

The use of nanomaterials in Russian construction industry is shown in Fig. 1.

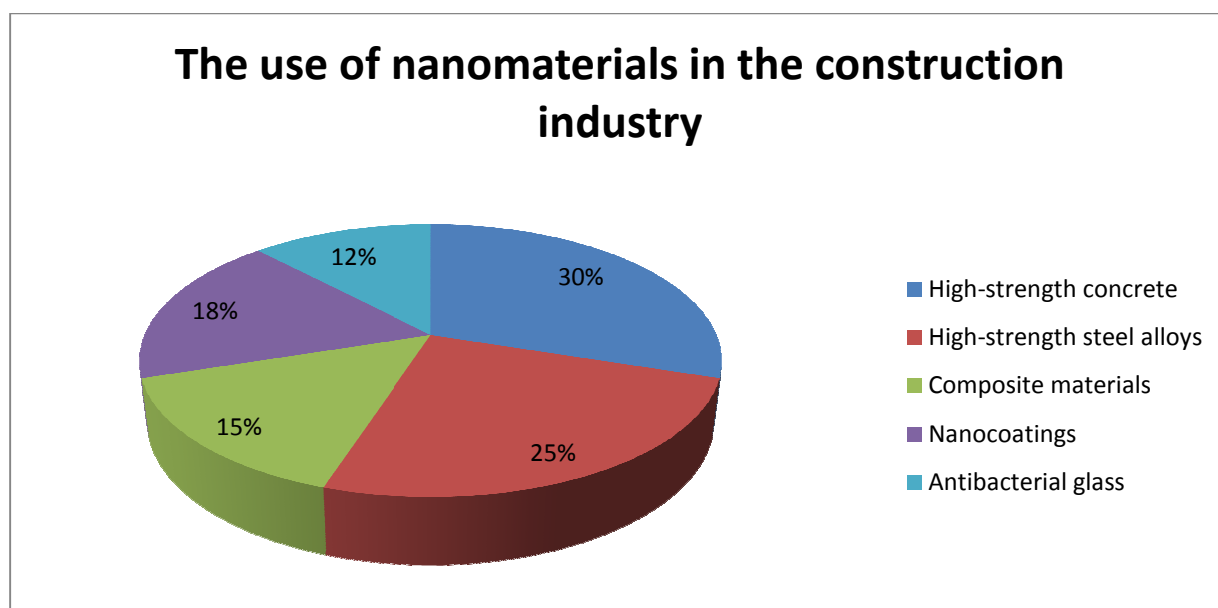


Fig. 1 The use of nanomaterials in the construction industry

Nanomaterials and the future of advanced materials:

- **Graphene.** From the theoretical perspective, there is nothing complicated in it. It's just a one-atom-thick layer of carbon. For decades, scientists and engineers have speculated on the advantages of graphene. However, only a few years ago it was possible to obtain graphene.

- Vantablack. The creators of Vantablack already expect that their offspring will be used to absorb third-party light sources in optical devices, for example, in telescopes. In the short term, this material will be used in thermal protection systems as well as in electronics.

- Graphene aerogel. Only one gram of graphene aerogel can absorb 68.8 grams of water. This material can be used while collecting oil after accidents on tankers or production platforms.

- Willow Glass. This is one of the promising versions of the famous Gorilla Glass which is actively used to create screens for mobile devices. Preserving all the advantages of the “gorilla”, in particular, good resistance to scratches and bumps, a new version of it has new possibilities, in particular, bendability and malleableness.

- Starlite. Starlite has unique physical properties. A British inventor and amateur scientist, Maurice Ward claimed that this plastic can withstand almost any heating up to the temperature of the atomic explosion. The latter is not proven, but this material easily withstands a blowtorch with a flame temperature of about 1000 degrees Celsius [4].

Nanomaterials in the construction industry are used in different Russian cities. We are going to consider the use of nanomaterials to repair old buildings in Tomsk.

Domestic nanoproducts are planned to be used in major repairs of typical five-storey Khrushchyovka buildings. It is planned that the houses will be covered with a disinfectant paint with nanoparticles, windows will be glazed with nanocoatings and automatic systems to monitor and record heat and electricity will be installed. Metal constructions will be replaced with the systems of outdoor reinforcement and composite fiber. In addition, all the roofs of the houses will be warmed with Tomsk vermiculite [5].

Conclusion. Nanotechnology creates opportunities to produce construction materials with novel functionalities and improved characteristics. However, being a key to a new world of the construction industry there are some challenges of nanotechnology such as cost, manufacturing process, safety and the environmental impact.

Society is a changing structure and it should not stand still. Mankind must constantly progress, develop and strive for the better. Nanotechnology is the path to success. It is necessary to improve the quality of people’s life and their housing environment.

REFERENCES

1. Gusev, A.I. (2011). Nanomaterials, nanostructures, nanotechnologies. M.: Fizmatlit, 416 p.
2. Rybiev, I.A. (2002). Construction material engineering. M.: High School. 700 p.
3. Cherkinsky, Yu.S. (1960). Polymer-cement concrete. M.: Gosstroyizdat, 147 p.
4. Paschenko, A.A. (1975). Matrix materials. Kiev: Vishcha school, 444 p.
5. Kruglitsky, N.N. (1981). Physicochemical mechanics of cement-polymer compositions. Kiev, Nauk.Dumka, 240 p.